RAIDIGHI COLLEGE

(NAAC Accredited Cycle - 1 on 05.11.2016)

P.O. & P.S. -Raidighi, South 24 Parganas, Pin- 743383

NIRF Participant & ISO 9001:2015 Certified

Mobile No. 9735310008 Phone No. +91-3218-358262

Website – www.raidighicollege.in

Email – raidighicollege95@gmail.com

DEPARTMENTAL LESSON PLANS

RAIDIGHI COLLEGE Estd.- 1995 24 Pgs. (S)

Dr. Sasabindu Jana
Principal
PRINCIPAL
RAIDIGHI COLLEGE

DEPARTMENTAL LESSON PLAN: ENGLISH HONOURS

ODD SEMESTERS					
SEM	**PAPER**	**TOPIC**	**MONTH**	**FACULTY**	**NO. OF LECTURES**
1	CC-1	HISTORY OF ENGLISH LANGUAGE	JULY-SEPTEMBER	BIDYUT SAHA	6
		HISTORY OF ENGLISH LITERATURE-1	JULY-SEPTEMBER	DEBASHIS BISWAS	4
		HISTORY OF ENGLISH LITERATURE-2	JULY-SEPTEMBER	SUVANKAR GHOSH ROY CHOWDHURY	8
		HISTORY OF ENGLISH LITERATURE-3	NOVEMBER-DECEMBER	BIDYUT SAHA	6
	CC-2	OEDIPUS REX	NOVEMBER-DECEMBER	BIDYUT SAHA	7
		HORACE'S SATIRE	NOVEMBER-DECEMBER	SUVANKAR GHOSH ROY CHOWDHURY	3
		METAMORPHOSIS	NOVEMBER-DECEMBER	SUVANKAR GHOSH ROY CHOWDHURY	3
		THE ILIAD	NOVEMBER-DECEMBER	DEBASHIS BISWAS	6
3	CC-5	AMERICAN POETRY & NOVEL	JULY-SEPTEMBER	DEBASHIS BISWAS	8
		AMERICAN POETRY & STORY	JULY-SEPTEMBER	SUVANKAR GHOSH ROY CHOWDHURY	5
		AMERICAN DRAMA & STORY	JULY-SEPTEMBER	BIDYUT SAHA	8
	CC-6	NONSENSE VERSE	JULY-SEPTEMBER	BIDYUT SAHA	5
		TINTIN IN TIBET	JULY-SEPTEMBER	SUVANKAR GHOSH ROY CHOWDHURY	5
		THE MURDER OF ROGER ACKROYD	NOVEMBER-DECEMBER	SUVANKAR GHOSH ROY CHOWDHURY	5

		THROUGH THE LOOKING GLASS	JULY-SEPTEMBER	DEBASHIS BISWAS	6
	CC-7	PARADISE LOST	NOVEMBER-DECEMBER	BIDYUT SAHA	6
		RAPE OF THE LOCK	NOVEMBER-DECEMBER	DEBASHIS BISWAS	6
		THE DUCHESS OF MALFI	NOVEMBER-DECEMBER	SUVANKAR GHOSH ROY CHOWDHURY	5
	SEC-A2	LETTER WRITING & REPORT WRITING	NOVEMBER-DECEMBER	SUVANKAR GHOSH ROY CHOWDHURY	4
		CV WRITING & EMAIL WRITING	NOVEMBER-DECEMBER	DEBASHIS BISWAS	2
		MEETING MINUTES WRITING	NOVEMBER-DECEMBER	BIDYUT SAHA	2
5	CC-11	WOMEN WRITING: POETRY & NON-FICTION	JULY-SEPTEMBER	SUVANKAR GHOSH ROY CHOWDHURY	8
		WOMEN WRITING: FICTION	JULY-SEPTEMBER	BIDYUT SAHA	7
		WOMEN WRITING: FICTION & NON-FICTION	NOVEMBER-DECEMBER	DEBASHIS BISWAS	8
	CC-12	MODERN POETRY & FICTION	JULY-SEPTEMBER	DEBASHIS BISWAS	6
		MODERN FICTION	NOVEMBER-DECEMBER	BIDYUT SAHA	7
		MODERN POETRY & DRAMA	NOVEMBER-DECEMBER	SUVANKAR GHOSH ROY CHOWDHURY	6
	DSE A1	TRANSLATED INDIAN POETRY & DRAMA	JULY-SEPTEMBER	SUVANKAR GHOSH ROY CHOWDHURY	7
		TRANSLATED INDIAN STORIES	JULY-SEPTEMBER	BIDYUT SAHA	6
		TRANSLATED INDIAN POETRY & NOVEL	JULY-SEPTEMBER	DEBASHIS BISWAS	8
	DSE B1	TRAGEDY	NOVEMBER-DECEMBER	BIDYUT SAHA	5

		SHORT STORY	JULY-SEPTEMBER	SUVANKAR GHOSH ROY CHOWDHURY	5
		RHETORIC & PROSODY	NOVEMBER-DECEMBER	SUVANKAR GHOSH ROY CHOWDHURY	6
EVEN SEMESTERS					
2	CC-3	INDIAN POETRY	JANUARY-MARCH	SUVANKAR GHOSH ROY CHOWDHURY	3
		INDIAN POETRY & DRAMA	JANUARY-MARCH	BIDYUT SAHA	6
		INDIAN POETRY & NOVEL	JANUARY-MARCH	DEBASHIS BISWAS	7
	CC-4	RENAISSANCE POETRY	APRIL-JUNE	DEBASHIS BISWAS	2
		RENAISSANCE POETRY & DRAMA	APRIL-JUNE	BIDYUT SAHA	7
		RENAISSANCE POETRY & DRAMA	APRIL-JUNE	SUVANKAR GHOSH ROY CHOWDHURY	7
4	CC-8	EIGHTEENTH CENTURY POETRY & DRAMA	JANUARY-MARCH	BIDYUT SAHA	4
		EIGHTEENTH CENTURY POETRY	JANUARY-MARCH	DEBASHIS BISWAS	2
		EIGHTEENTH CENTURY PROSE	JANUARY-MARCH	SUVANKAR GHOSH ROY CHOWDHURY	6
	CC-9	ROMANTIC POETRY	APRIL-JUNE	BIDYUT SAHA	4
		ROMANTIC POETRY & PROSE	APRIL-JUNE	DEBASHIS BISWAS	7
		ROMANTIC POETRY & PROSE	APRIL-JUNE	SUVANKAR GHOSH ROY CHOWDHURY	7
	CC-10	VICTORIAN POETRY	JANUARY-MARCH	SUVANKAR GHOSH ROY CHOWDHURY	2
		VICTORIAN POETRY	JANUARY-MARCH	DEBASHIS BISWAS	5

		VICTORIAN NOVEL-1	JANUARY-MARCH	BIDYUT SAHA	4
		VICTORIAN NOVEL-2	APRIL-JUNE	BIDYUT SAHA	4
	SEC B2	CITATION	JANUARY-MARCH	SUVANKAR GHOSH ROY CHOWDHURY	3
		ESSAYS & C.A. -1	APRIL-JUNE	SUVANKAR GHOSH ROY CHOWDHURY	4
		ESSAYS & C.A. -2	APRIL-JUNE	BIDYUT SAHA	4
		ESSAYS & C.A. -3	APRIL-JUNE	DEBASHIS BISWAS	4
6	CC-13	MODERN DRAMA -1	JANUARY-MARCH	BIDYUT SAHA	5
		MODERN DRAMA -2	JANUARY-MARCH	SUVANKAR GHOSH ROY CHOWDHURY	5
		MODERN DRAMA -3	JANUARY-MARCH	DEBASHIS BISWAS	5
	CC-14	POSTCOLONIAL POETRY	JANUARY-MARCH	SUVANKAR GHOSH ROY CHOWDHURY	4
		POSTCOLONIAL NOVEL -1	JANUARY-MARCH	BIDYUT SAHA	4
		POSTCOLONIAL NOVEL -2	JANUARY-MARCH	DEBASHIS BISWAS	4
	DSE A3	PARTITION NOVEL	APRIL-JUNE	DEBASHIS BISWAS	4
		PARTITION STORIES	APRIL-JUNE	BIDYUT SAHA	5
		PARTITION POETRY	APRIL-JUNE	SUVANKAR GHOSH ROY CHOWDHURY	3
	DSE B3	MY REMINISCENCES	JANUARY-MARCH	SUVANKAR GHOSH ROY CHOWDHURY	4
		AUTOBIOGRAPHY OF AN UNKNOWN INDIAN	APRIL-JUNE	SUVANKAR GHOSH ROY CHOWDHURY	4
		STORY OF MY EXPERIMENTS WITH TRUTH	APRIL-JUNE	BIDYUT SAHA	5

		MY STORY AND LIFE AS AN ACRTESS	APRIL-JUNE	DEBASHIS BISWAS	4

RAIDIGHI COLLEGE

TEACHING PLAN REPORT

SUBJECT: BENGALI
SESSION-2022-23

Teacher Name: Sabita Soren

Semester	Course Type	Unit Name(Topic)	Paper	Sub Unit Name	Month	No. of Classes
1st	Honours	বাংলা সাহিত্যের ইতিহাস	CC1	মঙ্গলকাব্যের উদ্ভব ও স্বরূপ	December	3
2nd	Honours	বাংলাসাহিত্য প্রবেশক পাঠ	CC2-4	কথা সাহিত্য	April	3
3rd	Honours	বাংলা সাহিত্যের ইতিহাস(বিংশ শতক)	CC3-5	সাময়িক পত্র	December	2
3rd	Honours	ঐতিহাসিক ভাষাবিজ্ঞান	CC-3-6	মডিউল-১ ভাষা ও ভাষাপরিবার মডিউল-২ প্রাচীন বাংলা ও মধ্য বাংলার ভাষাতাত্ত্বিক লক্ষণ মডিউল-৩ অন্ত্য-মধ্য বাংলা ও আধুনিক বাংলার ভাষাতাত্ত্বিক লক্ষণ	December	3
3rd	Honours	কথাসাহিত্য	CC-3-7	যোগাযোগ অরণ্যের অধিকার	April- May	3
4th	Honours	প্রবন্ধ ও বিবিধ রচনা	CC-4-10	সাহিত্য – রবীন্দ্রনাথ ঠাকুর	May	4
6th	Honours	সংস্কৃত, ইংরেজি ও প্রতিবেশী (হিন্দী) সাহিত্যের ইতিহাস	CC-6-14	প্রতিবেশী সাহিত্যের সংক্ষিপ্ত ইতিহাস	May	4
5th	Honours	বাংলার সমাজ ও সংস্কৃতির ইতিহাস	DSE-A-S-1	মডিউল-৩ আন্দোল (খাদ্য, নকশাল,বঙ্গভঙ্গ)	December	4
1st	Pass	বাংলা সাহিত্যের ইতিহাস(আধুনিক যুগ)	GE-1	উপন্যাস ও ছোটগল্প	December	4

2nd	Pass	ঐতিহাসিক ভাষাবিজ্ঞান ও ছন্দ অলঙ্কার	GE-2	ঐতিহাসিক ভাষাবিজ্ঞান	April	4
3rd	Pass	বাংলা কবিতা ও নাটক	GE-3	বাংলা নাটক (রাজা ও রানী)	May	2
4th	Pass	বাংলা কথাসাহিত্য ও প্রবন্ধ	GE-4	উপণ্যাস-পল্লীসমাজ	April	3
2nd	Pass	বাংলা ভাষা বিজ্ঞান, সাহিত্যের রূপভেদ	Z-4-1 (LCC)	মেঘনাদবধ কাব্য	May	2
6th	Pass	সাময়িক পত্র ও কথাসাহিত্য	6-2 (LCC)	র্jnee	April	2
3/s-2	Honours/ Pass	ব্যবহারিক বাংলা-১	SEC-A-2	সাহিত্য ও চলচিত্র বাংলা সাহিত্য চলচিত্রায়ণ	November	4

RAIDIGHI COLLEGE
TEACHING PLAN REPORT
SUBJECT : BENGALI
SESSION: 2022-23

TEACHER NAME: SONALI BASU

Semester	Course Type	Unit Name (Topic)	Paper	Sub Unit Name	Month	No. of Classes
1	Honours	বর্ণনামুলক ভাষাবিজ্ঞান ও বাংলা ভাষা	CC-1-2	বাংলা ভাষার রূপতাত্ত্বিক আলোচনয়া	September	4
2	Honours	বাংলা সাহিত্যের ইতিহাস (উনিশ শতক)	CC-2-3	কথা সাহিত্য ও সাময়িক পত্রিকা	March	4
2	Honours	বাংলা সাহিত্যের ইতিহাস (উনিশ শতক)	CC-2-3	গদ্য ও প্রবন্ধ	April	4
3	Honours	বাংলা সাহিত্যের ইতিহাস (বিংশ শতক)	CC-3-5	কথা সাহিত্য	November	4
4	Honours	প্রবন্ধ ও বিবিধ রচনা	CC-4-10	একালের প্রবন্ধ সঞ্চয়ন	April	4
6	Honours/ General	লোকসংস্কৃতি ও লোকসাহিত্য	BNGA DSE-B-6-4 /BNGG-DSE-B-6-2	লোকছড়া	May	4
4/6	Honours/ General	ব্যবহারিক বাংলা ও সাহিত্য গবেষণার পদ্ধতি বিজ্ঞান	SEC-B-4/6-1	প্রতিবেদন, বিচিত্র ও গল্প রচনা	April	3

RAIDIGHI COLLEGE
TEACHING PLAN REPORT
SUBJECT : BENGALI
SESSION: 2022-23
TEACHER NAME: MOLOY MONDAL

Semester	**Course Type**	**Unit Name (Topic)**	**Paper**	**Sub Unit Name**	**Month**	**No. of Classes**
1	Honours	বর্ণনামুলক ভাষাবিজ্ঞান ও বাংলা ভাষা	CC-1-2	ধ্বনি, বর্ণ, অক্ষর মৌলিক স্বরধ্বনি ভান্ডার বাংলা শব্দ	September	3
1	Honours	বর্ণনামুলক ভাষাবিজ্ঞান ও বাংলা ভাষা	CC-1-2	শব্দ বিবর্তন বাংলা শব্দার্থ পরিবর্তনের ধারা	November	4
2	Honours	বাংলা সাহিত্য প্রবেশক পাঠ	CC-2-4	নাটক ও গদ্য প্রবন্ধ	March	4
4	Honours	প্রবন্ধ ও বিবিধ রচনা	CC-4-10	একালের সমালোচনা সঞ্চয়	April	4
5	Honours	নাটক ও নাট্যসঞ্চয়	CC-5-12	রঙ্গমঞ্চের ইতিহাস	November	4
6	Honours	আধুনিক বাংলার কাব্য কবিতা	CC-6-13	একালের কবিতা সঞ্চয়ন	December	4
6	Honours		DSE-A-6-3	শঙ্কু সমগ্র	May	4
5	Honours	বাংলা শিশু কিশোর সাহিত্য	DSE-B-5-1	আবোল তাবোল সমগ্র	December	4

RAIDIGHI COLLEGE
TEACHING PLAN REPORT
SUBJECT : BENGALI
SESSION: 2022-23
TEACHER NAME: CHANDANA BAIDYA

Semester	Course Type	Unit Name (Topic)	Paper	Sub Unit Name	Month	No. of Classes
1	Honours	বাংলা সাহিত্যের ইতিহাস (১৮০০ খ্রিঃ পর্যন্ত)	CC-1-1	অনুবাদ, সাহিত্য, বৈষ্ণব পদাবলি, চৈতন্য চরিত সাহিত্য	September	3
2	Honours	বাংলা সাহিত্য প্রবেশক পাঠ	CC-2-4	কথা সাহিত্য	March	2
3	Honours	কথাসাহিত্য	CC-3-7	ছোট গল্প	November	3
4	Honours	প্রাগাধুনিক সাহিত্য	CC-4-8	বৈষ্ণব পদাবলী চন্ডী মঙ্গল শাক্ত পদাবলী	April	5
6	Honours	বাংলা গোয়েন্দা সাহিত্য	DSE-A-6-3	শজারুর কাঁটা	April	5
5	Honours	বাংলা শিশু কিশোর সাহিত্য	DSE-B-5-1	ক্ষীরের পুতুল, বাদশাহে আংটি, সবুজ দ্বীপের রাজা	December	5
3	General	বাংলা কাব্য কবিতা ও নাটক	GE-3-3	বৌষ্ণব পদাবলী	January	3
4	General	বাংলা কথাসাহিত্য ও প্রবন্ধ	GE-4	একালের ছোট গল্প সঞ্চয়ন	May	4

RAIDIGHI COLLEGE
TEACHING PLAN REPORT
SUBJECT : BENGALI
SESSION: 2022-23
TEACHER NAME: MANAB KANTI BAIDYA

Semester	Course Type	Unit Name (Topic)	Paper	Sub Unit Name	Month	No. of Classes
I	Honours	বাংলা সাহিত্যের ইতিহাস	CC1/GE -1-1	বাংলা ভাষা ও ইতিহাস সম্পর্কিত সাধারণ ধারনা	September	4
I	Honours	বাংলা সাহিত্যের ইতিহাস	CC1/GE -1-1	চর্যাপদ	September	2
I	Honours	বাংলা সাহিত্যের ইতিহাস	CC1/GE -1-1	শ্রীকৃষ্ণকীর্তন	November	2
II	Honours	বাংলা সাহিত্যের ইতিহাস (উনিশ শতক)	CC2-3	কাব্য-কবিতা ও নাটক- প্রহসন	April	1
III	Honours	বাংলা সাহিত্যের ইতিহাস (বিংশ শতক)	CC-3-5	কথাসাহিত্য	November	3
IV	Honours	ছন্দ অলঙ্কার ও কাব্যত্ত্ব	CC-4-9	ছন্দ	May	3
IV	Honours	ছন্দ অলঙ্কার ও কাব্যত্ত্ব	CC-4-9	অলংকার	April	4
V	Honours	সাহিত্যের রূপ ও রীতি	CC-5-11	কাব্য, কবিতা ও নাটক	September	3
V	Honours	নাটক ও নাট্যমঞ্চ	CC-5-12	উপন্যাস ও ছোটগল্প	November	3
V	Honours	নাটক ও নাট্যমঞ্চ	CC-5-12	বুড়ো শালিকের ঘারে রোঁ	December	3
VI	Honours	আধুনিক বাংলা কাব্য –কবিতা	CC-6-13	বীরাঙ্গনা কাব্য	May	3

VI	Honours	আধুনিক বাংলা কাব্য –কবিতা	CC-6-13	সোনার তরী ও সঞ্চিতা	May	3
3/5	BNGA/ BNGG General	ব্যবহারিক বাংলা ১	SEC-A-3-2	গল্পসূত্র থেকে কাহিনি নির্মাণ গল্প উপন্যাস থেকে নাট্যরূপ/ চিত্রনাট্য শিক্ষণ	September	3
4	General	বাংলা ভাষা বিজ্ঞান, সাহিত্যের রূপভেদ ও কাব্য	LCC-(2) A-1	সাহিত্যের রূপভেদ	May	3

RAIDIGHI COLLEGE

TEACHING PLAN REPORT

Dept. of Education **Session:2022-23**

ODD SEMESTER: SEM-1

Teacher's Name: Suprity Sarkar

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
1	Honours- Theory	Child Centricism and Play-way in Education	CC-1	Concept of child centricism in education	September	2
1	Honours- Theory	Child Centricism and Play-way in Education	CC-1	Characteristics and significance of child centricism in education	November	2
1	Honours- Theory	Child Centricism and Play-way in Education	CC-1	Concept of play and work	November	2
1	Honours- Theory	Child Centricism and Play-way in Education	CC-1	Kindergarten Method	November	2
1	Honours- Theory	Child Centricism and Play-way in Education	CC-1	Montessori Method and project method	December	2
1	General- Theory	Child Centricism and Play-way in Education	GE-1	Concept of child centricism in education Characteristics and significance of child centricism in education	September	2
1	General- Theory	Child Centricism and Play-way in Education	GE-1	Concept of play and work, Kindergarten Method	November	2

Teacher's Name: Sital Sing

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
1	Honours- Theory	Education in India during British period (1854-1946)	CC-2	Woods Despatch	September	3
1	Honours- Theory	Education in India during British period (1854-1946)	CC-2	Hunter Commission	November	2
1	Honours- Theory	Education in India during British period (1854-1946)	CC-2	Curzon policy regarding primary, secondary and higher education.	November	2
1	Honours- Theory	Education in India during British period (1854-1946)	CC-2	National education movement (Cause& effect)	November	2
1	Honours- Theory	Education in India during British period (1854-1946)	CC-2	Basic education (concept & development)	December	2
1	General- Theory	Child Centricism and Play-way in Education	GE-1	Montessori Method	September	1
1	General- Theory	Child Centricism and Play-way in Education	GE-1	Project method	November	2

Teacher's Name: Tanmoy Purkait

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
1	Honours- Theory	Agencies of Education	CC-1	Home	September	2
1	Honours- Theory	Agencies of Education	CC-1	School	November	2
1	Honours- Theory	Agencies of Education	CC-1	State	November	2
1	Honours- Theory	Agencies of Education	CC-1	Mass-media-television, radio, cinema and newspaper	December	2
1	Honours- Theory	Education in India during ancient and medieval period	CC-2	Vedic	September	2
1	Honours- Theory	Education in India during ancient and medieval period	CC-2	Brahmanic, Buddhistic	November	3
1	Honours- Theory	Education in India during ancient and medieval period	CC-2	Islamic	December	2

Teacher's Name: Pravati Kapat

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
1	Honours- Theory	Concept of Education	CC-1	Narrow and broader concept of education	September	2
1	Honours- Theory	Concept of Education	CC-1	Meaning, nature and scope of education	November	2
1	Honours- Theory	Concept of Education	CC-1	Aims of education – individual, social and vocational.	November	2
1	Honours- Theory	Concept of Education	CC-1	Democratic	November	1
1	Honours- Theory	Concept of Education	CC-1	Aims of modern education with special reference to Delor's Commission.	December	2
1	General- Theory	Concept of Education	GE-1	Narrow and broader concept of education	September	2
1	General- Theory	Concept of Education	GE-1	Meaning, nature and scope of education	November	2

Teacher's Name: Sharmila Ray

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
1	Honours- Theory	Factors of Education	CC-1	Child/ learner: influence of heredity and environment on the learner	September	2
1	Honours- Theory	Factors of Education	CC-1	Teacher: qualities and duties of a good teacher.	November	2
1	Honours- Theory	Factors of Education	CC-1	Curriculum-concept and types	November	2
1	Honours- Theory	Factors of Education	CC-1	Co-curricular activities	November	2
1	Honours- Theory	Factors of Education	CC-1	Educational institutions: informal, formal and non- formal their interrelation	December	2
1	General- Theory	Factors of Education	GE-1	Child/ learner: influence of heredity and environment on the learner	September	2
1	General- Theory	Factors of Education	GE-1	Teacher: qualities and duties of a good teacher. Curriculum-concept and types	November	2

ODD SEMESTER: SEM-3

Teacher's Name: Suprity Sarkar

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
3	Honours- Theory	Social Communication in Education	CC-5	Social communication: concept, nature.	September	2
3	Honours- Theory	Social Communication in Education	CC-5	Informal Agencies	November	2
3	Honours- Theory	Social Communication in Education	CC-5	Culture. Religion	November	2
3	Honours- Theory	Social Communication in Education	CC-5	Relation between Technology, Economy, and Education.	December	2
3	General- Theory	Social Communication in Education	GE-3	Social communication: concept, nature.	September	2
3	General- Theory	Social Communication in Education	GE-3	Informal Agencies, Culture. Religion	November	2

Teacher's Name: Sital Sing

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
3	Honours- Theory	Educational Management	CC-6	Meaning of educational management.	September	2
3	Honours- Theory	Educational Management	CC-6	Objectives of educational management	November	2
3	Honours- Theory	Educational Management	CC-6	Types of educational management	December	2
3	General- Theory	Social change and education	GE-3	Concept of social change	September	2
3	General- Theory	Social change and education	GE-3	Interrelation between social change and education	November	2

Teacher's Name: Tanmoy Purkait

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
3	Honours- Theory	Social change and education	CC-5	Concept of social change	September	2
3	Honours- Theory	Social change and education	CC-5	Interrelation between social change and education	November	2
3	Honours- Theory	Social change and education	CC-5	Social interaction process	December	2
3	General- Theory	Social Groups	GE-3	Meaning and definition	September	2
3	General- Theory	Social Groups	GE-3	Socialization process	November	2

Teacher's Name: Pravati Kapat

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
3	Honours- Theory	Guidance-Educational, Vocational, Personal	CC-7	Educational Guidance	September	2
3	Honours- Theory	Guidance-Educational, Vocational, Personal	CC-7	Vocational Guidance	November	2
3	Honours- Theory	Guidance-Educational, Vocational, Personal	CC-7	Personal Guidance	December	2
3	Honours- Theory	Organization and Management	CC-6	Concept of organization	September	2
3	Honours- Theory	Organization and Management	CC-6	Concept of educational organization	November	2

Teacher's Name: Sharmila Ray

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
3	Honours- Theory	Counselling – meaning, Techniques, Types	CC-7	Counselling- meaning, importance and scope	September	2
3	Honours- Theory	Counselling – meaning, Techniques, Types	CC-7	Techniques of counselling- Directive, Non-Directive, Eclectic.	November	2
3	Honours- Theory	Counselling – meaning, Techniques, Types	CC-7	Individual and Group counselling- meaning, Importance.	December	2
3	Honours- Theory	Introduction to Communication	SEC-A	Meaning, Nature and types of communication	September	2
3	Honours- Theory	Introduction to Communication	SEC-A	Principles of communication	November	2

ODD SEMESTER: SEM-5

Teacher's Name: Suprity Sarkar

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
5	Honours- Theory	Concept of statistics and Descriptive statistics	CC-12	Meaning and measures of Variability	September	2
5	Honours- Theory	Concept of statistics and Descriptive statistics	CC-12	Percentile and percentile Rank	November	2
5	Honours- Theory	Concept of statistics and Descriptive statistics	CC-12	Graphical presentation	December	2
5	General- Theory	Peace and Non violence	DSE-A	Factors of violence	September	2
5	General- Theory	Peace and Non violence	DSE-A	Role of peace for non- violence	November	2

Teacher's Name: Sital Sing

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
5	Honours- Theory	Tools and Techniques of Evaluation	CC-11	Concept of Tools and Techniques	September	2
5	Honours- Theory	Tools and Techniques of Evaluation	CC-11	Non testing tools: CRC, Portfolio.	November	2

5	Honours- Theory	Normal- Distribution and Derived Score	CC-12	Concept of NPC, Properties.	November	3
5	Honours- Theory	Normal- Distribution and Derived Score	CC-12	Skewness, Kurtosis, (concept and calculation)	December	5
5	Honours- Theory	Basic concept of teacher education	DSEB	Concept and meaning of teacher education, scope of teacher education	September	4

Teacher's Name: Tanmoy Purkait

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
5	Honours- Practical	Statistics (Practical)	CC-12	Practical	September	3
5	Honours- Practical	Statistics (Practical)	CC-12	Practical	November	3
5	Honours- Theory	Statistics (Practical)	CC-12	Practical	December	4
5	General- Theory	Protection of Children	SEC-A	Child protection, legal actions-POCSO	September	2

Teacher's Name: Pravati Kapat

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
5	Honours- Theory	Measurement and Evaluation in Education	CC-11	Concept of Educational Measurement and Evaluation	September	2
5	Honours- Theory	Measurement and Evaluation in Education	CC-11	Relation between Measurement, Assessment, and Evaluation.	November	2
5	Honours- Theory	Concept of statistics and Descriptive statistics	CC-12	Meaning and measures of Central Tendency	December	4
5	General- Theory	Peace Education	DSE-A	Concept and scope of peace Education	November	2

Teacher's Name: Sharmila Ray

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
5	Honours- Theory	Evaluation Process	CC-11	Evaluation process: Formative and Summative	September	2
5	Honours- Theory	Evaluation Process	CC-11	Norm-Referenced Test and Criterion Referenced Test.	November	2
5	Honours- Theory	Concept of statistics and Descriptive statistics	CC-12	Standard Deviation and Quartile Deviation- their properties.	November	2
5	Honours- Theory	Normal- Distribution and Derived Score	CC-12	Derived Scores- Z-Score, T-Score and Standard Score.	December	2

5	General- Theory	Role of the different agencies in teacher education	DSE-B	NCTE, NCERT, NUEPA.	November	4

EVEN SEMESTER: **2**

Teacher's Name: Suprity Sarkar

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
2	Honours- Theory	Learning: Concept and theories	CC-3	Concept and characteristics of learning	March	2
2	Honours- Theory	Learning: Concept and theories	CC-3	Memorization and Forgetting: Process of memorization, causes of forgetting and economical ways of improving memorization.	March	3
2	Honours- Theory	Philosophy for development of humanity	CC-4	Education and development of values, Education for National integration.	April	3
2	Honours- Theory	Philosophy for development of humanity	CC-4	Education and international understanding.	May	2
2	General- Theory	Learning: Concept and theories	GE-2	Concept and characteristics of learning	March	2
2	General- Theory	Learning: Concept and theories	GE-2	Memorization and Forgetting: Process of memorization, causes of forgetting and economical ways of improving memorization.	April	3

Teacher's Name: Sital Sing

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
2	Honours- Theory	Intelligence	CC-3	Concept of intelligence and types.	March	3
2	Honours- Theory	Intelligence	CC-	Spearman theory, Guilford theory	April	3
2	Honours- Theory	Concept of educational philosophy	CC-4	Meaning of philosophy, Etymological meaning of education, Relation between philosophy and education.	May	4
2	General- Theory	Intelligence	GE-2	Concept of intelligence and types.	March	2
2	General- Theory	Intelligence	GE-2	Spearman theory, Guilford theory	April	3

Teacher's Name: Tanmoy Purkait

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes

2	Honours- Theory	Stages and types of human development and their educational significance	CC-3	Piaget's cognitive development theory, Erikson's psycho-social development theory	March	4
2	Honours- Theory	Indian school of philosophy	CC-4	Sankhya	April	2
2	Honours- Theory		CC-4	Yoga	May	2
2	General- Theory	Stages and types of human development and their educational significance	GE-2	Erikson's psycho-social development theory	March	2
2	General- Theory	Stages and types of human development and their educational significance	GE-2	Piaget's cognitive development theory	April	2

Teacher's Name: Pravati Kapat

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
2	Honours- Theory	Indian school of philosophy	CC-4	Buddhism	March	2
2	Honours- Theory	Indian school of philosophy	CC-4	Jainism	April	2
2	Honours- Theory	Stages and types of human development and their educational significance	CC-3	Moral development theory	May	2
2	General- Theory	Stages and types of human development and their educational significance	GE-2	Piaget's cognitive development theory, Erikson's psycho-social development theory	March	3
2	General- Theory	Stages and types of human development and their educational significance	GE-2	Erikson's psycho-social development theory	April	2

Teacher's Name: Sharmila Ray

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
2	Honours- Theory	Western school of philosophy	CC-4	Idealism	March	2
2	Honours- Theory	Western school of philosophy	CC-4	Naturalism, pragmatism	April	4
2	Honours- Theory	Western school of philosophy	CC-4	Realism	May	2
2	General- Theory	Learning: Concept and theories	GE-2	Insightful learning	March	2
2	General- Theory	Learning: Concept and theories	GE-2	Memorization and Forgetting: Process of memorization,	April	2

EVEN SEMESTER: **4**

Teacher's Name: Suprity Sarkar

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
4	Honours- Theory	Socially Disabled	CC-10	Concept of SC, ST and OBC groups, concept of Gender, and sexuality.	March	3
4	Honours- Theory	Socially Disabled	CC-10	Causes of social exclusion.	April	2
4	Honours- Theory	Socially Disabled	CC-10	Understanding social inclusion: role of education	May	3
4	General- Theory	Socially Disabled	GE-3	Causes of social exclusion.	March	2
4	General- Theory	Socially Disabled	GE-3	Concept of SC, ST and OBC groups, concept of Gender, and sexuality.	April	3

Teacher's Name: Sital Sing

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
4	Honours- Theory	ICT and e-learning	CC-8	Meaning and concept of ICT, e-learning	March	2
4	Honours- Theory	ICT and e-learning	CC-8	MOOC, Project based learning, Co-operative learning.	April	4
4	Honours- Theory	Skills of Teaching	SEC-A1	Nature and definition of skills of teaching, Developing teaching skills.	May	4
4	General- Theory	Learning Design	SEC-A1	Concept and importance of learning design in teaching	March	2
4	General- Theory	Learning Design	SEC-A1	Qualities of good learning design.	April	2

Teacher's Name: Tanmoy Purkait

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
4	Honours- Theory	Introductory Concept	CC-8	Concept of Technology, Need and scope of educational Technology.	March	3
4	Honours- Theory	Introductory Concept	CC-8	System approach: concept and need	April	2
4	Honours- Theory	Curriculum Development	CC-9	NCF-2005	May	2
4	Honours- Theory	Curriculum Development	CC-9	Curriculum need and planning	March	2

Teacher's Name: Pravati Kapat

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
4	Honours- Theory	Inclusion Overview	CC-10	Meaning of Inclusion and Inclusive Society, Exclusion and Inclusion: conceptual overview	March	3
4	Honours- Theory	Inclusion Overview	CC-10	Obstacles/barriers in Inclusion	April	2
4	Honours- Theory	Inclusion Overview	CC-10	Elements necessary for creating an inclusive society.	May	2
4	General- Theory	Inclusion Overview	GE-3	Meaning of Inclusion and Inclusive Society, Exclusion and Inclusion: conceptual overview	March	3
4	General- Theory	Inclusion Overview	GE-3	Obstacles/barriers in Inclusion	April	2

Teacher's Name: Sharmila Ray

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
4	Honours- Theory	Evaluation & reform of curriculum	CC-9	Models of evaluation- Stufflebeam and Taylor	March	2
4	Honours- Theory	Evaluation & reform of curriculum	CC-9	Curriculum reform- factor and obstacles	April	2
4	Honours- Theory	Types of teaching	SEC	Micro-teaching and micro lesson	May	2
4	General- Theory	Types of teaching	GE-	Micro-teaching and micro lesson, simulated teaching	March	3
4	General- Theory	Types of teaching	GE	Integrated teaching	April	2

EVEN SEMESTER: 6

Teacher's Name: Suprity Sarkar

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
6	Honours- Theory	Adjustment, Maladjustment and problem Behaviour	CC-13	Concept of adjustment, adjustment and adaptability	March	2
6	Honours- Theory	Adjustment, Maladjustment and problem Behaviour	CC-13	Psychodynamic concept of adjustment, criteria of good adjustment	April	2
6	Honours- Theory	Gender Concepts	DSE-A	Definition of Gender and difference with sex, Gender Dynamics: Gender identity, Gender role and gender stereotype.	May	4

6	General- Theory	Historical perspectives of Woman Education	DSE-B	Synoptic view of woman education through the ages: Vedic, Brahminic, Medieval period.	March	3
6	General- Theory	Historical perspectives of Woman Education	DSE-B	Role of British Govt.	April	1

Teacher's Name: Sital Sing

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
6	Honours- Theory	Concept of Educational Research	CC-14	Definition and meaning and concept of research, educational research and its characteristics, Types of educational research.	March	3
6	Honours- Tutorial	Tutorial	CC-14	Research proposal	April	4
6	Honours- Tutorial	Tutorial	CC-14	Research proposal	May	2
6	Honours- Theory	Coping Strategies for Stressful Situation	CC-13	Stress and Stressors	March	2
6	Honours- Theory	Coping Strategies for Stressful Situation	CC-13	Personal and environmental stress	April	2

Teacher's Name: Tanmoy Purkait

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
6	Honours- Practical	Practical	CC-13	KNPI	March	4
6	Honours- Practical	Practical	CC-13	KIEI	April	3
6	Honours- Practical	Practical	CC-13	Effect of Learning material on memorization	May	2
6	Honours- Practical	Practical	CC-13	KNPI	March	2
6	Honours- Practical	Practical	CC-13	Effect of Learning material on memorization, KIEI.	April	2

Teacher's Name: Pravati Kapat

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
6	Honours- Theory	Gender roles	DSE-A	Gender roles and Relationship Matrix	March	2
6	Honours- Theory	Gender roles	DSE-A	Gender based division and Valuation of Work, Exploring Attitudes towards Gender.	April	2

6	**Honours- Theory**	**Major Constraints of Woman Education and Woman Empowerment**	**DSE-B**	**Social – Psychological, political- Economical.**	**May**	**3**
6	**Honours- Theory**	**Major Constraints of Woman Education and Woman Empowerment**	**DSE-B**	**Role of Woman empowerment in modern society.**	**April**	**2**

Teacher's Name: Sharmila Ray

Semester	**Course Type**	**Unit Name (Topic)**	**Paper**	**Subunit Name**	**Month**	**No. of Classes**
6	**Honours- Theory**	**Basic elements of educational research**	**CC-14**	**Literature review**	March	**2**
6	**Honours- Theory**	**Basic elements of educational research**	**CC-14**	**Problem selection, Objectives, Research question and hypothesis.**	**April**	**2**
6	**General- Theory**	**Role of Indian Thinkers in promoting Women Education**	**DSE-B**	**Rammohan Roy**	**April**	**2**
6	**General- Theory**	**Role of Indian Thinkers in promoting Women Education**	**DSE-B**	**Vidyasagar**	**May**	**2**

Lesson Plan of Geography Department

Raidighi College (University of Calcutta)

B.A./B.Sc. Geography (Honours & General Courses)

SL. NO	**2.1** **GEO-A-CC-1-01-TH–Geotectonic Geomorphology** 60Marks/4Credits	**No. of lectures**	**Faculty**	**Period**
	Unit I: Geotectonic			
1	Earth's tectonic and structural evolution with special reference to geological time scale	**3**	**SKP***	**July**
2	Earth's interior with special reference to seismology. Isostasy: Models of Airy, Pratt and their application	**3**	**SKP**	**August**
3	Plate tectonics as a unified theory of global tectonics: Processes and landforms at plate margins and hotspots	**10**	**SKP**	**August**
4	Folds and Faults – origin and types	**4**	**SKP**	**September**
	Unit I: Geomorphology			
5	Degradational processes: Weathering, mass wasting and resultant landforms	**5**	**SC****	**July**
6	Processes of entrainment, transportation and deposition by different geomorphic agents. Role of humans in landform development	**4**	**SC**	**August**
7	Development of river network and landforms on uniclinal and folded structure. Surface expression of faults	**6**	**AB*****	**July**
8	Development of river network and landforms on granites, basalts and limestones	**5**	**SC**	**August**
9	Coastal processes and landforms	**4**	**SC**	**September**
10	Glacial and glacio-fluvial processes and landforms	**4**	**SC**	**September**
11	Aeolian and fluvio-aeolian processes and landforms	**4**	**AB**	**November**
12	Role of time and systems approach in geomorphology. Models on landscape evolution: Views of Davis, Penck, King and Hack	**8**	**SC**	**December**

(SC- Dr. Sisir Chatterjee, SKP—Sanat Kumar Purkait, AB—Arindam Bhattacharya & SP—Swarup Purkait)

SL. NO	**2.1 GEO-A-CC-1-01-P–Geotectonic and Geomorphology** 60Marks/4Credits	**No. of lectures**	**Faculty**	**Period**
1	Measurement of dip and strike using clinometer	**6**	**AB**	**July**
2	Megascopic identification of (a) mineral samples: bauxite, calcite, chalcopyrite, feldspar, galena, gypsum, hematite, magnetite, mica, quartz, talc, tourmaline; and (b) rock samples: granite, basalt, dolerite, laterite, limestone, shale, sandstone, conglomerate, slate, phyllite, schist, gneiss, quartzite, marble	**14**	**SKP**	**September**
3	Extraction and interpretation of geomorphic information from Survey of India 1:50k topographical maps of plateau region: Delineation of drainage basin, construction of relief profiles (superimposed, projected and composite), relative relief map, slope map (Wentworth's method), stream ordering (Strahler) and bifurcation ration on a drainage basin	**30**	**SC, AB, SKP**	**July to September**
4	Construction of hypsometric curve and derivation of hypsometric integer from Survey of India 1:50k topographical maps of plateau region	**10**	**SP******	**November to December**
5	Viva-voce based on laboratory notebook	**5**		

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Lesson Plan of Geography Department

Raidighi College (University of Calcutta)

B.A./B.Sc. Geography (Honours & General Courses)

SL. NO	**2.1** GEO-A-CC-1-02-TH-Cartographic Techniques 60Marks/4Credits	**No. of lectures**	**Faculty**	**Period**
1	Maps: Components and classification [4]	**4**	**AB**	**July**
2	Concept and application of scales: Plain, comparative, diagonal and Vernier [8]	**8**	**SKP**	**August**
3	Coordinate systems: Polar and rectangular [6]	**6**	**SP**	**September**
4	Concept of generating globe [2]	**2**	**SP**	**November**
5	Grids: Angular and linear systems of measurement [5]	**5**	**AB**	**August**
6	Bearing: Magnetic and true, whole-circle and reduced [5]	**5**	**SP**	**August**
7	Concept of geoid and spheroid with special reference o Everestand WGS-84[4]	**4**	**AB**	**September**
8	Map projections: Classification, properties and uses [8]	**8**	**SP**	**September to November**
9	Concept and significance of UTM projection [2]	**2**	**SP**	**September**
10	Representation of data using dots, spheres and divided proportional circles [5]	**5**	**SKP**	**August**
11	Representation of data using isopleth, choropleth, and chorochromatic maps [5]	**5**	**AB**	**September**
12	Survey of India topographical maps: Reference scheme of old and open series. Information on the margin of maps [6]	**6**	**SKP**	**November**

(SC- Dr. Sisir Chatterjee, SKP—Sanat Kumar Purkait, AB—Arindam Bhattacharya & SP—Swarup Purkait)

Lesson Plan of Geography Department

Raidighi College (University of Calcutta)

B.A./B.Sc. Geography (Honours & General Courses)

SL NO.	**2.1** **GEO-A-CC-1-02-P–Cartographic Techniques Lab** 30Marks/2Credits	**No. of lectures**	**Faculty**	**Period**
1	Graphical construction of scales: Plain, comparative, diagonal and Vernier [16]	**16**	**SKP/AB**	**July to August**
2	Construction of projections: Polar Zenithal Stereographic, Simple Conic with one standard parallel, Bonne's, Cylindrical Equal Area, and Mercator's	**20**	**SP/AB**	**August to September**
3	Thematic maps: Proportional squares, pie diagrams with proportional circles, dots and spheres [12]	**12**	**SKP, AB**	**August to September**
4	Thematic maps: Choropleth, isopleth, and chorochromatic maps [12]	**12**	**AB, SP**	**November to December**
5	Viva-voce based on laboratory notebook (5 Marks)			

(SC- Dr. Sisir Chatterjee, SKP—Sanat Kumar Purkait, AB—Arindam Bhattacharya & SP—Swarup Purkait)

Lesson Plan of Geography Department

Raidighi College (University of Calcutta)

B.A./B.Sc. Geography (Honours & General Courses)

SL NO.	**2.1** **GEO-A-CC-2-03-TH–Human Geography** 60Marks/4Credits	**No. of lectures**	**Faculty**	**Period**
1	Nature, scope and recent trends. Elements of human geography [4]	**4**	**SC**	**March**
2	Approaches to Human Geography: Resource, locational, landscape, environment [6]	**6**	**SC**	**March**
3	Concept and classification of race. Ethnicity [5]	**5**	**SC**	**April**
4	Space, society, and cultural regions (language and religion) [5]	**5**	**SC**	**April**
5	Evolution of human societies: Hunting and food gathering, pastoral nomadism, subsistence farming, and industrial society [6]	**6**	**SC**	**May**
6	Human adaptation to environment: Case studies of Eskimo, Masai and Maori [4]	**4**	**AB**	**June**
7	Population growth and distribution, composition; demographic transition[5]	**5**	**AB**	**April**
8	Population–resource regions (Ackerman) [5]	**5**	**AB**	**May**
9	Development–environment conflict [5]	**5**	**SC**	**May**
10	Types and patterns of rural settlements [5]	**5**	**AB**	**June**
11	Rural house types in India [5]	**5**	**AB**	**May**
12	Morphology and hierarchy of urban settlements [5]	**5**	**SC**	**June**

Sl no.	**2.1 GEO-A-CC-2-03-P–Human Geography Lab** 30Marks/2Credits	**No. of lectures**	**Faculty**	**Period**
1	-Spatial variation in continent- or country-level religious composition by divided proportional circles [12]	**12**	**SC**	**March to April**
2	Measuring arithmetic growth rate of population comparing two decadal datasets [15]	**15**	**AB**	**March to April**
3	Types of age-sex pyramids (progressive, regressive, intermediate, and stationary): Graphical representation and analysis [20]	**20**	**AB**	**May to June**
4	Nearest neighbour analysis from Survey of India 1:50k topographical maps of plain region (c. 5’ x 5’) [13]	**13**	**SP**	**May to June**
5	Viva-voce based on laboratory notebook (5 Marks)			

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Raidighi College (University of Calcutta)

B.A./B.Sc. Geography (Honours & General Courses)

Si no.	**2.1 GEO-A-CC-2-04-TH – Thematic Mapping and Surveying** 60Marks/4Credits	**No. of lectures**	**Faculty**	**Period**
1	Concepts of rounding, scientific notation. Logarithm and anti-logarithm. Natural and log scales [4]	**4**	**SKP**	**March**
2	Concept of diagrammatic representation of data [2]	**2**	**SKP**	**April**
3	Preparation and interpretation of geological maps [5]	**5**	**SC**	**March**
4	Preparation and interpretation of weather maps [5]	**5**	**SC, SP**	**April to May**
5	Preparation and interpretation land use land cover maps [5]	**5**	**AB, SC**	**April**
6	Preparation and interpretation of socio-economic maps [5]	**5**	**AB**	**April**
7	Principal national agencies producing thematic maps in India: NATMO, GSI, NBSSLUP, NHO, and NRSC / Bhuvan [5]	**5**	**SKP**	**April to May**
8	Basic concepts of surveying and survey equipment: Prismatic compass [5]	**5**	**SKP**	**April**
9	Basic concepts of surveying and survey equipment: Dumpy level [7]	**7**	**SKP**	**April to June**
10	Basic concepts of surveying and survey equipment: Theodolite [7]	**7**	**SKP**	**April to June**
11	Basic concepts of surveying and survey equipment: Abney level [5]	**2**	**SP, AB**	**May**
12	Basic concepts of surveying and survey equipment: Laser distance measurer [5]	**5**	**AB, SKP**	**May to June**

(SC- Dr. Sisir Chatterjee, SKP—Sanat Kumar Purkait, AB—Arindam Bhattacharya & SP—Swarup Purkait)

Sl no.	**2.1 GEO-A-CC-2-04-P–Thematic Mapping and Surveying Lab** 30Marks/2Credits	No. of lectures	Faculty	Period
1	Traverse survey using prismatic compass [10]	**10**	**SKP**	**March to April**
2	Profile survey using dumpy Level [12]	**12**	**SKP**	**March to April**
3	Height determination of base accessible and inaccessible (same vertical plane method) objects by theodolite [18]	**18**	**SKP**	**April to May**
4	Interpretation of geological map with uniclinal structure, folds, unconformity, and intrusions [20]	**20**	**SC**	**March to May**
5	Viva-voce based on laboratory notebook (5 Marks			

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Raidighi College (University of Calcutta)

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Sl no.	**2.1 GEO-A-CC-3-05-TH–Climatology** 60Marks/ 4 Credits	**No. of lectures**	**Faculty**	**Period**
1	Nature, composition and layering of the atmosphere [4]	**4**	**SP**	**July**
2	Insolation: Controlling factors. Heat budget of the atmosphere [6]	**6**	**SP**	**August**
3	Temperature: horizontal and vertical distribution. Inversion of temperature: types, causes and consequences [6]	**6**	**SP**	**September**
4	Overview of climate change: Greenhouse effect. Formation, depletion, and significance of the ozone layer [4]	**4**	**SC**	**July**
5	Condensation: Process and forms. Mechanism of precipitation: Bergeron-Findeisen theory, collision and coalescence. Forms of precipitation [6]	**6**	**SC**	**July to August**
6	Air mass: Typology, origin, characteristics and modification [4]	**4**	**SC**	**August to September**
7	Fronts: Warm and cold, frontogenesis, and frontolysis [5]	**5**	**SP**	**September**
8	Weather: Stability and instability, barotropic and baroclinic conditions [5]	**5**	**SP**	**August**
9	Circulation in the atmosphere: Planetary winds, jet streams, index cycle [5]	**5**	**SP**	**September**
10	Atmospheric disturbances: Tropical and mid-latitude cyclones, thunderstorms [5]	**5**	**SC**	**September**
11	Monsoon circulation and mechanism with reference to India [5]	**5**	**SC**	**November**
12	Climatic classification after Thornthwaite (1955) and Oliver [5]	**5**	**SC**	**November**

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Sl no.	**2.1** **GEO-A-CC-3-05-P–Climatology Lab**30Marks / 2 Credits	**No. of lectures**	**Faculty**	**Period**
1	Measurement of weather elements using analogue instruments: Mean daily temperature, air pressure, relative humidity, and rainfall [15]	**15**	**SC, SP**	**August to September**
2	Interpretation of a daily weather map of India (any two): Pre-Monsoon, Monsoon, and Post-Monsoon [20]	**20**	**SC, SP**	**August to September**
3	Construction and interpretation of hythergraph and climograph (G.Taylor) [15]	**15**	**AB, SC**	**September to November**
4	Construction and interpretation of wind rose [10]	**10**	**AB**	**November**
5	Viva-voce based on laboratory notebook (5 Marks)			

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Raidighi College (University of Calcutta)

B.A./B.Sc. Geography (Honours & General Courses)

Sl no.	GEO-A-CC-3-06-TH–Hydrology and Oceanography 60Marks/4Credits	No. of lectures	Faculty	Period
1	Systems approach in hydrology. Global hydrological cycle: Its physical and biological role [5]	**5**	**SC**	**July**
2	Run off: controlling factors. Infiltration and evapo-transpiration. Runoff cycle [5]	**5**	**AB**	**August**
3	Drainage basin as a hydrological unit. Principles of water harvesting and watershed management [5]	**5**	**AB**	**August**
4	Groundwater: Occurrence and storage. Factors controlling recharge, discharge and movement [5]	**5**	**SC**	**August**
5	Major relief features of the ocean floor: Characteristics and origin according to plate tectonics [6]	**6**	**SC**	**September**
6	Physical and chemical properties of ocean water [4]	**4**	**AB**	**September**
7	Water mass, T–S diagram [4]	**4**	**AB**	**November**
8	Air-Sea interactions, ocean circulation, wave and tide [8]	**8**	**SC**	**November to December**
9	Ocean temperature and salinity: Distribution and determinants [4]	**4**	**SC**	**September**
10	Coral reefs: Formation, classification and threats [5]	**5**	**AB**	**November**
11	Marine resources: Classification and sustainable utilisation [4]	**4**	**AB**	**November to December**
12	Sea level change: Types and causes [5]	**5**	**SC**	**November to December**

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Sl no.	**2.1** **GEO-A-CC-3-06-P–Hydrology and Oceanography Lab** 30Marks/2Credits	**No. of lectures**	**Faculty**	**Period**
1	Construction and interpretation of rating curves [10]	**10**	**SC**	**July to August**
2	Construction and interpretation of hydrographs and unit hydrographs [15]	**15**	**SC**	**August to September**
3	Construction and interpretation of monthly rainfall dispersion diagram (Quartile method), Climatic water budget and Ergograph [25]	**25**	**SC**	**August to September**
4	Construction of Theissen polygon from precipitation data [10]	**10**	**SC/AB**	**November to December**
5	Viva-voce based on laboratory notebook (5 Marks)			

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B.A./B.Sc. Geography (Honours & General Courses)

Sl no.	2.1 GEO-A-CC-3-07-TH–Statistical Methods in Geography 60Marks/4Credits	No. of lectures	Faculty	Period
1	Importance and significance of statistics in Geography [4]	**4**	**SKP**	**July**
2	Discrete and continuous data, population and samples, scales of measurement (nominal, ordinal, interval and ratio) [5]	**5**	**SKP**	**July**
3	Sources of geographical data for statistical analysis [4]	**4**	**SKP**	**July**
4	Collection of data and preparation of statistical tables [5]	**5**	**SKP**	**August**
5	Sampling: Need, types, significance, and methods of random sampling [4]	**4**	**SKP**	**August**
6	Theoretical distribution: Frequency, cumulative frequency, normal, and probability [6]	**6**	**SKP**	**August**
7	Central tendency: Mean, median, mode, and partition values [6]	**6**	**SKP**	**August**
8	Measures of dispersion range, mean deviation, standard deviation, and coefficient of variation [6]	**6**	**SKP**	**September**
9	Association and correlation: Product moment correlation and rank correlation, [5]	**5**	**SKP**	**September**
10	Regression: Linear and non-linear [5]	**5**	**SKP**	**September**
11	Time series analysis: Moving average [5]	**5**	**SKP**	**November**
12	Hypothesis testing: Chi-square test and T-test [5]	**5**	**SKP**	**November**

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B.A./B.Sc. Geography (Honours & General Courses)

Sl no.	**2.1 GEO-A-CC-3-07-P–Statistical Methods inGeography Lab** 30Marks/2Credits	**No. of lectures**	**Faculty**	**Period**
1	Construction of data matrix with each row representing an areal unit (districts / blocks /mouzas / towns) and corresponding columns of relevant attributes [15]	**15**	**SKP**	**July to August**
2	Based on the above, a frequency table, measures of central tendency, and dispersion would be computed and interpreted using histogram and frequency curve [15]	**15**	**SKP**	**August to September**
3	From the data matrix, a sample set (20%) would be drawn using random, systematic, and stratified methods of sampling and the samples would be located on a map with an explanation of the methods used [15]	**15**	**SKP**	**August to September**
4	Based on the sample set and using two relevant attributes, a scatter diagram and linear regression line would be plotted and residual from regression would be mapped with a short interpretation [15]	**15**	**SKP**	**November to December**
5	Viva-voce based on laboratory notebook (5 Marks)			

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B.A./B.Sc. Geography (Honours & General Courses)

Sl no.	4.1 GEO-A-SEC-A-3-02-TH – Tourism Management 90Marks / 2 Credits	No. of lectures	Faculty	Period
1	Scope and Nature: Concepts and issues, tourism, recreation and leisure inter-relations; Factors influencing tourism, Types of Tourism: Ecotourism, cultural tourism, adventure tourism, medical tourism, pilgrimage, international, national [10]	**10**	**SC/AB**	**September**
2	Use of information on factors (historical, natural, socio-cultural and economic; motivating factors for pilgrimages) to plan destination marketing; tourism products. Niche tourism planning [5]	**5**	**AB**	**November**
3	Tourism impact assessment, Sustainable tourism, Information Technology and Tourism, Tour operations planning and guiding [8]	**8**	**SC**	**November to December**
4	Increasing Global tourism; Tourism in India: Tourism infrastructure, access, planning for different budgets forcase study sites of Western Himalayas, Goa, Chilka /Vembanad, Jaipur [7]	**7**	**SC**	**November to December**

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Sl no.	2.1 **GEO-A-CC-4-08-TH–Economic Geography**✧60Marks/4Credits	No. of lectures	Faculty	Period
1	Meaning and approaches to economic geography [4]	**4**	**SC**	**March**
2	Concepts in economic geography: Goods and services, production, exchange, and consumption [6]	**6**	**SC**	**March**
3	Concept of economic man. Theories of choices [6]	**6**	**SC**	**April**
4	Economic distance and transport costs [4]	**4**	**SC**	**April**
5	Concept and classification of economic activities [4]	**4**	**SC**	**April**
6	Factors affecting location of economic activity with special reference to agriculture (von Thünen), and industry (Weber)[6]	**6**	**SC**	**April**
7	Primary activities: Agriculture, forestry, fishing, and mining [6]	**6**	**SC**	**May**
8	Secondary activities: Classification of manufacturing, concept of manufacturing regions, special economic zones and technology parks [6]	**6**	**SC**	**May**
9	Tertiary activities: Transport, trade and services [6]	**6**	**SC**	**May**
10	Transnational sea-routes, railways and highways with reference to India [4]	**4**	**SC**	**May**
11	International trade and economic blocs [4]	**4**	**SC**	**June**
12	WTO and BRICS: Evolution, structure and functions [4]	**4**	**SC**	**June**

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Sl no.	**2.1** **GEO-A-CC-4-08-P–Economic Geography Lab** ✧30Marks/2Credits	**No. of Lectures**	**Faculty**	**Period**
1	Choropleth mapping of state-wise variation in GDP [10]	**10**	**SC/AB**	**March to April**
2	State-wise variation in occupational structure by proportional divided circles [15]	**12**	**SP**	**April to May**
3	Time series analysis of industrial production (India and West Bengal) [20]	**20**	**AB**	**April to June**
4	Transport network analysis by detour index and shortest path analysis [15]	**15**	**SP**	**April to May**
5	Viva-voce based on laboratory notebook (5 Marks)			

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B.A./B.Sc. Geography (Honours & General Courses)

Sl no.	**2.1 GEO-A-CC-4-09-TH–Regional Planning and Development** 60Marks/4Credits	**No. of lectures**	**Faculty**	**Period**
1	Regions: Concept, types, and delineation [4]	**4**	**SKP**	**March**
2	Regional Planning: Types, principles, objectives, tool and techniques [6]	**6**	**SKP**	**April**
3	Regional planning and multi-level planning in India [6]	**6**	**SKP**	**May**
4	Concept of metropolitan area and urban agglomeration [4]	**4**	**AB**	**April**
5	Concept of growth and development, growth versus development [6]	**6**	**SC**	**April**
6	Indicators of development: Economic, demographic, and environmental [6]	**6**	**SC**	**May**
7	Human development: Concept and measurement [4]	**4**	**SKP**	**June**
8	Theories and models for regional development: Cumulative causation (Myrdal)[4]	**4**	**AB**	**May**
9	Models and theories in regional development: Stages of development (Rostow), growth pole model (Perroux)[6]	**6**	**SP**	**April**
10	Under development: Concept and causes [4]	**4**	**SC**	**May**
11	Regional development in India: Disparity and diversity [5]	**5**	**SKP**	**May**
12	Need and measures for balanced development in India [5]	**5**	**SKP**	**June**

Sl no.	2.1 **GEO-A-CC-4-09-P–Regional Planning and Development Lab**✧30Marks/2C r e d I t s	No. of lectures	Faculty	Period
1	Delineation of formal regions by weighted index method [15]	**15**	**SKP**	**April to May**
2	Delineation of functional regions by breaking point analysis [15]	**15**	**SKP**	**April to May**
3	Measurement of inequality by location quotient [15]	**15**	**SKP**	**May to June**
4	Measuring regional disparity by Sopher index [15]	**15**	**SKP**	**May to June**
5	Viva-voce based on laboratory notebook (5Marks)			

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B.A./B.Sc. Geography (Honours & General Courses)

Sl no.	2.1 GEO-A-CC-4-10-TH–Soil and Biogeography ✧60Marks/4Credits	No. of lectures	Faculty	Period
1	Factors of soil formation [3]	**3**	**AB**	**March**
2	Definition and significance of soil properties: Texture, structure, and moisture [5]	**5**	**AB**	**April**
3	Definition and significance of soil properties: pH, organic matter, and NPK [5]	**5**	**AB**	**April**
4	Soil profile. Origin and profile characteristics of lateritic, podsol and chernozem soils [6]	**6**	**AB**	**May**
5	Soil erosion and degradation: Factors, processes and management measures. Humans as active agents of soil transformation [5]	**5**	**AB**	**May to June**
6	Principles of soil classification: Genetic and USDA. Conceptof land capability and its classification [6]	**6**	**AB**	**May to June**
7	Concepts of biosphere, ecosystem, biome, ecotone, community and ecology [5]	**5**	**SP**	**March**
8	Concepts of trophic structure, food chain and food web. Energy flow in ecosystems [5]	**5**	**SP**	**March**
9	Classification of world biomes (Whittaker). Geographical extent and characteristics of tropical rain forest, savanna, hot desert, taiga and coral reef biomes [8]	**8**	**SP**	**April**
10	Bio-geochemical cycles with special reference to carbon di oxide and nitrogen [4]	**4**	**SP**	**April**
11	Deforestation: Causes, consequences and management [4]	**4**	**SP**	**May to June**
12	Biodiversity: Definition, types, threats and conservation measures [4]	**4**	**SP**	**May to June**

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Sl no.	**2.1** **GEO-A-CC-4-10-P–Soil and Biogeography Lab** 30Marks/2Credits	**No. of lectures**	**Faculty**	**Period**
1	Determination of soil reaction (pH) and salinity using field kit [15]	**15**	**SC**	**March to April**
2	Determination of soil type by ternary diagram textural plotting [15]	**15**	**AB**	**May**
3	Plant species diversity determination by matrix method [10]	**10**	**SC/SP**	**April to May**
4	Time series analysis of biogeography data [20]	**20**	**SP**	**May to June**
5	Viva-voce based on laboratory note book (5Marks)			

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Sl no.	**4.1** GEO-A-SEC-B-4-03-TH – Rural Development ✧90Marks /2 Credits	**No. of lectures**	**Faculty**	**Period**
1	Rural Development: Concept, basic elements, measures of level of rural development [5]	**5**	**SC**	**March**
2	Paradigms of rural development: Gandhian approach to rural development Lewis model of economic development, 'big push' theory of development, Myrdal's model of 'spread and backwash effects' [10]	**10**	**SP**	**April**
3	Area based approach to rural development: Drought prone area programmes, PMGSY, SJSY, MNREGA, Jan Dhan Yojana [10]	**10**	**SKP**	**May**
4	Rural Governance: Panchayati Raj System and rural development policies and Programmes in India [5]	**5**	**SC**	**April**

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Sl no.	2.1 GEO-A-CC-5-11-TH–Research Methodology and Fieldwork 60Marks/4Credits	No. of lectures	Faculty	Period
1	Research in Geography: Meaning, types and significance [5]	**5**	**SC**	**July**
2	Literature review and formulation of research design [5]	**5**	**SC**	**July**
3	Defining research problem, objectives and hypothesis [6]	**6**	**SC**	**July**
4	Research materials and methods [4]	**4**	**SC**	**August**
5	Techniques of writing scientific reports: Preparing notes, references, bibliography, abstract, and keywords [6]	**6**	**SC/SKP**	**September**
6	Plagiarism: Classification and prevention [4]	**4**	**SKP**	**August**
7	Fieldwork in Geographical studies: Role and significance . Selection of study area and objectives. Pre-field academic preparations. Ethics of field work [6]	**6**	**SC**	**September to November**
8	Field techniques and tools: Observation (participant, non-participant), questionnaires (open, closed, structured, non-structured). Interview [5]	**5**	**SC**	**September to November**
9	Field techniques and tools: Landscapes survey using transects and quadrants, constructing a sketch, photo and video recording [5]	**5**	**SKP/SC**	**September to November**
10	Positioning and collection of samples. Preparation of inventory from field data [4]	**4**	**SC**	**August**
11	Post- field tabulation, processing and analysis of quantitative and qualitative data [5]	**5**	**SC**	**August to September**
12	Field work: Logistics and handling of emergencies [5]	**5**	**SC**	**September**

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2.22 GEO-A-CC-5-11-P–Research Methodology and Fieldwork Lab30Marks/2Credits–

SC, SKP, SP & AB

Sl no.	2.1 GEO-A-CC-5-12-TH–Remote Sensing, GIS and GNSS [?] 60Marks/2Credits	No. of lectures	Faculty	Period
1	Principles of Remote Sensing (RS): Types of RS satellites and sensors [5]	**5**	**SKP**	**July**
2	Sensor resolutions and their applications with reference to IRS and Landsat missions [5]	**5**	**SKP**	**July**
3	Imager referencing schemes and acquisition procedure of free geospatial data from NRSC/ Bhuvan and USGS [5]	**5**	**SKP**	**August**
4	Preparation of False Colour Composites from IRSLISS-3 and Landsat TM/OLI data.[5]	**5**	**SKP**	**August**
5	Principles of image interpretation. Preparation of inventories of landuse landcover (LULC) features from satellite images [5]	**5**	**SKP**	**August**
6	Acquisition and utilisation of free Digital Elevation Model data: Car to DEM, SRTM and ALOS[5]	**5**	**SKP**	**September**
7	GIS data structures types: Spatial and non-spatial, raster and vector [5]	**5**	**SKP**	**September**
8	Principles of preparing attribute tables, data manipulation, and overlay analysis [6]	**6**	**SKP**	**September**
9	Principles and significance of buffer preparation [4]	**4**	**SKP**	**November**
10	Principles and significance of overlay analysis [5]	**5**	**SKP**	**November**
11	Principles of GNSS positioning and waypoint collection [5]	**5**	**SKP**	**November**
12	Principles of transferring of GNSS waypoints to GIS. Area and length calculations from GNSS data [5]	**5**	**SKP**	**December**

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Sl no.	2.1 GEO-A-CC-5-12-P–Remote Sensing, GIS and GNSS Lab 30Marks/2Credits	No. of lectures	Faculty	Period
1	Image geo referencing and enhancement. Preparation of reflectance libraries of LULC features across different image bands of IRS L3 or Landsat OLI data [15]	**15**	**SKP**	**July to August**
2	Supervised image classification, class editing, and post-classification analysis [15]	**15**	**SKP**	**August to September**
3	Digitization of features and administrative boundaries. Data attachment, overlay, and preparation of annotated thematic maps [20]	**20**	**SKP**	**September to November**
4	Way point collection from GNSS receivers and exporting to GIS database [10]	**10**	**SKP**	**November**
5	Viva-voce based on laboratory notebooks(5Marks)			

Sl no.	3.1 GEO-A-DSE-A-5-02-TH–Climate Change: Vulnerability and Adaptations60Marks	No. of lectures	Faculty	Period
1	The science of climate change: Origin, scope and trends [5]	**5**	**SC**	**July**
2	Climate change with reference to the geological time scale [6]	**6**	**SC**	**August**
3	Evidences and factors of climate change: The nature–man dichotomy [4]	**4**	**SC**	**August**
4	Greenhouse gases and global warming [5]	**5**	**SC**	**August**
5	Electromagnetic spectrum, atmospheric window, heat balance of the earth [5]	**5**	**SC**	**September**
6	Global climatic assessment: IPCC reports [5]	**5**	**SC**	**September**
7	Climate change and vulnerability: Physical; economic and social [5]	**5**	**SC**	**September**
8	Impact of climate change: Agriculture and water; flora and fauna; human health and morbidity [5]	**5**	**SC**	**November**
9	Global initiatives to climate change mitigation: Kyoto Protocol, carbon trading, clean development mechanism COP, climate fund [5]	**5**	**SC**	**November**
10	Climate change vulnerability assessment and adaptive strategies with particular reference to South Asia [5]	**5**	**SC**	**November**
11	National Action Plan on climate change [5]	**5**	**SC**	**December**
12	Role of urban local bodies, panchayats, and educational institutions on climate change mitigation: Awareness and action programmes [5]	**5**	**SC**	**December**

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B.A./B.Sc. Geography (Honours & General Courses)

Sl. no	GEO-A-DSE-A-5-02-P–Climate Change: Vulnerability and Adaptations Lab 30Marks	No of lectures	Faculty	Period
1	Analysis of trends of temperatures (maximum and minimum of about three decades) of any Indian Meteorological Department (IMD) station [10]	**10**	**SC**	**July to August**
2	Comparative analysis of seasonal variability of rainfall on the basis of monthly data of any two IMD stations [15]	**15**	**SC**	**August to September**
3	Annual rainfall variability of about three decades for any two representative climatic regions of India [15]	**15**	**SC**	**September to November**
4	Preparation of an inventory of extreme climatic events and mitigation measure of any climatic region / country of South Asia for a period of one decade on the basis of secondary information [20]	**20**	**SC**	**September to November**
5	Viva-voce based on laboratory notebook (5Marks)			

Lesson Plan of Geography Department

Raidighi College (University of Calcutta)

B.A./B.Sc. Geography (Honours & General Courses)

Sl. no.	3.1 GEO-A-DSE-A-5-02-TH–Cultural and Settlement Geography 60Marks	No. of lectures	Faculty	Period
1	Definition, scope and content of cultural geography [5]	**5**	**SP**	**July**
2	Development of cultural geography in relation to allied disciplines [6]	**5**	**SP**	**August**
3	Cultural hearth and realm, cultural diffusion of major world religions and languages [4]	**6**	**SP**	**August**
4	Cultural segregation and cultural diversity, culture, technology and development. [5]	**5**	**SP**	**September**
5	Races and racial groups of the world [5]	**5**	**SP**	**November**
6	Cultural regions of India [5]	**4**	**SP**	**July**
7	Rural settlement: Definition, nature and characteristics [5]	**3**	**AB**	**August**
8	Morphology of rural settlements: site and situation, layout- internal and External [5]	**5**	**AB**	**August**
9	Rural house types with reference to India, Social segregation in rural areas; Census categories of rural settlements [5]	**7**	**AB**	**September**
10	Urban settlements: Census definition (Temporal) and categories in India [5]	**3**	**AB**	**September**
11	Urban morphology: Models of Burgess, Hoyt, Harris and Ullman [5]	**7**	**AB**	**November**
12	City-region and conurbation. Functional classification of cities: Schemes of Harris, Nelson and McKenzie [5]	**5**	**AB**	**November**

Sl. no	GEO-A-DSE-A-5-02-P–Cultural and Settlement Geography Lab 30Marks	No of lectures	Faculty	Period
1	Mapping language distribution of India [10]	**10**	**SP**	**August to September**
2	CD block-wise housing distribution in any district ofWest Bengal using proportional square [20]	**20**	**AB**	**August to September**
3	Identification of rural settlement types from toposheet [15]	**15**	**AB**	**September to November**
4	Social area analysis of a city (Shevky & Bell) [15]	**15**	**SP**	**September to November**
5	Viva-voce based on laboratory notebook (5Marks)			

(SC- Dr. Sisir Chatterjee, SKP—Sanat Kumar Purkait, AB—Arindam Bhattacharya & SP—Swarup Purkait)

Lesson Plan of Geography Department

Raidighi College (University of Calcutta)

B.A./B.Sc. Geography (Honours & General Courses)

Sl. no	**GEO-A-CC-6-13-TH–Evolution of Geographical Thought** 60Marks/4Credits	**No. of lectures**	**Faculty**	**Period**
1	Development of pre-modern Geography: Contributions of Greek, Chinese, and Indian geographers [5]	**5**	**SC**	**July**
2	Impact of 'Dark Age' in Geography and Arab contributions [5]	**5**	**SC**	**August**
3	Geography during the age of 'Discovery' and 'Exploration' (contributions of Portuguese voyages, Columbus, Vasco da Gama, Magellan, Thomas Cook) [5]	**5**	**SC**	**August**
4	Transition from cosmography to scientific Geography (contributions of Bernard Varenius and Immanuel Kant). Dualism and Dichotomies (General vs. Particular, Physical vs. Human, Regional vs. Systematic, Determinism vs. Possibilism, Ideographic vs. Nomothetic) [7]	**7**	**SC**	**August**
5	Evolution of Geographical thoughts in Germany, France, Britain, andUnited States of America [5]	**5**	**SC**	**September**
6	Contributions of Humboldt and Ritter [3]	**3**	**SC**	**September**
7	Contributions of Richthofen, Hartshorne– Schaeffer, Ratzel, La Blaché[6]	**6**	**SC**	**September**
8	Trends of geography in the post-World War-II period: Quantitative revolutions, systems approach [7]	**7**	**SC**	**September**
9	Structuralism and historical materialism [3]	**3**	**SC**	**November**
10	Changing concept of space with special reference to Harvey[5]	**5**	**SC**	**November**
11	Evolution of Critical Geography: Behavioural, humanistic, and radical [5]	**5**	**SC**	**November**
12	Towards post modernism: Geography in the 21s century[5]	**5**	**SC**	**December**

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Lesson Plan of Geography Department

Raidighi College (University of Calcutta)

B.A./B.Sc. Geography (Honours & General Courses)

Sl no.	**2.1** **GEO-A-CC-6-13-P–Evolution of Geographical Thought Lab**30Marks/2Credits	**No. of Lectures**	**Faculty**	**Period**
1	Changing perception of maps of the world (Ptolemy, Ibn Batuta, Mercator)	**-**	**SC**	**August**
2	Mapping voyages; Columbus, Vasco da Gama, Magellan, Thomas Cook	**-**	**SC**	**September**
3	Group Presentation of five to ten students on any selected school of geographical thought (20 marks)	**-**	**SC**	**November**
4	Viva-voce based on laboratory notebook on topics 1 and 2 (10 Marks)			

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Sl no	**2.1** **GEO-A-CC-6-14-TH–Hazard Management** 60Marks/4Credits	**No. of lectures**	**Faculty**	**Period**
1	Classification of hazards and disasters. Hazard continuum [4]	**4**	**SC**	**July**
2	Approaches to hazard study: Risk perception and vulnerability assessment. Hazard paradigms [6]	**6**	**SC**	**July**
3	Responses to hazards: Preparedness, trauma, and aftermath. Resilience, capacity building [5]	**5**	**SC**	**August**
4	Hazards mapping: Data and geospatial techniques (for hazards enlisted in Unit II and GEO-A-CC-6-14-P) [5]	**5**	**SC**	**August**
5	Earthquake: Factors, vulnerability, consequences, and management [5]	**5**	**AB**	**August**
6	Landslide: Factors, vulnerability, consequences, and management [5]	**5**	**SKP**	**July**
7	Land subsidence: Factors, vulnerability, consequences, and management [5]	**5**	**SKP**	**August**
8	Tropical cyclone: Factors, vulnerability, consequences, and management [5]	**5**	**SKP**	**August**
9	Flood: Factors, vulnerability, consequences, and management [5]	**5**	**SKP**	**September**
10	River bank erosion: Factors, vulnerability, consequences, and management [5]	**5**	**SKP**	**September**
11	Fire: Factors, vulnerability, consequences, and management [5]	**5**	**SKP**	**November**
12	Bio hazard: Classification, vulnerability, consequences, and management [5]	**5**	**SKP**	**November**

Lesson Plan of Geography Department

Raidighi College (University of Calcutta)

B.A./B.Sc. Geography (Honours & General Courses)

Sl no.	**3.1** **GEO-A-DSE-A-6-04-TH–Resource Geography** 60Marks/4Credits	**No. of lectures**	**Faculty**	**Period**
1	Natural resources: Concept and classification [4]	**4**	**AB**	**July**
2	Approaches to resource utilization: Utilitarian, conservational, community based adaptive [6]	**6**	**AB**	**July**
3	Significance of resources: Backbone of economic growth and development [5]	**5**	**AB**	**August**
4	Pressure on resources. Appraisal and conservation of natural resources [5]	**5**	**AB**	**August**
5	Problems of resource depletion: global scenario (forest, water, fossil fuels) [7]	**7**	**AB**	**August**
6	Sustainable resource development [3]	**3**	**AB**	**September**
7	Distribution, utilisation, problems and management of metallic mineral resources: Iron ore, bauxite, copper [6]	**6**	**AB**	**September**
8	Distribution, utilization, problems and management of non-metallic mineral resources: Limestone, mica, gypsum [6]	**6**	**AB**	**September**
9	Distribution, utilization, problems and management of energy resources: Conventional and non-conventional [6]	**6**	**AB**	**November**
10	Contemporary energy crisis and future scenario [4]	**4**	**AB**	**November**
11	Politics of power resources [3]	**3**	**AB**	**November**
12	Limits to growth and sustainable use of resources. Concept of resource sharing [5]	**5**	**AB**	**December**

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Lesson Plan of Geography Department

Raidighi College (University of Calcutta)

B.A./B.Sc. Geography (Honours & General Courses)

Sl. no	**3.1** **GEO-A-DSE-A-6-04-P – Resource Geography Lab**30 Marks / 2 Credits	No. of lecture	Faculty	Period
1	Mapping and area estimate of changes in forest or vegetation cover from maps and /or satellite images [15]	**15**	**AB**	**July to August**
2	Mapping and number estimate of changes in water bodies from maps and / or satellite images [15]	**15**	**AB**	**July to August**
3	Decadal changes in state-wise production of coal and iron ore [15]	**15**	**AB**	**September to November**
4	Computing Human Development index: Comparative decadal change of top five Indian states [15]	**15**	**AB**	**September to November**
5	Viva-voce based on laboratory note book (5Marks)			

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Lesson Plan of Geography Department

Raidighi College (University of Calcutta)

B.A./B.Sc. Geography (Honours & General Courses)

Sl. no	3.1 GEO-A-DSE-B-6-07-TH – Urban Geography60 Marks /4 Credits	No. of lecture	Faculty
1	Urban Geography: Nature and scope, different approaches and recenttrends in urban geography [5]	5	
2	Origin of urban places in ancient, medieval, modern and post-modernperiods: Factors, stages, and characteristics [7]	7	
3	Theories of urban evolution and growth: Hydraulic theory andeconomic theory [3]	3	
4	Aspects of urban places: Location, site, and situation. Size and spacingof cities: Rank size rule, law of primate city [5]	5	
5	Urban hierarchies: Central place theory. August Lösch's theory of market centres [5]	5	
6	Patterns of urbanisation in developed and developing countries [5]	5	
7	Ecological processes of urban growth, Urban fringe. City-region[5]	5	
8	Models on urban structure: Political economy, bid-rent curve, social areaanalysis[5]	5	
9	Urban issues :Problems of housing, slums, civic amenities (water andtransport)[7]	7	
10	Patterns and trends of urbanisation in India[3]	3	
11	Policies on urbanisation. Urban change in post-liberalised period in India[5]	5	
12	Case studies of Delhi ,Kolkata, and Chandigarh with reference to landuse[5]	5	

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Raidighi College (University of Calcutta)

B.A./B.Sc. Geography (Honours & General Courses)

Sl no.	3.1 **GEO-A-DSE-B-6-07-P – Urban Geography** **Lab** 30 Marks / 2 Credits	No. of lectures	Faculty
1	Hierarchy of urban settlements: Rank-size rule[15]	15	
2	State-wise variation and trends of urbanisation[15]	15	
3	Temporal analysis of urban growth using Census of Indiadata[15]	15	
4	Preparation of urban landuse landcover map from satelliteimages[15]	15	
5	Viva-voce based on laboratory notebook (5Marks)		

Lesson Plan of Geography Department

Raidighi College (University of Calcutta)

B.A./B.Sc. Geography (Honours & General Courses)

Sl no.	**5.1** GEO-G-CC-1-01-TH–Physical Geography 60 Marks / 4 Credits	No. of lectures	Faculty	Period
1	Earth's interior with special reference to seismology [3]	**3**	**SP**	**July**
2	Plate Tectonic as a unified theory of global tectonics. Formation of major relief features of the ocean floor and continents according to Plate Tectonics [7]	**7**	**SP**	**August**
3	Folds and faults: Classification and surface expressions [6]	**6**	**SP**	**August**
4	Degradational processes: Weathering, mass wasting, and resultant landforms [4]	**4**	**SP**	**August**
5	Principal geomorphic agents. Classification and evolution of fluvial, coastal, aeolian, and glacial landforms [12]	**12**	**SP**	**September to November**
6	Basic models of slope evolution: Decline, replacement, and retreat. Systems approach and its significance in geomorphology [6].	**6**	**SP**	**July**
7	Global hydrological cycle: Its physical and biological role [2]	**2**	**SC**	**August**
8	Run off: Controlling factors. Concept of ecological flow [3]	**3**	**SC**	**September**
9	Drainage basin as a hydrological unit. Principles of watershed management [3]	**3**	**SC**	**November**
10	Physical and chemical properties of ocean water. Distribution and determinants of temperature and salinity [4]	**4**	**SC**	**November**
11	Ocean circulation, wave, and tide [7]	**7**	**SC**	**September**
12	Marine resources: Classification and sustainable utilization [3]	**3**	**SC**	**November**

Lesson Plan of Geography Department

Raidighi College (University of Calcutta)

B.A./B.Sc. Geography (Honours & General Courses)

Sl. no	5.1 GEO-G-CC-1-01-P – Physical Geography Lab 30 Marks / 2 Credits	No. of lectures	Faculty	Period
1	Megascopic identification of *mineral samples*: Bauxite, calcite, chalcopyrite, feldspar, galena, hematite, mica, quartz, talc, tourmaline [8]	**8**	**SP**	**July to August**
2	Megascopic identification of *rock samples*: Granite, basalt, laterite, limestone, shale, sandstone, conglomerate, slate, phyllite, schist, gneiss, quartzite [12]	**12**	**SP**	**August to September**
3	Extraction of physiographic information from Survey of India 1:50k topographical maps of plateau region: Construction and interpretation of relief profiles (superimposed, projected and composite), Construction and interpretation of relative relief map (c. 5'×5') [20]	**20**	**SC**	**September to November**
4	Extraction of drainage information from Survey of India topographical maps of plateau region: Extraction and interpretation of channel features and drainage patterns, Construction of channel profiles [20]	**20**	**SC**	**September to November**
5	Viva-voce based on laboratory notebook(5Marks)			

Sl no.	5.1 GEO-G-CC-2-02-TH – Environmental Geography 60 Marks / 4 Credits	No. of Lectures	Faculty	Period
1	Insolation and Heat Budget. Horizontal and vertical distribution of atmospheric temperature and pressure [5]	**5**	**SP**	**March**
2	Overview of planetary wind systems. Indian Monsoons: Mechanisms andcontrols[6]	**6**	**SP**	**March**
3	Atmospheric disturbances: Tropical and temperate cyclones. Thunderstorms [7]	**7**	**SP**	**April**
4	Overview of global climatic change: Greenhouse effect. Ozone depletion [5]	**5**	**SP**	**April**
5	Scheme of world climatic classification by Köppen[2]	**2**	**SP**	**April**
6	Factors of soil formation [4]	**4**	**SP**	**April**
7	Soil profile development under different climatic conditions: Laterite, Podsol, and Chernozem [6]	**6**	**SP**	**May**
8	Physical and chemical properties of soils: Texture, structure, pH, salinity, and NPK status[6]	**6**	**SP**	**May**
9	USDA classification of soils. Soil erosion and its management [4]	**4**	**SP**	**May**
10	Ecosystem and Biomes. Distribution and characteristics of tropical rainforest; Savannah, and hot desert biomes [6]	**6**	**SP**	**May to June**
11	Plant types, occurrence and ecological adaptations :Halophytes, xerophytes, hydrophytes, and mesophytes[5]	**5**	**SP**	**May to June**
12	Biodiversity: Types, threats and management with special reference to India[4]	**4**	**SP**	**June**

Lesson Plan of Geography Department

Raidighi College (University of Calcutta)

B.A./B.Sc. Geography (Honours & General Courses)

Sl no.	**5.1** **GEO-G-CC-2-02-P – Environmental Geography** **Lab** 30 Marks / 2 Credits	**No. of lectures**	**Faculty**	**Period**
1	Interpretation of daily weather map of India (anyone): Pre- Monsoon or Monsoon or Post-Monsoon [20]	**20**	**SP**	**March to April**
2	Construction and interpretation of hythergraph, climograph (G.Taylor) and windrose (seasonal)[20]	**20**	**SP/AB**	**April to May**
3	Determination of soil type by ternary diagram textural plotting [10]	**10**	**SP**	**April to June**
4	Preparation of peoples' biodiversity register [10]	**10**	**AB**	**April to May**
5	Viva-voce based on laboratory notebook(5Marks)			

Lesson Plan of Geography Department

Raidighi College (University of Calcutta)

B.A./B.Sc. Geography (Honours & General Courses)

Sl no.	**5.1** **GEO-G-CC-3-03-TH – Human Geography** 60Marks / 4 Credits	**No. of lectures**	**Faculty**	**Period**
1	Sectors of the economy: Primary, Secondary, Tertiary and Quaternary. Factors affecting location of economic activities [5]	**5**	**AB**	**August**
2	Location of economic activities: Theories of Von Thünen, Lösch, and Weber [5]	**5**	**AB**	**August**
3	Location of industries with special reference to India: Cotton, Iron and Steel [5]	**5**	**AB**	**August**
4	Globalization and integration of world economies [5]	**5**	**AB**	**August**
5	Human Society: Structure, functions, social systems. Population and migration: overview, causes and effects [5]	**5**	**AB**	**September**
6	Types and characteristics of social organizations: Primitive, hunting–gathering, agrarian, industrial [5]	**5**	**AB**	**September**
7	Race, Language and Religion: Origin, characteristics and spatial variations [6]	**6**	**AB**	**September**
8	Social Issues: Diversity, conflict and transformation [5]	**5**	**AB**	**September**
9	Carl Sauer: cultural landscape and its elements [6]	**6**	**AB**	**November**
10	Rural and urban settlements: Differentiation in cultural landscapes [5]	**5**	**AB**	**November**
11	Cultural regions and cultural realms [5]	**5**	**AB**	**December**
12	Diffusion of culture and innovations [4]	**4**	**AB**	**December**

Lesson Plan of Geography Department

Raidighi College (University of Calcutta)

B.A./B.Sc. Geography (Honours & General Courses)

Sl no.	5.1 GEO-G-CC-3-03-P – Human Geography Lab 30Marks / 2 Credits	No. of lectures	Faculty	Period
1	State-wise variation in occupational structure by proportional divided circles[15]	15	AB	August to September
2	Time series analysis of industrial production using any two manufactured goods from India [20]	20	AB	November to December
3	Measuring arithmetic growth rate of population comparing two datasets[15]	15	AB	September
4	Nearest neighbour analysis: Rural example from Survey of India1:50k topographical maps[10]	10	AB	November to December
5	Viva-voce based on laboratory notebook(5Marks)			

Lesson Plan of Geography Department

Raidighi College (University of Calcutta)

B.A./B.Sc. Geography (Honours & General Courses)

Sl. no	5.1 **GEO-G-CC-4-04-TH –Cartography**60Marks / 4 Credits	**No. of lectures**	**Faculty**	**Period**
1	Maps: Classification and types. Scales: Types, significance, and applications [3]	**3**	**SP**	**March**
2	Coordinate systems: Polar and rectangular. Bearing: Magnetic and true, whole-circle and reduced [3]	**3**	**SP**	**March**
3	Map projections: Classification, properties and uses. Conceptand significance of UTM projection [8]	**8**	**SP**	**March to April**
4	Survey of India topographical maps: Reference scheme of old and open series. Information on the margin of Maps [4]	**4**	**SKP**	**April**
5	Representation of data by dots and proportional circles [4]	**4**	**SKP**	**April**
6	Representation of data by isopleths and choropleth [4]	**4**	**SP**	**April**
7	Principal national agencies producing thematic maps in India: GSI, NATMO, NBSSLUP, NHO, and NRSC. Acquaintance with Bhuvan platform [5]	**5**	**SKP**	**April**
8	Basics of Remote Sensing: Types of satellites, sensors, bands, and resolutions with special reference to the ISRO missions[10]	**10**	**SKP**	**April to May**
9	Principles of preparing standard FCCs and classified raster images[5]	**5**	**SKP**	**April to May**
10	Principles of Geographical Information System: Concepts of vector types, attribute tables, buffers, and overlay analysis [6]	**6**	**SKP**	**June**
11	Basic concepts of surveying and survey equipment: Prismatic compass [6]	**6**	**SKP**	**April to May**
12	Basic concepts of surveying and survey equipment: Dumpy level [6]	**6**	**SKP**	**April to May**

Sl.No.	**5.1 GEO-G-CC-4-04-P –Cartography Lab** 30 Marks /2 Credits	**No. of lectures**	**Faculty**	**Period**
1	Graphical construction of scales: Plain and comparative [10]	**10**	**SP**	**March to April**
2	Construction of projections: Simple Conic with one standard parallel, Cylindrical Equal Area, and Polar Zenithal Stereographic [20]	**20**	**SP**	**April to May**
3	Construction of thematic maps: Proportional squares, proportional circles, choropleths, and isopleths [20]	**20**	**SKP**	**April to June**
4	Preparation of annotated thematic overlays from satellite standard FCCs of 1:50k [10]	**10**	**SKP**	**April to May**
5	Viva-voce based on laboratory notebook (5 Marks)			

Lesson Plan : 2022-23:Department of History

ODD SEMESTER

Teacher: Dr. Sudhin Sinha

1) Semester -V

*Course Type : Hons.

*Papers: CC-11: History of Modern Europe(1780-1939)

*Units & Subunits /Month/ No.of Class

French Revolution- August - 3

Restoration -. September 2

Industrialisation- September 2

Transformation - November 2

Rise of nationalism -November 2

Imperialism,World Wars- December 2

CC-12: History of India (1750-1857)

*Units& Subunits / Month / No.of Class

India in Mid 18 th Century- August -2

Colonial state- September - 2

Expansion & activities- September -2

Rural society, economy- November -2

Anticolonial movements.- November -4

DSEA-1: History of Bengal (1857-1905)

*Units & Subunits/ Month/ No.of Class

Bengal Nawabs- September -2

Battles against British- September -2

Society , economy and culture-Nov.-3

Revolts against the Raj- Nov.- 2

Partition of Bengal- December -3

DSEB1:History of Modern East Asia (China:1840-1949)

*Units & Subunits/ Month/ No. of Class

Feudalism - August - 2

Transformation in China- Sept.-2

Popular movements & Reforms:

1911 Revolution- September -2

May Fourth of 1919- November -2

nationalism and communism- Dec.-2

2) Semester -I

*Course Type: Hons.

*Paper: CC-2: Social Formations & Cultural Patterns of the Ancient World other than India

* Units & Subunits / Month/ No. of Class

Evolution of Human kind- September -2

Food Production- September -2

Bronze Age- November -2

Nomades in Central & West Asia- Nov.-2

Slaves in Greece & Rome- December -2

Police in Greece- December - 2

Teacher: Dr. Jahan Ali Purkait

1) Semester : III

*Course Type : Hons.

. * Papers:

CC-5: History of India (750-1206)

*Units & Subunits /Month/ No.of Class

Sources of History - August -. 2

Arab Conquest of Sindh- September -2

Agrarian and social change- September -2

Trade and Commerce- November -2

religious and cultural developments -Nov.-2

CC-6: Rise of the Modern West(1)

*Units& Subunits / Month/ No.of Class

Transition - September - 1

Renaissance- September - 2

Reformation movements- November -2

political and economic developments-Dec.-2.

CC- 7: History of India (1206-1526)

Units& Subunits / Month / No.of Class

Delhi Sultanate- September -2

Pol.Structure, kings &kingdoms- Sept.-2

Socio-economic changes- November -2

Religious and cultural movements- Nov.-2

SECA2: Understanding Heritage

*Units& Subunits / Month/ No.of Class

Definition & features- September -2

Types&examples- September -2

Legislations - November - 3

Heritage site visit - December - 3 Days

Project Supervision - December -2

2) Semester -1

* Course Type : Hons.

* Paper: CC-1: History of India from the earliest times to C 300 BCE.

*Unit& Subunits / Month / No.of Class

Notions of History- September -3

Sources &tools- September -2

Different Ages and their features- Nov.-3

Harappan Civilization- November -2

Cultures in transition - December-2

Teacher : Prof. Sarbani Halder

1) Semester -III

Course Type : General
Paper : CC-3/GE-3: History of India (1206-1707)
*Units & Subunits / Month/ No.of Class
Delhi Sultanates - September - 2
Mughals political and administrative developments- September -. 2
Eco-cultural developments- Nov.-2
Maratha vs. Mughals -December -2

Teacher : Prof. Himanshu Shekhar Halder

Semester -V

*Course Type : General

*Paper: DSEA-2: Some Aspects of European History (1789-1945)

* Units & Subunits / Month / No.of Class

The French Revolutions- September -3

unifications of Germany & Italy- Sept.-2

World Wars I& II- November -3

Fascism & Nazism - December -3

Teacher : Prof. Begum Naziya Sultana

Semester – I
Course Type : General
Paper: CC-I/GE-I: History of India from earliest times to 300 CE
Units& Subunits / Month/ No.of Class
Sources and interpretation- September -2
Harappan & Vedic civilization-September-2
Native kings & Kingdoms-November-3
Foreign invasions- November - 2
Religious and cultural aspects- Dec.- 2

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Teacher : Prof Rames Chandra Das

Semester -III & V
Course Type : General
Paper: 1) SECA-1: Historical Tourism : Theory & Practice
Units & Subunits / Month / No. of Class
Definition & Features- September -2
Types& examples- September - 2
Art, Architecture- November -2
Built Heritage - November - 2

visit to Heritage site- December - 3 Days
Project Supervision - December -2
SECA-2 : Museums and Archives in India
Units& Subunits / Month/ No.of Class
Definition& Features-September - 2
Historical overview- September -2
Laws & Acts- November - 2
Field visit and training- December - 1 Day

EVEN SEMESTER

Teacher : Dr. Sudhin Sinha

1) Semester -VI

Course Type : Hons.
Papers: CC-13: History of India (1857-1964)
Units& Subunits / Month/ No.of Class
Reform movements- March- 3
Trends of nationalism upto 1919-March-2
Gandhian movements- April - 3
Awakening of subalterns- April - 2
communal ideologies& organisations-April-2 independence and partition-May- 2
New constitution& Nehruvian era- May-2
*CC-14: History of World Politics (1945-1994)
Units& Subunits / Month/ No.of Class
The Cold War- March - 2
USA vs. USSR- March - 2
Critical issues& conflicts- April -2
Decline of USSR- April - 2
Emergence of China- May- 2
Israel- Palestine crises- May- 2
Decolonization in the world- May-2
*DSEA-3: History of Bengal (1905-1947)
Units& Subunits / Month/ No.of Class
Anti partition movements- March-2
Communal politics- March - 2
National movements under Gandhiji- April -2
Muslim League, Leftist movements- April -3
Women movement - May- 1
Netaji S. C.Bose- May- 1
Partition & Riots - May- 2

*DSEB-3: History of Modern East Asia (Japan -1868-1945)
Units& Subunits / Month/ No.of Class
Feudalism to capitalism – March- 2
Tokugawa decline- March- 1
Meiji restoration & reforms- April - 2
New constitution- April -. 2
people's right movement- May- 2
Militarism& post war- May- 2
*2) Semester -II
Course Type : Hons.
Paper : CC-3: History of India (BCE 300-750 CE)
Units& Subunits / Month/ No.of Class
Economy and Society- April - 2
Mauryan empire- April - 2
Early medieval period – socio-economic changes- May- 2
Gupta Era and changes- May- 2
, Religion , art,architecture - May- 2

Teacher : Dr. Jahan Ali Purkait

1) Semester -IV
Course Type : Hons.
Papers: CC- 8: Rise of the Modern West II
Units& Subunits / Month/ No.of Class
Revolution in print& war technique- March -2
17 th century crises in Europe- March -2
The English revolution – scientific & industrial
April - 3
political development in Europe /parliamentary monarchy - May- 2
*CC-9:History of India (1526-1605)
Units& Subunits / Month/ No.of Class
Sources & Historiography- March -2
Mughal administrative, military and economic developments- March - 2
Expansion and integration- April - 2
Land revenue system- April - 2
Religious and cultural developments- May-2
*CC-10: History of India (1605-1750)
Units& Subunits / Month/ No.of Class
Native sources- March - 2
Awrangzab policy - March -2
Different crises - April - 2
paintings and architecture- April -2
Trade & Commerce- May- 2
*SECB-1: Understanding popular culture
Units& Subunits / Month/ No.of Class
Definition & Historicity- March - 2

visual & performing arts- March -2
Fairs,festivals & rituals- April - 3
, Field visit - May- 3 Days

2) Semester -II

Paper: CC-4:Social Formations & Cultural pattern of the Medieval world other than India
Units& Subunits / Month/ No.of Class
Crises of Roman Empire and causes- April -2
Religions and culture - April - 2
Feudal society and its crises- May-2
Judaism and Christianity under Islam- May-4

Teacher : Prof.Sarbani Halder

*Semester -IV
* Course Type : General
*Paper:CC-4/GE-4: History of India (1707-1950)
Units& Subunits / Month/ No.of Class
18 th Century debate- March -2
Independent states- March -1
Colonial expansion- April - 2
1857 Revolt- April - 3
socio- religious movements- May- 2
Gandhian movements- May- 2
Communal politics, Freedom and constitution
May- 4

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Teacher : Prof. Himanshu Shekhar Halder

*Semester –VI

* Course Type : General

* Paper: DSEB-2: Some aspects of society & economy of modern Europe (Century 15-17)

* Units& Subunits / Month / No.of Class

Historiographical trends- March - 2

Feudal crises- March - 2

Renaissance&Reformation- April -4

Feudalism to capitalism -May-2

Industrial revolution in England- May- 4

Teacher : Prof.Begam Naziya Sultana .

Semester -II
Course Type :General

Paper:-CC-2/GE-2:History of India (C.300-1206CE)
Units& Subunits / Month/ Class
Aspects of Gupta age- April -2
Harsha & his Kingdom- April -2
polity, economy, society and culture in South India- May- 2
Pal ,pratihar ,Rashtyakut,Chalukya- May-3
Arabs in Sindh- May- 1

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Teacher : Prof. Rames Chandra Das

Semester -IV& VI
Course Type : General
*Papers : SECB-1: Museums and Archives in India
Units& Subunits / Month/ No.of Class
Definition& features - March - 2
Historical development- March- 2
Activities & impacts - April - 2
Field visit & training. - May- 1 Day
Project supervision - May - 2
* SECB-2 : Orality and Oral culture in India
* Units& Subunits / Month/ No.of Class
Definition & feaures- March - 2
History and historiography- March 2
Life histories- April - 2
Research methodologies- April -2
primary sources- May- 2
Site visit - May - 1 Day

RAIDIGHI COLLEGE

DEPARTMENT OF POLITICAL SCIENCE

LESSON PLAN,SESSION : 2022-23

TEACHER NAME:MANAS GAYEN

SEMESTER	COURSE TYPE	PAPER AND PAPER NAME	MODULE	UNIT NAME(TOPIC)	MONTH	NO.OF CLASS
VI	hons	cc14:administration and public policy in india.	II	Whole(theory + practicum)	Whole session	30
		Dse b(1):citizenship in a globalizing world.	I			
V	hons	cc-11:western political thought and theory 11	II	Whole(theory+ practicum	Whole session	30
		Dse a(1):gender and politics	I			
IV	hons	cc-8:Indian political thought.	II	Whole(theory+ practicum)	Whole session	30
		Sec-b(1):legislative practices and procedures.	II	Whole(theory)		
III	hons	cc-6:comparative government and politics.	I	Whole(theory+ practicum)	Whole session	30
		Sec-a(1):democratic awareness through legal literacy.	I	Whole(theory)		
II	hons	cc-3:constitutional government in india.	II	Whole(theory + practicum)	Whole session	15
I	hons	cc-2:understanding political theory:approaches and debates.	II	Whole(theory + practicum)	Whole session	15
VI	general	Sec b(2):basic research method	I	Whole(theory)	Whole session	15
V	general	Seca(2);understanding the legal system.	I	Whole(theory)	Whole session	15
IV	general	nil	nil	nil	nil	nil
III	general	cc-3/ge3:government and politics in india.	II	Whole(theory + practicum)	Whole(theory	30
		Sec a(1):legal literacy.	I	Whole(theory)		
II	general	nil	nil	nil	nil	nil
I	general	ccI/geI:introduction to political theory.	II	Fascism,political party,interest group.	Whole session	08

TEACHER NAME:SHAKUNTALA GHOSH

SEMESTER	COURSE TYPE	PAPER AND PAPER NAME	MODULE	UNIT NAME(TOPIC)	MONTH	NO.OF CLASS
VI	hons	cc13:public administration concepts and perspectives.	II	Whole(theory + practicum)	Whole session	30
		Dse b(1):citizenship in a globalizing world.	II			
V	hons	cc-11:western political thought and theory 11	I	Whole(theory + practicum)	Whole session	30
		Dse a(1):gender and politics	II			
IV	hons	cc-8:Indian political thought.	I	Whole(theory+ practicum)	Whole session	30
		Sec-b(1):legislative practices and procedures.	I	Whole(theory)		
III	hons	cc-6:comparative government and politics.	II	Whole(theory+ practicum)	Whole session	30
		Sec-a(1):democratic awareness through legal literacy.	II	Whole(theory)		
II	hons	cc-4:politics in india:structures and processes	I	Whole(theory + practicum)	Whole session	15
I	hons	cc-2:understanding political theory:approaches and debates.	II	Whole(theory + practicum)	Whole session	15
VI	general	Sec b(2):basic research method	II	Whole(theory)	Whole session	15
V	general	Seca(2);understanding the legal system.	II	Whole(theory)	Whole session	15
IV	general	nil	nil	nil	nil	nil
III	general	cc-3/ge3:government and politics in india.	I	Whole(theory + practicum)	Whole session	30
		Sec a(1):legal literacy.	II	Whole(theory)		
II	general	nil	nil	nil	nil	nil
I	general	ccI/geI:introduction to political theory.	II	Marxism + practicum	Whole session	10

TEACHER NAME:Dr.HAMID IQBAL

SEMESTER	COURSE TYPE	PAPER AND PAPER NAME	MODULE	UNIT NAME(TOPIC)	MONTH	NO.OF CLASS
VI	hons	cc14:administration and public policy in india.	I	Whole(theory + practicum)	Whole session	30
		Dse a(3):public policy in india.	I			
V	hons	cc-12:political sociology.	II	Whole(theory + practicum)	Whole session	30
		Dse b(1):Indian foreign policy in a globalizing world.	II			
IV	hons	cc-9:global politics since 1945	I, II	Whole(theory+ practicum)	Whole session	30
III	hons	cc-7:perspectives on international relations.	I,II	Whole(theory+ practicum)	Whole session	30
II	hons	cc-3:constitutional government in india.	I	Whole(theory + practicum)	Whole session	15
I	hons	cc-1:understanding political theory:concepts.	I	Whole(theory + practicum)	Whole session	15
VI	general	dse b(2):human rights:theory and indian context.	II	Whole(theory)	Whole session	15
V	general	dsea(1):public administration	II	Whole(theory)	Whole session	15
IV	general	cc-4:international relations.	I	Whole(theory+ practicum	Whole session	15
		Sec-b(1):elementary pimentions of research.	II	Whole(theory	Whole session	15
III	general	nil	nil	nil	nil	nil
II	general	cc-2/ge-2:comparative government and politics.	I	Whole(theory+ practicum	Whole sessio	15
I	general	ccI/geI:introduction to political theory.	I	Nature of political science,theory of state	Whole session	08

TEACHER NAME:DIBBYENDU SAHA

SEMESTER	COURSE TYPE	PAPER AND PAPER NAME	MODULE	UNIT NAME(TOPIC)	MONTH	NO.OF CLASS
VI	hons	cc13:public administration concepts and perspectives.	I	Whole(theory + practicum)	Whole session	30
		Dse a(3):public policy in india.	II			
V	hons	cc-12:political sociology.	I	Whole(theory + practicum)	Whole session	30
		Dse b(1):Indian foreign policy in a globalizing world.	I			
IV	hons		I, II	Whole(theory+ practicum)	Whole session	30
III	hons	cc-5:Indian political though.	I,II	Whole(theory+ practicum)	Whole session	30
II	hons	cc-4:politics in india:structurs and processes.	I	Whole(theory + practicum)	Whole session	15
I	hons	cc-1:understanding political theory:concepts.	II	Whole(theory + practicum)	Whole session	15
VI	general	dse b(2):human rights:theory and indian context.	I	Whole(theory)	Whole session	15
V	general	dsea(1):public administration	I	Whole(theory)	Whole session	15
IV	general	cc-4:international relations.	II	Whole(theory + practicum)	Whole sessio	15
		Sec-b(1):elementary dimentions of research.	I	Whole(theory)	Whole sessio	15
III	general	nil	nil	nil	nil	nil
II	general	cc-2/ge-2:comparative government and politics.	II	Whole(theory + practicum)	Whole session	15
I	general	ccI/geI:introduction to political theory.	I	Law,right,liberty ,equality,nationalism and internationalism.	Whole session	08

RAIDIGHI COLLEGE

TEACHING PLAN REPORT

Dept. of Physical Education **Session: 2022-23**

SEMESTER: I

Paper: **Foundation and History of Physical Education**

Teacher's Name: Hamidur Rahaman Molla

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
1	General- Theory	Unit- II: Foundations of Physical Education	CC-1/ GE-1	2.1. Growth and Development 2.2. Age Characteristics 2.3. Play, Game and Sports	September	9
1	General- Theory	Unit- II: Foundations of Physical Education	CC-1/ GE-1	2.4. Society	November	3
1	General- Theory	Unit- IV: Yoga Education	CC-1/ GE-1	4.1 Yoga: 4.2 History of Yoga	November	6
1	General- Theory	Unit- IV: Yoga Education	CC-1/ GE-1	4.3 Astanga Yoga 4.4 Yogic Concept of Personality and Diet, Yoga for Health and Wellness	December	7

Teacher's Name: Bularani Mondal

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
1	General- Theory	Unit- I: Introduction	CC-1/ GE-1	1.1. Meaning and Definition of Physical Education. 1.2. Aim and Objectives of Physical Education 1.3. Misconceptions and Modern Concept of Physical Education.	September	9
1	General- Theory	Unit- I: Introduction	CC-1/ GE-1	1.4. Physical Education in Ancient and Modern Society.	November	3
1	General- Theory	Unit- III: History of Physical Education	CC-1/ GE-1	3.1 History of Physical 3.2 Olympic Movement	November	7
1	General- Theory	Unit- III: History of Physical Education	CC-1/ GE-1	3.3 Asian Games, Commonwealth Games and SAF Games. 3.4 National Sports Awards	December	6

SEMESTER: III

Paper: **Anatomy, Physiology and Exercise Physiology**

Teacher's Name: Hamidur Rahaman Molla

Semester	**Course Type**	**Unit Name (Topic)**	**Paper**	**Subunit Name**	**Month**	**No. of Classes**
3	General- Theory	Unit-II: Musculo-skeletal System	CC-3/ GE-3	2.1 Skeletal System 2.2 Muscular System 2.3. Muscular Contraction	September	10
3	General- Theory	Unit-II: Musculo-skeletal System	CC-3/ GE-3	2.4. Effect of Exercise and Training on Muscular System.	November	3
3	General- Theory	Unit- IV: Respiratory System	CC-3/ GE-3	4.1 Structure and Functions of Human Respiratory Organs. 4.2 Respiration Mechanism.	November	6
3	General- Theory	Unit- IV: Respiratory System	CC-3/ GE-3	4.3 Meaning and Definition of Term. 4.4 Effect of Exercise and Training on Respiratory System.	December	6

Teacher's Name: Bularani Mondal

Semester	**Course Type**	**Unit Name (Topic)**	**Paper**	**Subunit Name**	**Month**	**No. of Classes**
3	General- Theory	Unit- I: Introduction	CC-3/ GE-3	1.1. Anatomy, Physiology and Exercise Physiology 1.2. Cell. 1.3. Tissue.	September	10
3	General- Theory	Unit- I: Introduction	CC-3/ GE-3	1.4. System.	November	3
3	General- Theory	Unit- III: Circulatory System	CC-3/ GE-3	3.1 Blood 3.2 Heart.	November	6
3	General- Theory	Unit- III: Circulatory System	CC-3/ GE-3	3.3 Meaning and Definition of Term. 3.4 Effect of Exercise and Training on Circulatory System.	December	7

SEMESTER: III

Paper: **Track and Field**

Teacher's Name: Hamidur Rahaman Molla

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
3	General-Practical	2. Field Events	SEC-A-1	2.1. Long Jump. 2.2. High jump. 2.3. Shot put.	September	10
3	General-Practical	2. Field Events	SEC-A-1	2.4. Discus Throw. 2.5. Javelin Throw.	November	6
3	General-Practical	Project-cum-Practical Record Book	SEC-A-1	1. Introduction of the Sport, History of Development 2. Performance status of India and renowned personalities – Indian & International 3. Fundamental Skills	December	9

Teacher's Name: Bularani Mondal

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
3	General-Practical	1. Track Events	SEC-A-1	1.1. Starting Techniques. 1.2. Acceleration with proper running techniques.	September	12
3	General-Practical	1. Track Events	SEC-A-1	1.3. Finishing Technique. 1.4. Relay Race.	November	6
3	General-Practical	Project-cum-Practical Record Book	SEC-A-1	4. Rules & regulations with Field/Court diagram 5. Tournaments & Sports Federations (National & International).	December	7

SEMESTER: V

Paper: **Management in Physical Education and Sports**

Teacher's Name: Hamidur Rahaman Molla

Semester	**Course Type**	**Unit Name (Topic)**	**Paper**	**Subunit Name**	**Month**	**No. of Classes**
5	General- Theory	Unit- I: Introduction	DSE-A-1	1.1. Sports Management. 1.2. Emergence. 1.3. 1.3. Basics.	September	9
5	General- Theory	Unit- I: Introduction	DSE-A-1	1.4. Application.	November	3
5	General- Theory	Unit- III: Facilities and Equipment	DSE-A-1	3.1 Lay-out. 3.2 Care and Maintenance.	November	6
5	General- Theory	Unit- III: Facilities and Equipment	DSE-A-1	3.3 Documentation. 3.4 Time Table.	December	6
5	General- Lab & Field Practical	Lab & Field Practical	DSE-A-1	1. Lay out of a Standard Track and any two sport field/court 2. Fixture of Different type Tournaments	December	21

Teacher's Name: Bularani Mondal

Semester	**Course Type**	**Unit Name (Topic)**	**Paper**	**Subunit Name**	**Month**	**No. of Classes**
5	General-Theory	Unit- II: Tournaments	DSE-A-1	2.1. Tournaments. 2.2. Organization. 2.3. Annual Program.	September	9
5	General-Theory	Unit- II: Tournaments	DSE-A-1	2.4. Year-round Programme	November	4
5	General-Theory	Unit- IV: Financial Management	DSE-A-1	4.1. Financial Management. 4.2. Budget	November	7
5	General-Theory	Unit- IV: Financial Management	DSE-A-1	4.3. Sponsorship. 4.4. Sports Promotion.	December	6
5	General- Lab & Field Practical	Lab & Field Practical	DSE-A-1	3. Preparation of a Model Budget and ideal Time Table.	December	17

SEMESTER: V

Paper: **Modern Trends in Physical Education and Exercise Science**

Teacher's Name: Hamidur Rahaman Molla

Semester	**Course Type**	**Unit Name (Topic)**	**Paper**	**Subunit Name**	**Month**	**No. of Classes**
5	General- Theory	Unit- I: Introduction	DSE-A-2	1.1. Orientation. 1.2. Function. 1.3. Scope.	September	9
5	General- Theory	Unit- I: Introduction	DSE-A-2	1.4. The Concepts.	November	3
5	General- Theory	Unit- III: History of Physical Education	DSE-A-2	3.1 History. 3.2 Olympic.	November	6
5	General- Theory	Unit- III: History of Physical Education	DSE-A-2	3.3 Rights about Physical Education. 3.4 Promotion of Physical Education and Sports.	December	7
5	General- Lab & Field Practical	Lab & Field Practical	DSE-A-2	2. Assessment of Movement Literacy Components with Development. 3. UNESCO Charter with interpretation.	December	19

Teacher's Name: Bularani Mondal

Semester	**Course Type**	**Unit Name (Topic)**	**Paper**	**Subunit Name**	**Month**	**No. of Classes**
5	General- Theory	Unit – II: Foundations	DSE-A-2	2.1. Biological Foundation. 2.2. Psychological Foundation. 2.3. Sociological Foundation.	September	10
5	General- Theory	Unit – II: Foundations	DSE-A-2	2.4. Role of games and sports in National Integration and International Understanding.	November	3
5	General- Theory	Unit- IV: Exercise Sciences	DSE-A-2	4.1 Exercise and Exercise Physiology. 4.2 Sports Bio-mechanics.	November	6
5	General- Theory	Unit- IV: Exercise Sciences	DSE-A-2	4.3 Sports Psychology. 4.4 Sports Sociology	December	6
5	General- Lab & Field Practical	Lab & Field Practical	DSE-A-1	1. Health and Physical Fitness Dimensions with Functions	December	16

SEMESTER: V

Paper**: Ball Games**

Teacher’s Name: Hamidur Rahaman Molla

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
5	General-Practical	FOOTBALL A. Fundamental Skills	SEC-A-2	1. Kicking. 2. Trapping. 3. Dribbling. 4. Heading. 5. Throw-in.	September	17
5	General-Practical	FOOTBALL A. Fundamental Skills	SEC-A-2	6. Feinting. 7. Tackling. 8. Goal Keeping.	November	9
5	General-Practical	CRICKET A. Fundamental Skills	SEC-A-2	1. Batting. 2. Bowling.	November	11
5	General-Practical	CRICKET A. Fundamental Skills	SEC-A-2	3. Fielding. 4. Wicket Keeping	December	17
5	General-Practical	FOOTBALL A. CRICKET	SEC-A-2	B. Rules and their interpretation and duties of officials. B. Rules and their interpretation and duties of officials.	December	9

Teacher’s Name: Bularani Mondal

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
5	General-Practical	BASKETBALL A. Fundamental Skills	SEC-A-2	1. Passing. 2. Receiving. 3. Dribbling. 4. Shooting. 5. Rebounding.	September	23
5	General-Practical	BASKETBALL A. Fundamental Skills. B. Rules	SEC-A-2	6. Individual Defence. 7. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials.	November	13
5	General-Practical	VOLLEYBALL A. Fundamental skills	SEC-A-2	1. Serve. 2. Passing.	November	12
5	General-Practical	VOLLEYBALL A. Fundamental skills. B. Rules	SEC-A-2	3. Setting. 4. Spiking. 5. Blocking. 6. Service reception and Court coverage. 7. Rotation and front court and back court players. B. Rules and their interpretation and duties of officials.	December	21

SEMESTER: II

Paper**: Health Education, Physical Fitness and Wellness**

Teacher's Name: Hamidur Rahaman Molla

Semester	**Course Type**	**Unit Name (Topic)**	**Paper**	**Subunit Name**	**Month**	**No. of Classes**
2	General- Theory	Unit- II: Health Problems in India - Prevention and Control	CC-2/ GE-2	2.1. Communicable Disease. 2.2. Hypokinetic Disorders. 2.3. Nutrition.	March	9
2	General- Theory	Unit- II: Health Problems in India - Prevention and Control	CC-2/ GE-2	2.4. Posture.	April	4
2	General- Theory	Unit- IV: Health and First-aid Management	CC-2/ GE-2	4.1 First-aid. 4.2 Sports Injuries.	April	6
2	General- Theory	Unit- IV: Health and First-aid Management	CC-2/ GE-2	4.3 Therapeutic Modalities. 4.4 Sports Injury Management.	May	6

Teacher's Name: Bularani Mondal

Semester	**Course Type**	**Unit Name (Topic)**	**Paper**	**Subunit Name**	**Month**	**No. of Classes**
2	General- Theory	Unit- I: Introduction	CC-2/ GE-2	1.1. Health. 1.2. Health Education. 1.3. School Health Program.	March	10
2	General- Theory	Unit- I: Introduction	CC-2/ GE-2	1.4. Aim, Objectives and Functions.	April	3
2	General- Theory	Unit- III: Physical Fitness and Wellness	CC-2/ GE-2	3.1 Physical Fitness. 3.2 Physical Fitness Components.	April	6
2	General- Theory	Unit- III: Physical Fitness and Wellness	CC-2/ GE-2	3.3 Concept of Wellness. 3.4 Ageing.	May	6

SEMESTER: IV

Paper: **Psychology and Sociology in Physical Education and Sports**

Teacher's Name: Hamidur Rahaman Molla

Semester	**Course Type**	**Unit Name (Topic)**	**Paper**	**Subunit Name**	**Month**	**No. of Classes**
4	General- Theory	Unit- II: Learning	CC-4/ GE-4	2.1. Learning. 2.2. Learning Phenomenon. 2.3. Learning Process.	March	9
4	General- Theory	Unit- II: Learning	CC-4/ GE-4	2.4. Transfer of Learning.	April	3
4	General- Theory	Unit- IV: Sociological Aspects	CC-4/ GE-4	4.1 Sociology. 4.2 Culture.	April	7
4	General- Theory	Unit- IV: Sociological Aspects	CC-4/ GE-4	4.3 Leadership. 4.4 Sports Related Social Issues.	May	6

Teacher's Name: Bularani Mondal

Semester	**Course Type**	**Unit Name (Topic)**	**Paper**	**Subunit Name**	**Month**	**No. of Classes**
4	General- Theory	Unit- I: Introduction	CC-4/ GE-4	1.1. Psychology. 1.2. Nature of Psychology. 1.3. Sports Psychology:	March	9
4	General- Theory	Unit- I: Introduction	CC-4/ GE-4	1.4. Need for Psychology.	April	3
4	General- Theory	Unit- III: Psychological Factors	CC-4/ GE-4	3.1 Motivation. 3.2 Instinct and Emotion.	April	6
4	General- Theory	Unit- III: Psychological Factors	CC-4/ GE-4	3.3 Stress. 3.4 Personality	May	7

SEMESTER: IV

Paper**: Gymnastics and Yoga**

Teacher's Name: Hamidur Rahaman Molla

Semester	**Course Type**	**Unit Name (Topic)**	**Paper**	**Subunit Name**	**Month**	**No. of Classes**
4	General-Practical	GYMNASTICS	SEC-B-1	1.1. Forward Roll 1.2. T-Balance 1.3. Forward Roll with Split leg.	March	9
4	General-Practical	GYMNASTICS	SEC-B-1	.1.4. Backward Roll 1.5. Cart-Wheel	April	6
4	General-Practical	YOGA 3. Asana	SEC-B-1	3.1.1. Ardhachandrasana. 3.1.2. Brikshasana. 3.1.3. Padahastasana	April	9
4	General-Practical	4. Suryanamaskara and Pranayama	SEC-B-1	4.1. Suryanamaskara. 4.2 Kapalbhati . 4.3 Pranayama - Bhramari and Anulam Vilom	May	15

Teacher's Name: Bularani Mondal

Semester	**Course Type**	**Unit Name (Topic)**	**Paper**	**Subunit Name**	**Month**	**No. of Classes**
4	General-Practical	GYMNASTICS	SEC-B-1	2.1. Dive and Forward Roll 2.2. Hand Spring 2.3. Head Spring	March	9
4	General-Practical	GYMNASTICS	SEC-B-1	2.4. Neck Spring 2.5. Hand Stand and Forward Roll 2.6. Summersault	April	5
4	General-Practical	YOGA 3. Asana. 3.2. Sitting Posture. 3.3. Supine Posture	SEC-B-1	3.2.1. Ardhakurmasana. 3.2.2. Paschimottanasana. 3.2.3. Gomukhasana 3.3.1. Setubandhasana 3.3.2. Halasana 3.3.3. Matsyasana	April	6
4	General-Practical	YOGA 3. Asana. 3.4 Prone Posture 3.5 Inverted Posture.	SEC-B-1	3.4.1 Bhujangasana. 3.4.2 Salvasana. 3.4.3 Dhanurasana. 3.5.1 Sarbangasana. 3.5.2 Shirsasana. 3.5.3 Bhagrasana	May	6

SEMESTER: VI

Paper: **Sports Training**

Teacher's Name: Hamidur Rahaman Molla

Semester	**Course Type**	**Unit Name (Topic)**	**Paper**	**Subunit Name**	**Month**	**No. of Classes**
6	General- Theory	Unit- I: Introduction	DSE-B-1	1.1. Sports Training. 1.2. Aim, Objectives and Characteristics of Sports Training. 1.3. Principles of Sports Training. 1.4. Need and Importance of Sports Training.	March	12
6	General- Theory	Unit- III: Training Load and Adaptation	DSE-B-1	3.1 Training Load. 3.2 Training Load Components. 3.3 Over Load. 3.4 Load Adaptation	April	13
6	General- Lab & Field Practical	Lab & Field Practical	DSE-B-1	1. Weight Training – Practice with Principles. 2. Measurement of Speed, Strength, Endurance and Flexibility.	May	22

Teacher's Name: Bularani Mondal

Semester	**Course Type**	**Unit Name (Topic)**	**Paper**	**Subunit Name**	**Month**	**No. of Classes**
6	General- Theory	Unit- II: Methods of Training and Conditioning in Sports	DSE-B-1	2.1. Warming-up and Cooling-down. 2.2. Conditioning. 2.3. Training Methods. 2.4. Periodization	March	13
6	General- Theory	Unit- IV: Training Techniques	DSE-B-1	4.1 Strength. 4.2 Speed. 4.3 Endurance. 4.4 Flexibility.	April	12
6	General- Lab & Field Practical	Lab & Field Practical	DSE-B-1	3. Circuit Training - Practice with Principles and Periodization Chart	May	19

SEMESTER: VI

Paper: **Tests, Measurement and Evaluation in Physical Education**

Teacher's Name: Hamidur Rahaman Molla

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
6	General- Theory	Unit- I: Introduction	DSE-B-2	1.1. Meaning and Definition. 1.2. Criteria of a Good Test. 1.3. Principles of Evaluation. 1.4. Importance.	March	12
6	General- Theory	Unit- III: Fitness Test	DSE-B-2	3.1 Kraus-Weber Muscular Strength Test. 3.2 AAHPER Health Related Fitness Test. 3.3 Queens College Step Test 3.4 J.C.R. Test	April	13
6	General- Lab & Field Practical	Lab & Field Practical	DSE-B-2	1. Assessment of Body Composition: LBM & % body fat.	May	20

Teacher's Name: Bularani Mondal

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
6	General- Theory	Unit – II: Body Composition and Somatotype	DSE-B-2	2.1. Body Mass Index (BMI). 2.2. Body Fat. 2.3. Lean Body Mass (LBM). 2.4. Somatotype.	March	13
6	General- Theory	Unit- IV: Sports Skill Test	DSE-B-2	4.1 Lockhart and McPherson Badminton Skill Test. 4.2 Johnson Basketball Test Battery 4.3 McDonald Soccer Test. 4.4 Brady Volleyball Test	April	12
6	General- Lab & Field Practical	Lab & Field Practical	DSE-B-2	2. Assessment of Fitness by AAHPER Health-Related Fitness Test. 3. Queens College Step Test and Brady Volleyball Test.	May	23

SEMESTER: VI

Paper: **Indian Games (Any One) and Racket Sports (Any One).**

Teacher's Name: Hamidur Rahaman Molla

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
6	General-Practical	KABADDI A. Fundamental skills	SEC-B-2	1.Raiding Skills 2. Holding skills. 3. Formation during holding. 4. Additional Raiding skills.	March	23
6	General-Practical	KABADDI A. Fundamental skills. B. Rules.	SEC-B-2	5. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of the officials.	April	15
6	General-Practical	BADMINTON A. Fundamental skills	SEC-B-2	1. Basic Knowledge. 2. Basic foot work and court coverage.	April	15
6	General-Practical	BADMINTON A. Fundamental skills B. Rules	SEC-B-2	3. Basic Stance. 4. Service. 5. Shots. 6. Game practice B. Rules and their interpretations and duties of the officials.	May	21

Teacher's Name: Bularani Mondal

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
6	General-Practical	KHO-KHO A. Fundamental skills	SEC-B-2	1. Chasing Skills. 2. Running Skills. 3. Game practice with application of Rules and Regulations.	March	20
6	General-Practical	KHO-KHO B. Rules	SEC-B-2	B. Rules and their interpretations and duties of the officials.	April	6
6	General-Practical	TABLE TENNIS A. Fundamental skills	SEC-B-2	1.Basic Knowledge. 2. Stance. 3. Service.	April	19
6	General-Practical	TABLE TENNIS A. Fundamental skills B. Rules	SEC-B-2	4. Chop. 5. Receive return and receiving. 6. Game practice B. Rules and their interpretations and duties of the officials.	May	21

Raidighi College
Teaching Report Plan
Department of Philosophy
Session 2022- 23
CBCS SEM - 1
General theory : 1) Charvak Epistemology : September
2) Nyaya Epistemology : November
3) Vaisesika Metaphysics: November+ December
4) Advaita Metaphysics: December.

3rd Sem : General
1) Introductory topic of Logic- September
2) Aristotelian logic, Existentialism, Boolean interpretation, Categorical proposition - September
3) categorical syllogism : November
4) symbolic logic - November
5) Tautology - Contradiction - December.

5th sem : General
Four purusarthas : September.
Buddhist Ethics : September
Moral and non moral action : November
Deontological Ethics: November
Theories of punishment: December.

CBCS SEM 2 : PHILOSOPHY
General : Different Sence of Know - March
Theories of Origine of Knoeledge , March + April
Causality - April
Mind Body problem - May

Sem 4 th : General
Sensation : March
Consciousness : March+April
Memory : April
Intelligence: April+May

Sem 6th : General
Swami Vivekananda: March
M.K. Gandhi : April
B.R. Ambedkar: April +May.

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Teaching Plan for SAN-G-CC-A1-TH/TU: Sanskrit Poetry

Semester: I

- **Course Type:** 3 Year General
- **Course Name:** SAN-G-CC-A1-TH/TU
- **Course Details:** Sanskrit Poetry
- **Credits:** 6
- **Total No. of Classes:** 100
- **Total Marks:** 90
- **Teacher's Name:** SB

Section	Unit	Sub Unit Name	Total No. of Classes	No. of Lesson Plan	Month	No. of Class	Marks
A: Raghuvaṃśam (Canto I)	I	Introduction to the Author and Text	5	1	[Aug-March]	5	5
		Analysis of Verses 1-5	5	1	[Aug-March]	5	5
	II	Detailed Translation and Explanation of Verses 6-10	5	1	[Aug-March]	5	5
		Analysis of Verses 11-15, Role of Dilīpa	5	1	[Aug-March]	5	5
B: Śiśupālavadham (Canto I)	I	Introduction to the Author and Text	5	1	[Aug-March]	5	5
		Analysis of Verses 1-5, Appropriateness of Title	5	1	[Aug-March]	5	5
	II	Detailed Translation and Explanation of Verses 6-10	5	1	[Aug-March]	5	5
		Poetic Excellence and Thematic Analysis of Verses 11-15	5	1	[Aug-March]	5	5
C: Nītiśatakam	I	Translation and Explanation of	5	1	[Aug-March]	5	5

		Verses 1-5					
		Social Insights from Verses 6-10	5	1	[Aug-March]	5	5
	II	Analysis and Translation of Verses 11-15	5	1	[Aug-March]	5	5
		Examination of Social Experiences from Verses 16-20	5	1	[Aug-March]	5	5
D: History of Sanskrit Poetry	I	Overview of Major Poets and Their Works	10	1	[Aug-March]	10	15
	II	Development of Mahākāvya and Gītikāvya	10	1	[Aug-March]	10	15

Course Objectives:

- **Section A-D:** Each section will delve into a specific classic text or poet, providing an in-depth study of the verses, including their meaning, translation, contextual relevance, and poetic analysis.
- **Overall Goal:** The course aims to cultivate a comprehensive understanding of Classical Sanskrit Poetry, enhancing students' appreciation of its literary, cultural, and historical aspects.

Assessment Strategy:

- **Quizzes:** Regular quizzes covering translations, explanations, and historical contexts.
- **Essays:** Analytical essays on thematic elements and poetical techniques.
- **Final Examination:** Cumulative test including short answers, translations, and critical essays on selected texts.

Materials and Resources:

- Recommended editions of texts, secondary literature for deeper understanding, and access to online databases for supplementary research.

Teaching Plan for SAN-G-CC-A2-TH/TU: Sanskrit Prose

Semester: II

- **Course Type:** 3 Year General
- **Course Name:** SAN-G-CC-A2-TH/TU
- **Course Details:** Sanskrit Prose
- **Credits:** 6
- **Total No. of Classes:** 100
- **Total Marks:** 65
- **Teacher's Name:** SB

Section	Unit	Sub Unit Name	Total No. of Classes	No. of Lesson Plan	Month	No. of Classes	Marks
A: Śukanāsopadeśa	I	1. Introduction to Author and Text	2	1	[April-Aug]	2	5
		2. Overview of Text Themes	2	1	[April-Aug]	2	5
		3. Analysis of Selected Passages	2	1	[April-Aug]	2	5
	II	1. Society Depiction in Text	3	1	[April-Aug]	3	7.5
		2. Political Thoughts in the Text	3	1	[April-Aug]	3	7.5
		3. Application of Sayings	2	1	[April-Aug]	2	7.5
B: Śivarājavijayam, Niśvāsa-I	I	1. Introduction to the Text and Author	2	1	[April-Aug]	2	5
		2. Text Reading and Grammar Analysis (Paras 1-10)	3	1	[April-Aug]	3	5
		3. Translation and Explanation (Paras 11-20)	3	1	[April-Aug]	3	5
		4. Poetic Excellence and Plot Discussion	2	1	[April-Aug]	2	5
	II	1. Continued	3	1	[April-	3	5

		Text Reading and Grammar (Paras 21-30)			Aug]		
		2. Translation and In-depth Analysis (Paras 31 to end)	3	1	[April-Aug]	3	5
		3. Comprehensive Review of Poetic and Plot Elements	4	1	[April-Aug]	4	5
C: Survey of Sanskrit Literature: Prose	I	1. Historical Overview of Sanskrit Prose	3	1	[April-Aug]	3	5
		2. Key Prose Works and Their Significance	3	1	[Month]	3	5
		3. Analysis of Prose Styles	4	1	[April-Aug]	4	5
	II	1. Detailed Study of Subandhu, Bāṇa, and Daṇḍin	3	1	[April-Aug]	3	5
		2. Exploration of Pañcatantra and Hitopadeśa	3	1	[April-Aug]	3	5
		3. Review of Later Prose Works and Their Themes	4	1	[April-Aug]	4	5

Explanation:

- Each section is meticulously planned to allow a comprehensive and detailed study of each aspect of the texts covered in the syllabus.
- The subdivision into smaller sub-units allows for a focus on specific themes, authorial backgrounds, textual analysis, and critical interpretations.

Assessment Strategy:

- **Continuous Assessment:** Includes quizzes, short essays, and translation exercises after each major sub-unit.
- **Mid-Semester Project:** A group project involving detailed analysis of a chosen text.

- **Final Examination:** A comprehensive test with translation, critical essays, and analysis of themes and stylistic elements.

Teaching Plan for SAN-G-CC-A3-TH/TU: Sanskrit Drama

Semester: III

- **Course Type:** 3 Year General
- **Course Name:** SAN-G-CC-A3-TH/TU
- **Course Details:** Sanskrit Drama
- **Credits:** 6
- **Unit Name / Teacher's Name:** As per Syllabus / [SB]
- **Total No. of Classes:** 100
- **No of Lesson Plan:** Each Sub Unit should have 1 lesson plan
- **Total Marks:** 90 (TH + IA + TU)

Detailed Course Layout:

Section	Unit	Sub Unit Name	Total No. of Classes	No. of Lesson Plan	Month	No. of Classes	Marks
A: Abhijñānaśākuntalam : Kālidāsa (Acts I-IV)	I	(a) Introduction to the Play	5	1	[Aug-Feb]	5	25
		(b) Act I: Themes and Character Introduction	5	1	[Aug-Feb]	5	-
		(c) Act II: Plot Development and Analysis	5	1	[Aug-Feb]	5	-
		(d) Act III: Key Dramatic Elements	5	1	[Aug-Feb]	5	-
		(e) Act IV: Climactic Elements	5	1	[Aug-Feb]	5	-
		(f) Act IV: Resolution and Analysis	5	1	[Month]	5	-
B:	I	(a) Act V:	5	1	[Aug-	5	15

Abhijñānaśākuntalam : Kālidāsa (Acts V-VII)		Advanced Analysis			Feb]		
		(b) Act VI: Character and Conflict	5	1	[Aug-Feb]	5	-
		(c) Act VII: Conclusion and Poetic Devices	5	1	[Aug-Feb]	5	-
		(d) Comprehensive Analysis	5	1	[Aug-Feb]	5	-
		(e) Thematic and Dramatic Synthesis	5	1	[Aug-Feb]]	5	-
		(f) Final Review of Acts V-VII	5	1	[Aug-Feb]	5	-
C: Technical Terms from Sanskrit Dramaturgy	I	(a) Introduction to Dramatic Terms	5	1	[Aug-Feb]	5	10
	II	(b) Detailed Study of Dramaturgical Elements	5	1	[Aug-Feb]	5	10
		(c) Application of Terms in Analysis	5	1	[Aug-Feb]	5	-
		(d) Review and Evaluation of Dramatic Terms	5	1	[Aug-Feb]	5	-
D: History of Sanskrit Drama	I	(a) Early Development of Sanskrit Drama	5	1	[Aug-Feb]	5	15
		(b) Evolution of Theatrical Forms and Styles	5	1	[Aug-Feb]	5	-
	II	(a) Major Dramatists and Their Contributions	5	1	[Aug-Feb]	5	15

		(b) Analysis of Selected Dramatic Works	5	1	[Aug-Feb]	5	-
		(c) Influence on Later Drama	5	1	[Aug-Feb]	5	-

Course Overview:

- **Sections A and B:** Deep analysis of Kālidāsa's "Abhijñānaśākuntalam," focusing on a detailed examination of its acts, character development, and literary techniques.
- **Section C:** Exploration of technical terms used in Sanskrit dramaturgy, aimed at equipping students with the necessary tools for dramatic analysis.
- **Section D:** Detailed study of the history and development of Sanskrit drama, including the works and influence of major dramatists.

Assessment Strategy:

- **Continuous Assessment:** Regular quizzes, essays, and presentations based on the analysis of dramatic texts and terminology.
- **Project Work/Tutorials:** Group projects and individual reports on specific aspects of Sanskrit drama.
- **Final Examination:** Comprehensive testing involving textual analysis, historical context, and application of learned dramaturgical terms.

Teaching Plan for SAN-G-SEC-A-1-TH/TU: Basic Sanskrit

Semester: 3

- **Course Type:** 3 Year General
- **Course Name:** SAN-G-SEC-A-1-TH/TU
- **Course Details:** SEC-A1 - Basic Sanskrit
- **Credits:** 2
- **Unit Name / Teacher's Name:** As per Syllabus / [SB]
- **Total No. of Classes:** 100
- **No of Lesson Plan:** Each Sub Unit should have 1 lesson plan
- **Total Marks:** 90 (TH + IA + TU)

Detailed Course Layout:

Section	Unit	Sub Unit Name	Total No. of	No. of Lesson	Month	No. of Classes	Marks

			Classes	**Plan**			
A: Translation	I	Vernacular to Sanskrit: Basics	5	1	[Aug-Feb]	5	10
		Vernacular to Sanskrit: Advanced	5	1	[Aug-Feb]	5	10
	II	Sanskrit to Vernacular: Basics	5	1	[Aug-Feb]	5	10
		Sanskrit to Vernacular: Advanced	5	1	[Aug-Feb]	5	10
B: Comprehension	I	Basic Comprehension Skills	5	1	[Aug-Feb]]	5	10
C: Writing Skills	I	Paragraph Writing	5	1	[Aug-Feb]	5	10
	II	Letter Writing	5	1	[Aug-Feb]	5	10
	III	Essay Writing: Basics	5	1	[Aug-Feb]	5	10
	IV	Essay Writing: Advanced	5	1	[Aug-Feb]	5	10

Course Overview:

- **Section A: Translation**
  - Focus on translating basic and advanced sentences and paragraphs from vernacular to Sanskrit and vice versa, enhancing translation accuracy and understanding.
- **Section B: Comprehension**
  - Develop skills to comprehend and interpret Sanskrit texts, with exercises to improve reading and understanding.
- **Section C: Writing Skills**
  - Detailed modules on writing paragraphs, letters, and essays in Sanskrit, focusing on structure, vocabulary, and style to enhance writing proficiency.

Assessment Strategy:

- **Continuous Assessment:** Regular quizzes and assignments for each sub-unit to evaluate progress in translation accuracy, comprehension, and writing skills.
- **Project Work/Tutorials:** In-depth projects might include creating a portfolio of translated texts, a series of written assignments like essays and letters, or comprehensive comprehension exercises.

- **Final Examination:** A comprehensive exam testing translation skills, understanding of Sanskrit passages, and ability to express thoughts clearly in Sanskrit through various forms of writing.

Teaching Plan for SAN-G-CC-A4-TH/TU: Sanskrit Grammar

Semester: 4

- **Course Type:** 3 Year General
- **Course Name:** SAN-G-CC-A4-TH/TU
- **Course Details:** Sanskrit Grammar
- **Credits:** 6
- **Unit Name / Teacher's Name:** As per Syllabus / [SB]
- **Total No. of Classes:** 100
- **No of Lesson Plan:** Each Sub Unit should have 1 lesson plan
- **Total Marks:** 90 (TH + IA + TU)

Detailed Course Layout:

Section	Unit	Sub Unit Name	Total No. of Classes	No. of Lesson Plan	Month	No. of Classes	Marks
A: Laghusiddhāntakaumudī: Saṃjñāprakaraṇa	I	Introduction to Saṃjñāprakaraṇa	5	1	[April-July]	5	20
		Basic Concepts of Saṃjñāprakaraṇa	5	1	[April-July]	5	-
		Detailed Study of Terms and Definitions	5	1	[April-July]	5	-
		Application of Saṃjñāprakaraṇa	5	1	[April-July]	5	-
		Revision and Case Studies	5	1	[April-July]	5	-
B: Laghusiddhāntakaumudī: Sandhiprakaraṇa	I	ac sandhi: Introduction and Rules	5	1	[April-July]	5	15
		yaṇ, guṇa, dīrgha sandhi	5	1	[April-July]	5	-

	II	ayādi, vṛddhi sandhi	5	1	[April-July]	5	10
	III	pūrvarūpa sandhi	5	1	[April-July]	5	10
		Review and Practice of Sandhiprakaraṇa	5	1	[April-July]	5	-
		halsandhi: Advanced Concepts	5	1	[April-July]	5	-
		visargasandhi: Rules and Applications	5	1	[April-July]	5	-
C: Laghusiddhāntakaumudī: VibhaktyarthaPrakaraṇa	I	Introduction to Vibhaktyartha	5	1	[April-July]	5	35
		Detailed Analysis of Cases	5	1	[April-July]	5	-
		Using Cases in Classical Texts	5	1	[April-July]	5	-
	II	Practical Applications of Vibhaktyartha	5	1	[April-July]	5	-
		Revision and Assessment	5	1	[April-July]	5	-
		Advanced Study and Comparative Analysis	10	2	[April-July]	10	-

Course Overview:

- **Section A:** Focuses on introducing and exploring the Saṃjñāprakaraṇa, its basic concepts, detailed studies, and practical applications.
- **Section B:** Delves into Sandhiprakaraṇa, covering various sandhi rules such as ac, halsandhi, and visargasandhi, including detailed practice and review sessions.
- **Section C:** Discusses VibhaktyarthaPrakaraṇa with an emphasis on understanding and applying case endings in real-world contexts, supported by classical and contemporary examples.

Assessment Strategy:

- **Continuous Assessment:** Regular quizzes and assignments focused on each prakaraṇa’s rules and applications.
- **Project Work/Tutorials:** Group projects involving detailed analysis and application of grammatical rules in creating or translating texts.
- **Final Examination:** A comprehensive test covering all topics, with a focus on the ability to apply grammatical knowledge effectively.

Teaching Plan for SAN-G-SEC-B-1-TH/TU: Spoken Sanskrit & Computer Awareness

Semester: 4

- **Course Type:** 3 Year General
- **Course Name:** SAN-G-SEC-B-1-TH/TU
- **Course Details:** SEC-B1
- **Credits:** 2
- **Unit Name / Teacher's Name:** As per Syllabus / [SB]
- **Total No. of Classes:** 100
- **No of Lesson Plan:** Each Sub Unit should have 1 lesson plan
- **Total Marks:** 90 (TH + IA + TU)

Detailed Course Layout:

Section	Unit	Sub Unit Name	Total No. of Classes	No. of Lesson Plan	Month	No. of Classes	Marks
A: Spoken Sanskrit	I	Introduction to Spoken Sanskrit	5	1	[April-July]	5	40
		Basic Conversational Structures	5	1	[April-July]	5	
		Vocabulary Building	5	1	[April-July]	5	
		Sentence Formation and Usage	5	1	[April-July]	5	
B: Computer Awareness for Sanskrit	I	Basic Computer Awareness	5	1	[April-July]	5	50
		Introduction to	5	1	[April-	5	

		Unicode Typing			July]		
	II	Using Tools for Digitalization of Sanskrit Texts	5	1	[April-July]	5	
		Web Publishing for Sanskrit	5	1	[April-July]	5	

Course Overview:

- **Section A: Spoken Sanskrit**
    - This section introduces students to the basics of spoken Sanskrit through interactive sessions focusing on everyday conversational skills, vocabulary enrichment, and sentence structuring to enhance speaking fluency.
- **Section B: Computer Awareness for Sanskrit**
    - Focuses on providing foundational knowledge in computer operations relevant to Sanskrit, including Unicode typing, digital preservation, and web publishing techniques specific to Sanskrit texts.

Assessment Strategy:

- **Continuous Assessment:** Includes practical assignments on spoken Sanskrit dialogues, quizzes on vocabulary and sentence structures, and practical tests on computer applications in Sanskrit.
- **Project Work/Tutorials:** In-depth projects involving the creation of a digital archive of Sanskrit texts or developing a simple website showcasing Sanskrit content.
- **Final Examination:** A comprehensive test combining spoken Sanskrit proficiency with technical skills in managing Sanskrit texts digitally.

Teaching Plan for SAN-G-DSE-1-TH/TU: Philosophy, Religion, and Culture in Sanskrit Tradition

Semester: 5

- **Course Type:** 3 Year General
- **Course Name:** SAN-G-DSE-1-TH/TU
- **Course Details:** Philosophy, Religion and Culture in Sanskrit Tradition
- **Credits:** 6
- **Unit Name / Teacher's Name:** As per Syllabus / [SB]
- **Total No. of Classes:** 100
- **No of Lesson Plan:** Each Sub Unit should have 1 lesson plan
- **Total Marks:** 90 (TH + IA + TU)

Detailed Course Layout:

Section	Unit	Sub Unit Name	Total No. of Classes	No. of Lesson Plan	Month	No. of Classes	Marks
A: Dharma	I	Introduction to Dharma Concepts	5	1	[July-Jan]	5	10
		Ten-fold Dharma & Definitions	5	1	[July-Jan]	5	-
	II	Theories of Satya and Ahiṃsā	5	1	[July-Jan]	5	10
		Theories of Asteya and Aparigraha	5	1	[July-Jan]	5	-
	III	Study of Pañcamahāyajña	5	1	[July-Jan]	5	10
		Theory of Three Debts	5	1	[July-Jan]	5	-
B: Saṃskāra and Puruṣārtha	I	Understanding Saṃskāra	5	1	[July-Jan]	5	15
		Processes of Acculturation	5	1	[July-Jan]	5	-
	II	The Aim of Human Life	5	1	[July-Jan]	5	15
		Discussion on Puruṣārtha	5	1	[July-Jan]	5	-
C: Svadharma	I	Concept of Svadharma	5	1	[July-Jan]	5	15

		Analysis of Karmayoga	5	1	[July-Jan]	5	-
	II	The Impact of Prakṛti's Guṇas	5	1	[July-Jan]	5	15
		Study of Adṛṣṭa and Karma Types	5	1	[July-Jan]	5	-

Course Overview:

- **Section A: Dharma**
  - Explores the principles of Dharma, including detailed discussions on its various elements like satya (truth), ahiṃsā (non-violence), asteya (non-stealing), aparigraha (non-possessiveness), and the theory of debts in life.
- **Section B: Saṃskāra and Puruṣārtha**
  - Focuses on the process of cultural and spiritual education through Saṃskāra and the aim of human life as viewed through the lens of Puruṣārtha (human pursuits).
- **Section C: Svadharma**
  - Delves into the concept of Svadharma (one's own duty) in the context of karmayoga, the influences of Prakṛti's guṇas (qualities), and the different types of karma (actions).

Assessment Strategy:

- **Continuous Assessment:** Includes written assignments, quizzes, and oral presentations on each major philosophical theme.
- **Project Work/Tutorials:** Students may engage in group discussions, research projects, or presentations that explore the practical applications of these philosophical teachings in modern society.
- **Final Examination:** A comprehensive examination that assesses students' understanding of the philosophical, religious, and cultural aspects taught throughout the semester.

Teaching Plan for SAN-G-SEC-A-2-TH/TU: Basic Elements of Āyurveda

Semester: 5

- **Course Type:** 3 Year General
- **Course Name:** SAN-G-SEC-A-2-TH/TU
- **Course Details:** Basic Elements of Āyurveda
- **Credits:** 2
- **Unit Name / Teacher's Name:** As per Syllabus / [SB]
- **Total No. of Classes:** 100
- **No of Lesson Plan:** Each Sub Unit should have 1 lesson plan
- **Total Marks:** 90 (TH + IA + TU)

Detailed Course Layout:

Section	Unit	Sub Unit Name	Total No. of Classes	No. of Lesson Plan	Month	No. of Classes	Marks
A: Introduction of Āyurveda	I	Overview of Āyurveda Principles	5	1	[July-Jan]	5	10
		Historical Development of Āyurveda	5	1	[July-Jan]	5	10
		Key Concepts and Terminology	5	1	[July-Jan]	5	10
B: Carakasaṃhitā - Sūtrasthānam	I	Fundamental Principles of Carakasaṃhitā	5	1	[July-Jan]	5	10
		Examination of Major Sūtras	5	1	[July-Jan]	5	10
	II	Practical Applications and Case Studies	5	1	[July-Jan]	5	10
		Advanced Studies in Sūtrasthānam	5	1	[July-Jan]	5	10
C: Taittirīyopaniṣad	I	Philosophical Implications	5	1	[July-Jan]]	5	10
		Analysis of Key Verses	5	1	[July-Jan]	5	10
		Integration of	5	1	[July-	5	10

		Āyurveda and Upaniṣad			Jan]		

Course Overview:

- **Section A: Introduction of Āyurveda**
  - This section covers the foundational principles, historical development, and essential concepts of Āyurveda, providing a thorough introduction to the traditional Indian medicine system.
- **Section B: Carakasaṃhitā - Sūtrasthānam**
  - Detailed exploration of the Carakasaṃhitā's Sūtrasthānam, discussing fundamental principles, key sūtras, their practical applications, and advanced studies, focusing on how these principles are applied in contemporary Āyurvedic practice.
- **Section C: Taittirīyopaniṣad**
  - Examination of the Taittirīyopaniṣad with an emphasis on its philosophical implications, analysis of key verses, and the integration of Āyurvedic principles with Vedic philosophy.

Assessment Strategy:

- **Continuous Assessment:** Regular quizzes, assignments, and practical examinations based on Āyurvedic concepts, Carakasaṃhitā analysis, and interpretations of the Taittirīyopaniṣad.
- **Project Work/Tutorials:** In-depth projects involving case studies in Āyurveda, presentations on the integration of Āyurvedic principles with philosophical texts, and group discussions.
- **Final Examination:** A comprehensive examination that tests theoretical knowledge, practical applications, and integrative understanding of Āyurveda and Vedic texts.

Teaching Plan for SAN-G-DSE-3-TH/TU: Literary Criticism

Semester: 6

- **Course Type:** 3 Year General
- **Course Name:** SAN-G-DSE-3-TH/TU
- **Course Details:** Literary Criticism
- **Credits:** 6
- **Unit Name / Teacher's Name:** As per Syllabus / [SB]
- **Total No. of Classes:** 100
- **No of Lesson Plan:** Each Sub Unit should have 1 lesson plan
- **Total Marks:** 90 (TH + IA + TU)

Detailed Course Layout:

Section	Unit	Sub Unit Name	Total No. of Classes	No. of Lesson Plan	Month	No. of Classes	Marks
A: Kāvyaprakāśa: Kāvyavaiśiṣṭya	I	Introduction to Literary Criticism	5	1	[April-June]	5	35
		Critical Theories and Approaches	5	1	[April-June]	5	-
		Analysis of Major Critical Essays	5	1	[April-June]	5	-
		Practical Applications of Critical Theories	5	1	[April-June]	5	-
		Revision and Case Studies	5	1	[April-June]	5	-
B: Kāvyaprakāśa: Kāvyakāraṇa	I	Fundamentals of Poetics	5	1	[April-June]	5	25
		Forms and Techniques in Poetry	5	1	[April-June]	5	-
		Comparative Study of Poetic Forms	5	1	[April-June]	5	-
		Modern Criticism and Poetic Forms	5	1	[April-June]	5	-
		Evaluation of Poetic Criticism	5	1	[April-June]	5	-
C: Kāvyaprakāśa: Kāvyasvarūpa	I	Essence and Nature of Poetry	5	1	[April-June]	5	30
		Historical Development of Literary Forms	5	1	[April-June]	5	-
		Study of Major Literary Movements	5	1	[April-June]	5	-
		Influence of Cultural Contexts on	5	1	[April-June]	5	-

		Literature					
		Synthesis of Contemporary Literary Criticism	5	1	[April-June]	5	-

Course Overview:

- **Section A:** Focuses on the introduction and detailed analysis of literary criticism, incorporating theoretical frameworks and their practical applications.
- **Section B:** Examines the formation and function of poetry, exploring different poetic devices and their critical evaluations.
- **Section C:** Delves into the essence, historical development, and cultural influences on literary forms, emphasizing contemporary criticism.

Assessment Strategy:

- **Continuous Assessment:** Regular quizzes, critical essays, and analytical assignments on literary theories and texts.
- **Project Work/Tutorials:** Group projects involving the analysis of literary texts using various critical approaches or the creation of essays on selected literary theories.
- **Final Examination:** A comprehensive exam that tests students on their analytical skills, understanding of literary forms, and ability to apply critical theories to texts.

Teaching Plan for SAN-G-SEC-B-2-TH/TU: Yogasūtra of Patañjali

Semester: 6

- **Course Type:** 3 Year General
- **Course Name:** SAN-G-SEC-B-2-TH/TU
- **Course Details:** Yogasūtra of Patañjali
- **Credits:** 2
- **Unit Name / Teacher's Name:** As per Syllabus / [SB]
- **Total No. of Classes:** 100
- **No of Lesson Plan:** Each Sub Unit should have 1 lesson plan
- **Total Marks:** 90 (TH + IA + TU)

Detailed Course Layout:

Section	Unit	Sub Unit Name	Total No. of Classes	No. of Lesson Plan	Month	No. of Classes	Marks
A: Samādhipāda	I	Introduction to Samādhipāda	5	1	[April-June]	5	30

		Definition and Types of Samādhi	5	1	[April-June]	5	-
		Obstacles in the path of Samādhi	5	1	[April-June]	5	-
		Techniques to Achieve Samādhi	5	1	[April-June]	5	-
		Summary and Revision of Samādhipāda	5	1	[April-June]	5	-
B: Sādhanapāda	I	Foundations of Spiritual Practice	5	1	[April-June]	5	30
		Aspects of Kriyā Yoga	5	1	[April-June]	5	-
		Eight Limbs of Ashtanga Yoga	5	1	[April-June]	5	-
		Ethical Precepts in Yoga Practice	5	1	[April-June]	5	-
		Review and Practical Application	5	1	[April-June]	5	-
C: Vibhūtipāda	I	Powers Attainable through Yoga	5	1	[April-June]	5	30
		Techniques for Attaining Powers	5	1	[April-June]	5	-
		Ethical Considerations of Powers	5	1	[April-June]	5	-
		Integration of Powers in Daily Life	5	1	[April-June]	5	-
		Summary and Implications of Vibhūtipāda	5	1	[April-June]	5	-

Course Overview:

- **Section A: Samādhipāda** provides an introductory exploration into the concept and practice of Samādhi, covering definitions, obstacles, and techniques, followed by a comprehensive review.
- **Section B: Sādhanapāda** dives into the practical aspects of yoga, discussing the foundational practices within Kriyā Yoga, the ethics involved, and the famed Ashtanga Yoga (Eight Limbs), concluding with practical applications.

- **Section C: Vibhūtipāda** focuses on the attainable powers through yoga practice, ethical considerations, and practical integration into daily life, emphasizing the broader implications of such attainments.

Assessment Strategy:

- **Continuous Assessment:** Regular quizzes on theoretical understanding, practical demonstrations of yoga techniques, and reflective essays on personal experiences with yoga practices.
- **Project Work/Tutorials:** Group projects might involve in-depth studies on specific sutras, creating presentations, or conducting workshops on how these practices can be integrated into daily life.
- **Final Examination:** A comprehensive written test that covers all aspects of the syllabus with a focus on both theoretical knowledge and practical understanding.

RAIDIGHI COLLEGE

TEACHING PLAN REPORT

Subject- Chemistry **Session-2022-2023**

Teacher Name – Dr. Debasree Saha

Course: Honours

Semester	Course Type	Unit Name(Topic)	Paper	Sub Unit Name	Month
Sem-I	Honours	Organic chemistry 1A	CC-1-1	Basics of organic chemistry (Valence bond theory, Electronic displacements) +Practicals	Sept
Sem-I	Honours	Organic chemistry 1A	CC-1-1	Basic of organic chemistry (MO Theory, Physical properties, General treatment of reaction mechanism) +Practicals	Oct-Nov
; Sem-I	Honours	Organic Chemistry-1B	CC-1-2	Stereochemistry, General treatment of reaction mechanism. +Practicals	Dec
Sem-II	Honours	Organic Chemistry-2	CC-2-3	StereochemistryII (Chirality arising out of stereoaxis,concept of prostereoisomerism,conformation)+Practicals	April
Sem-II	Honours	Organic Chemistry-2	CC-2-3	General treatment of reaction mechanismIII (Reaction thermodynamics, Tatomerism,Reaction kinetics)	May
Sem-II	Honours	Organic Chemistry-2	CC-2-3	Substitution and Elimination reaction (Free radical substitution reaction, Nucleophilic substitution reaction, Elimination reaction	June
Sem-III	Honours	Organic Chemistry-3	CC-3-7	Chemistry of alkenes and alkynes (Addition to C=C and C≡C)+Practicals	Aug
Sem-III	Honours	Organic Chemistry-3	CC-3-7	Aromatic substitution(Electrophilic aromatic substitution , Nucleophilic aromatic substitution)+Practicals	Sept
Sem-III	Honours	Organic Chemistry-3	CC-3-7	Carbonyl and related compounds (Addition to C=O,Exploitation of acidity of α-H of C=O, Nucleophilic addition of α,β-unsaturated carbonyl system.)+Practicals	Oct-Nov
Sem-III	Honours	Organic Chemistry-3	CC-3-7	Organometallics + Practicals	Dec
Sem-III	Honours	SEC 2: Analytical Clinical Biochemistry	SEC 2	Carbohydrates	Aug-Sept
Sem-IV	Honours	Organic Chemistry-4	CC-4-8	Nitrogen Compounds (Aliphatic and aromatic amines,alkylnitrile and isonitrile, Diazonium salts)+Practicals	Mar
Sem-IV	Honours	Organic Chemistry-4	CC-4-8	Rearrangements +Practicals	April
Sem-IV	Honours	Organic Chemistry-4	CC-4-8	The logic of Organic synthesis	May
Sem-IV	Honours	Organic Chemistry-4	CC-4-8	Organic Spectroscopy (UV-spectra,IR-spectra, NMR-spectra and applications)	June
Sem-IV	Honours	SEC 4: Pesticide Chemistry	SEC 4	General introduction to pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides	Mar-April

Sem-V	Honours	Organic Chemistry-5	CC-5-12	Carbocyles and Heterocycles+Practicals	Aug
Sem-V	Honours	Organic Chemistry-5	CC-5-12	Cyclic stereochemistry +Pericyclic reactions+ Practicals	Sept
Sem-V	Honours	Organic Chemistry-5	CC-5-12	Carbohydrates (Monosaccharides, Disaccharides)+Biomolecules(Aminoacides, Peptides, Nucleic acids)+Practicals	Oct-Nov
Sem-V	Honours	Inorganic Materials of Industrial Importance	DSE-B-1:	Alloys	Dec
Sem-V	Honours	Inorganic Materials of Industrial Importance	DSE-B-1:	Catalysis	Dec
Sem-VI	Honours	Analytical Methods in Chemistry	DSE-A4	Thermal methods of analysis +Practicals	Feb-Mar
Sem-VI	Honours	Dissertation	DSE-B4	Research/review on a particular topic with project report and digital presentation	April, May, June

Teacher Name – Dr. Debasree Saha

Course: General

Semester	Course Type	Unit Name(Topic)	Paper	Sub Unit Name	Month
Sem-I	General	CC1/GE1	CC1/GE1	Fundamentals of Organic Chemistry	Sept
Sem-I	General	CC1/GE1	CC1/GE1	Stereochemistry	Oct-Nov
Sem-I	General	CC1/GE1	CC1/GE1	Nucleophilic Substitution and Elimination Reactions	Dec
Sem-II	General	CC2/GE2	CC2/GE2	Aliphatic Hydrocarbons	April-May
Sem-II	General	CC2/GE2	CC2/GE2	Error Analysis and Computer Applications	June
Sem-III	General	CC3/GE3	CC3/GE3	Aromatic Hydrocarbons	Aug-Sept
Sem-III	General	CC3/GE3	CC3/GE3	Organometallic Compounds	Oct-Nov
Sem-III	General	CC3/GE3	CC3/GE3	Aryl Halides	Dec
Sem-IV	General	CC4/GE4	CC4/GE4	Carbonyl Compounds + Practicals	Mar
Sem-IV	General	CC4/GE4	CC4/GE4	Carboxylic Acids and Their Derivatives+ Practicals	April
Sem-IV	General	CC4/GE4	CC4/GE4	Amines and Diazonium Salts	May
Sem-IV	General	CC4/GE4	CC4/GE4	Amino Acids and Carbohydrates	June
Sem-V	General	Inorganic Materials of Industrial Importance	DSE-A2	Alloys	Nov
Sem-V	General	Inorganic Materials of Industrial Importance	DSE-A2	Catalysis	Dec
Sem-V	General	SEC 2: Analytical Clinical Biochemistry	SEC 2	Carbohydrates	Aug-Sept

Sem-VI	General	Analytical Methods in Chemistry	DSE-B2	Thermal methods of analysis +Practicals	Feb-Mar-April
Sem-VI	General	SEC 4: Pesticide Chemistry	SEC 4	General introduction to pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides	May-June

Teacher Name –Surojit Khan

Course: Honours

Semester	Course Type	Unit Name(Topic)	Paper	SubUnit Name	Month
Sem-I	Honours	Inorganic Chemistry	CC-1-1	Acid base reactions + Practicals	September
Sem-I	Honours	Inorganic Chemistry	CC-1-1	Redox reactions	October
Sem-I	Honours	Inorganic Chemistry	CC-1-1	Electro analytical methods + Solubility and solubility effects	November+ December
Sem-II	Honours	Inorganic Chemistry	CC-2-4	Chemical Bonding-I(Covalent bond)	April
Sem-II	Honours	Inorganic Chemistry	CC-2-4	Chemical Bonding-II(MO-Theory, Metallic bond, Weak chemical forces)	May
Sem-III	Honours	Inorganic Chemistry	CC-3-6	Chemical Periodicity+ Practicals	September+October+November
Sem-III	Honours	Inorganic Chemistry	CC-4-10	Chemistry of s and p block elements + Practicals	December
Sem-IV	Honours	Inorganic Chemistry	CC-4-10	Co-Ordination chemistry-II(CFT)+ Practicals	March+April
Sem-IV	Honours	Inorganic Chemistry	CC-4-10	Practicals	April -June
Sem-VI	Honours	Inorganic Chemistry	CC-6-13	Radical analysis	March -June
Sem-VI	Honours	Inorganic Chemistry	CC-6-13	Bio-Inorganic Chemistry	April

Sem-VI	Honours	Inorganic Chemistry	CC-6-13	Theoretical Principles in qualitative analysis(Solubility, solubility products ,common ion effects)	May
Sem-VI	Honours	Inorganic Chemistry	CC-6-13	Bio-Inorganic Chemistry+ Radical analysis	June

Teacher Name –Surojit Khan

Course: General

Semester	Course Type	Unit Name(Topic)	Paper	SubUnit Name	Month
Sem-I	General	CC1/GE1	CC1/GE 1	Acid and bases	Septem ber
Sem-I	General	CC1/GE1	CC1/GE 1	chemical periodicity	Octobe r
Sem-I	General	CC1/GE1	CC1/GE 1	practical	Novem ber+ Decem ber
Sem-II	General	CC2/GE2	CC2/GE 2	phase equilibria	April
Sem-II	General	CC2/GE2	CC2/GE 2	redox reactions	May
Sem-III	General	CC3/GE3	CC3/GE 3	Chemical bonding and molecular structure	Septem ber+O ctober +Nove mber
Sem-III	General	CC3/GE3	CC3/GE 3	Comparative study of p block elements +Practicals	Decem ber
Sem-IV	General	CC4/GE4	CC4/GE 4	Crystal field theory	April -May
Sem-V	General	Inorganic Materials of Industrial Importance	DSE-A2	Silicate industry	April -June
Sem-VI	General	Analytical Methods in Chemistry	DSE-B2	Separation techniques	March -June
Sem-VI	General	Pesticide Chemistry	SEC 4	General introduction to pesticides	April

Teacher Name – Joydeb Roy

Honours Course

Semester	Course Type	Unit Name(Topic)	Paper	SubUnit Name	Month
Sem-I	Honours	Physical Chemistry	CC-1-2-TH	Kinetic theory of gaseous state(Ideal gas, Maxwell's distribution of speed and energy,Real gas Virial equation)	Sept
Sem-I	Honours	Physical Chemistry	CC-1-2-TH	Chemical kinetics(Rate law, order and molecularity, kcp, tcp, role of temperature, homogeneous catalysis)	Oct-Nov
; Sem-I	Honours	Physical Chemistry	CC-1-2-TH	Transport processes(Diffusion,viscosity)	Dec
Sem-III	Honours	Physical Chemistry	CC-3-5-TH	Chemical Thermodynamics-I(1st law of thermodynamics, Thermochemistry)+ Chemical Thermodynamics-II(2nd law of thermodynamics)+practical's	Aug-Sep
Sem-III	Honours	Physical Chemistry	CC-3-5-TH	Chemical Thermodynamics – II(Thermodynamic relation)+System of variable composition+ Practical's	Sep-Oct
Sem-III	Honours	Physical Chemistry	CC-3-5-TH	Application of thermodynamics + Electrochemistry(conductance and transport number)+practical's	Nov
Sem-III	Honours	Physical Chemistry	CC-3-5-TH	Electrochemistry(Ionic equilibrium, Electromotive force) + Practicals	Dec
Sem-III	Honours	Sec-2 Analytical Clinical Biochemistry	SEC-2	Enzymes and Lipids	Nov-Dec
Sem-IV	Honours	Physical Chemistry	CC-4-9-TH	Application of Thermodynamics – II(Colligative properties and phase equilibrium) + Practicals	Mar-April
Sem-IV	Honours	Physical Chemistry	CC-4-9-TH	Fundamental of quantum mechanics(Beginning of Quantum mechanics,wave function, operators, particles in 1D box)+ Practicals	May
Sem-IV	Honours	Physical Chemistry	CC-4-9-TH	Crystal structure(Bravais lattice and laws of Crystallography, Crystal planes, Specific heat of salid)+Practicals	June
Sem-IV	Honours	Sec-4,Presticide Chemistry	Sec-4	Organochlorines and Organophospates	June
Sem-V	Honours	Physical Chemistry	CC-5-11	Quantum chemistry-II(Simple Harmonic Oscillator,Angular momentum,Hydrogen atom and hydrogen like ions)+ Practicals	Aug
Sem-V	Honours	Physical Chemistry	CC-5-11-TH	Quantum chemistry-II(LCAO) + Practicals	Sep-Oct
Sem-V	Honours	Physical Chemistry	CC-6-14	Statistical thermodynamics(Configuration, Boltzman distribution ,Partition function)+ Numerical analysis+ Practicals	Nov-Dec
Sem-V	Honours	DSE-A-2-Applications	DSE-A-2	FORTRAN,MS-Excel,Statistical analysis	Aug-Dec

		of computers in Chemistry			
Sem-Vi	Honours	Physical Chemistry	CC-6-14TH	Molecular spectroscopy(Rotational spectroscopy,vibrational spectroscopy, electronic spectroscopy)+Practicals	Feb-Mar
Sem-Vi	Honours	Physical Chemistry	CC-6-14-Th	Molecular spectroscopy(Raman spectroscopy)+Photo chemistry and theory of reaction rate.	April-May
Sem-Vi	Honours	Physical Chemistry	CC-6-14-TH	Surfacephenomenon,Adsorption,Colloids,Dipole moment.	June
Sem-Vi	Honours	DSE-A-4-Analytical Methods in Chemistry	DSE-A-4	Optical Mathods of analysis (Spectroscopy)	March-April

Teacher Name-Joydeb Roy

General Course

Semester	**Course Type**	**Unit name**	**Paper**	**Sub Unit Name**	**Month**
Sem-I	General	CC1/GE1	CC1/GE1	Chemical kinetics	Sep-Oct
Sem-I	General	CC1/GE1	CC1/GE1	Kinetic Theory of Gases and Real gases	Nov-Dec
Sem-II	General	CC2/GE2	CC2/GE2	Chemical Thermodynamics+Practicals	April-May
Sem-II	General	CC2/GE2	CC2/GE2	Chemical Equilibrium+Practicals	June
Sem-III	General	CC3/GE3	CC3/GE3	Conductance	Aug-Sep
Sem-III	General	CC3/GE3	CC3/GE3	Electromotive force	Oct-Dec
Sem-IV	General	CC4/GE4	CC4/GE4	Quantum Chemistry and Spectroscopy	March-June
Sem-V	General	DSE-A2-Inorganic Materials of industrial importance	DSE-A2	Surface Coating	Sep-Oct
Sem-V	General	DSE-A2-Inorganic Materials of industrial importance	DSE-A2	Chemical Explosives	Oct-Nov
Sem-V	General	SEC-2-Analytical Clinical Biochemistry	SEC-2	Enzymes and Lipids	Dec
Sem-VI	General	DSE-B2-Analytical Methodes in Chemistry	DSE-B2	Optical methods of analysis +Practicals	Feb-May
Sem-VI	General	SEC-4-Presticide Chemistry	SEC-4	Organochlorines and Organophosphates	May-June

Teacher Name – Shrabony Kar

Honours course

Semester	Course Type	Unit Name(Topic)	Paper	SubUnit Name	Month
Sem-I	Honours	Inorganic Chemistry	CC-1-1	Extra nuclear structure of atom (Quantum no. and its significance ,)+ Practical's	Sept
Sem-I	Honours	Inorganic Chemistry	CC-1-1	Radial and angular wave functions and distribution curves.+ Practical	Oct-Nov
Sem-I	Honours	Inorganic Chemistry	CC-1-1	Term symbols of atom and ions and Practicals	Dec
Sem-II	Honours	Inorganic Chemistry	CC-2-4	Radioactivity	Apr-May
Sem-II	Honours	Inorganic Chemistry	CC-2-4	Chemical Bonding –I(Ionic bond)	May-June
Sem-III	Honours	Inorganic Chemistry	CC-3-6	Co-ordination chemistry-I and Inorganic polymers.	Aug-Nov
Sem-III	Honours	Sec 2: Analytical Clinical Biochemistry	Sec 2	Lipoproteins and biochemistry of diseases	Aug-Sept
Sem-IV	Honours	Inorganic Chemistry	CC-4-10	Chemistry of d and f block elements(Transition elements,)+ Practicals	Mar-Apr
Sem-IV	Honours	Inorganic Chemistry	CC-4-10	f-block elements(Lanthanoids and Actinoids)+ Practicals	May
Sem-IV	Honours	Inorganic Chemistry	CC-4-10	Reaction kinetics and mechanism + Practicals	June
Sem-IV	Honours	SEC 4: Pesticide Chemistry	Sec 4	Synthesis and technical manufacture and uses of carbamates quinines and anilides	June
Sem-V	Honours	Inorganic Chemistry	DSE-B-1	Inorganic materials of industrial importance (Silicate industries)+ Practicals	Aug-Sept
Sem-V	Honours	Inorganic Chemistry	DSE-B-1	Inorganic materials of industrial importance (Fertilizers , batteries and chemical explosives)+ Practicals	Sept-Oct
Sem-V	Honours	Inorganic Chemistry	DSE-B-1	Inorganic materials of industrial importance (Catalysis , Alloys)+ Practicals	Oct
Sem-V	Honours	Inorganic Chemistry	DSE-B-1	Inorganic materials of industrial importance Surface coatings+ Practicals	Nov
Sem-VI	Honours	Inorganic Chemistry	CC-6-13	Organometallic chemistry (Definition, classification,hepticity,18 and 16 electrons rules)+Dissertation	Feb
Sem-VI	Honours	Inorganic Chemistry	CC-6-13	Organometallic chemistry(Application of 18-electrons rule to organometallic compounds, synergistic effict)	Mar-Apr
Sem-VI	Honours	Inorganic Chemistry	CC-6-13	Organometallic chemistry(Use of IR data in back bonding , Zeise's salt, ferrocene)	Apr-May
Sem-VI	Honours	Inorganic Chemistry	CC-6-13	Organometallic chemistry(Reactions of organometallic complexes) Catalysis by Organometallic compounds(Homogeneous and heterogeneous catalysis+ Dissertation	May
Sem-VI	Honours	Ananlytical Methods in Chemistry	DSE-A4	Electroanalytical methods	Feb-Mar-Apr

Sem-VI	Honours	Dissertation	DSE-B4	Project report and digital presentation	Feb-Mar-Apr

Teacher's name: Shrabony kar

General course

Semester	Course Type	Unit Name(Topic)	Paper	Sub Unit Name	Month
Sem-I	General	CC1/GE1	CC1/GE1	Bohr's theory for H atom, atomic spectra of H and Bohr's model	Sept
Sem-I	General	CC1/GE1	CC1/GE1	Sommerfeld's model, quantum nos and their significance, Pauli's exclution principle	Oct-Nov
Sem-I	General	CC1/GE1	CC1/GE1	Electroni configuration of many electron's system, aufbau principles and its limitations.	Dec
Sem-II	General	CC2/GE2	CC2/GE2	Solutions	April-May
Sem-II	General	CC2/GE2	CC2/GE2	Solids	June
Sem-III	General	CC3/GE3	CC3/GE3	Transition elements (3d series)	Aug-Sept
Sem-III	General	CC3/GE3	CC3/GE3	Lanthanoids and Actinoids	Oct
Sem-III	General	CC3/GE3	CC3/GE3	Co-ordination chemistry	Nov-Dec
Sem-IV	General	CC4/GE4	CC4/GE4	Alcohol	Mar
Sem-IV	General	CC4/GE4	CC4/GE4	Phenol	April
Sem-IV	General	CC4/GE4	CC4/GE4	Ether	May
Sem-IV	General	CC4/GE4	CC4/GE4	Diol	June
Sem-V	General	Inorganic Materials of Industrial Importance	DSE-A2	Fertilizers + practicals	Nov
Sem-V	General	Inorganic Materials of Industrial Importance	DSE-A2	Batteries + practicals	Dec
Sem-V	General	SEC 2: Analytical Clinical Biochemistry	SEC 2	Lipoproteins and biochemistry of diseases	Nov-Dec
Sem-VI	General	Ananlytical Methods in Chemistry	DSE-B2	Electroanalytical methods	Feb-Mar-Apr

Note: Classes taken during May-June recess period were in online mode.

Department of Mathematics

Raidighi College

Three-year B.Sc. in Mathematics (Honours) under CBCS System ODD SEMESTER-Teaching Plan-2022-23

Semester	Course Type	Course Name	Course Details	Credits	Unit Name /Teacher's Name	Total No. of Classes	No of Lesson Plan**	Sub Unit Name **	Month	No. of Class
I	Honours	Core Course -1	Calculus, Geometry & Vector Analysis	6	Unit-1: Calculus /DJ	25	2	Exploring Applications and Techniques for Higher Order Calculus	[Sep to Feb]	10
								Exploring Reduction Formulae, Parametric Curves, and Applications		15
					Unit-2 : Geometry /GB	30	3	Exploring Conics, Rotation of Axes, and Equation of Planes	[Sep to Feb]	10
								Exploring Equations, Intersections, and Distances		10
								Spheres, Cylindrical Surfaces, and Central Conicoids		10
					Unit-3 : Vector Analysis/PG	15	1	Triple Product, Vector Equations, and Vector Functions	[Sep to Feb]	15
I	Honours	Core Course-2	Algebra	6	Unit-1: Classical Algebra/URM	30	1	Complex numbers	[Sep to Feb]	5
								Theory of equations		5
								Inequality		4
								Linear difference equations with constant coefficients		5
								Problem-solving session and examination		11
					Unit-2: Algebra/ URM	30	1	Relation	[Sep to Feb]	5
								Mapping and Set Theoretic Operations		5
								Principles of Mathematical Induction and Number Theory		5
								Arithmetic Functions and Advanced Number Theory		5
								Problem-solving session and examination		10
					Unit-3:Matrix Operations and Systems of Linear Equations/ PG	15	1	Introduction to Matrix Operations	[Sep to Feb]	2
								Rank of a Matrix		2
								Inverse of a Matrix		2
								Characterizations of Invertible Matrices		2
								Systems of Linear Equations		3
								Applications of Linear Systems		4

III	Honours	Core Course-5	Theory of Real Functions	6	Unit-1: Limit & Continuity of functions/SB	40	5	Limits of Functions	[Sep to Feb]	5
								Continuity		10
								Boundedness and Intermediate Value Theorem		5
								Discontinuity and Monotone Functions		10
								Uniform continuity		10
					Unit-2 : Differentiability of functions/SB	35	3	Differentiability of Functions	[Sep to Feb]	5
								Differentiability of Functions-Theorems and Applications		15
								L'Hospital's Rule and Extremum		15
III	Honours	Core Course-6	Ring Theory & Linear Algebra-I	6	Unit-1 : Ring theory/PG	35	2	Definition, Properties, and Applications of Rings	[Sep to Feb]	15
								Ring Homomorphisms, Isomorphism Theorems, and Congruences		20
					Unit-2 : Linear algebra/PG	40	2	Vector Spaces, Subspaces, and Dimension	[Sep to Feb]	15
								Understanding Linear Transformations, Eigenvalues, and Isomorphisms		25
III	Honours	Core Course-7	Ordinary Differential Equation & Multivariate Calculus-I	6	Unit-1 : Ordinary differential equation /URM	35	7	Exploring First-Order Differential Equations	[Sep to Feb]	5
								Linear and Higher-Degree Equations with Applications		5
								Basic Theory of Linear Systems		5
								Exploring Second-Order Linear Differential Equations		5
								Exploring Linear Systems and Differential Operators		5
								Equilibrium Points and Phase Portraits		5
								Power Series Solutions and Regular Singular Points		5
					Unit-2 : Multivariate Calculus-I/SB	30	3	Understanding Neighbourhoods, Limits, and Continuity in Higher Dimensions	[Sep to Feb]	5
								Partial Derivatives, Total Derivative, and Chain Rule		5
								Exploring Directional Derivatives, Gradient, and Optimization		20
III	Honours	SEC-A	C Programmi	2	C Programming	30	9	Theoretical Foundations and History of Computers	[Sep to Feb]	3

			ng Language		Language/URM			Understanding Character Set and Declarations		3
								Exploring Arithmetic, Relational, and Logical Operators		3
								Implementing Decision-Making Statements in C		4
								Mastering While, Do-While, and For Loops		3
								Exploring One-Dimensional, Two-Dimensional, and Multidimensional Arrays		4
								Understanding Function Definitions, Scope, and Recurrence		4
								Exploring Standard Library Functions in C		3
								Applying C Programming Concepts in Real-world Scenarios		3
V	Honours	Core Course-11	Probability & Statistics	6	Unit-1: Probability /DJ	20	2	Understanding Random Experiments and Probability Axioms	[Sept - Jan]	5
								Real Random Variables, Distributions, and Applications		15
					Unit-2: Probability/ DJ	15	1	Joint Distributions, Regression, and Bivariate Normal Distribution	[Sept - Jan]	15
					Unit-3: Probability/ DJ	5	1	Markov's and Chebyshev's Inequalities, Convergence, and Central Limit Theorem	[Sept - Jan]	5
					Unit-4: Statistics in Mathematics /DJ	15	3	Sampling and Sampling Distributions	[Sept - Jan]	5
								Sampling Distributions		5
								Estimation of Parameters, Maximum Likelihood Method		5
					Unit-5:Statistical hypothesis/DJ	15	1	Statistical Hypothesis Testing	[Sept - Jan]	15
V	Honours	Core Course-12	Group Theory-II & Linear Algebra-II	6	Unit-1 : Group theory/SB	20	1	External Direct Product and Finite Abelian Groups	[Sept - Jan]	20
					Unit-2 : Linear algebra/SB	40	3	Inner Product Spaces and Orthogonalization Processes	[Sept - Jan]	10
								Bilinear and Quadratic Forms, Diagonalization of Symmetric Matrices		10
								Dual Spaces, Eigenspaces, and Canonical Forms		20
V	Honours	DSE-A (1)	Advanced Algebra	6	Unit-1: Group Theory/URM	25	2	Group Actions and Permutation Representations	[Sept - Jan]	10

								Groups Acting on Themselves and Sylow's Theorems		15
					Unit-2: Ring Theory/URM	45	3	Principal Ideal Domains and Euclidean Domains	[Sept - Jan]	20
								Understanding Polynomial Rings and Unique Factorization		15
								Understanding ring embedding, quotient fields, regular rings, and ideals		10
V	Honours	DSE-B(1)	Linear Programming & Game Theory	6	Unit-1:LPP/PG	15	2	Understanding Linear Programming & Game Theory	[Sept - Jan]	5
								Understanding Convex Sets and Extreme Points		10
					Unit-2:LPP/PG	20	2	Slack and Surplus Variables, Standard Form of L.P.P., Simplex Method Theory, Feasibility and Optimality Conditions	[Sept - Jan]	10
								Exploring the Algorithm and Two-Phase Method		10
					Unit-3:LPP/PG	10	1	Understanding the Dual of Dual and its Applications	[Sept - Jan]	10
					Unit-4: Game Theory/PG	30	2	Transportation and Assignment Problems	[Sept - Jan]	10
								Exploring Concepts, Strategies, and Applications		20

Teacher's Name	
PG	DR. PAYEL GHOSH
URM	UTTAM ROY MANDAL
GB	GOUTAM BAIDYA
DJ	DEBADRATA JANA
SB	SWADHIN BANERJEE

** This comprehensive lesson plan (below) aims to provide undergraduate students with a solid understanding of topics.

Department of Mathematics
Raidighi College
Three-year B.Sc. in Mathematics
(Honours) *under* CBCS System

ODD SEMESTER-Lesson Plan

Algebra

Semester : 1

Core Course-1 *Full Marks : 65+15**+20***=100*

Paper Code(Theory): MTM-A-CC-1-1-TH

Paper Code (Tutorial):MTM-A-CC-1-1-TU

Unit-1: Calculus

Title	Comprehensive Calculus: Hyperbolic Functions and Advanced Derivatives
Subtitle	Exploring Applications and Techniques for Higher Order Calculus
Duration	10 hours (10 sessions x 1 hour each)
Teacher's Name	**Debabrata Jana (DJ)**
Date	[Date]

Session 1: Introduction to Hyperbolic Functions and Higher Order Derivatives (1 hour)

Objectives:

- Introduce hyperbolic functions and their properties.
- Understand the concept of higher order derivatives and Leibniz's rule.

Key Concepts:

- Definitions of hyperbolic functions: sinh, cosh, tanh, etc.
- Basic properties and graphs of hyperbolic functions.
- Concept of higher order derivatives.
- Leibniz's rule for differentiating products of functions.

Teaching Strategies:

- Lecture with visual aids to explain the definitions and properties.

Activities:

- Work through examples of finding higher order derivatives using Leibniz's rule.

Assessment:

- Quiz on definitions and properties of hyperbolic functions.
- Practice problems on finding higher order derivatives.

Session 2: Applications of Higher Order Derivatives (1 hour)

Objectives:

- Apply higher order derivatives to solve real-world problems.

Key Concepts:

- Applications of higher order derivatives in physics, engineering, and economics.
- Curve tracing using higher order derivatives.

Teaching Strategies:

- Work through examples of applying higher order derivatives to real-world problems.
- Use software tools for curve tracing.

Activities:

- Solve optimization problems using higher order derivatives.

Assessment:

- Problem-solving tasks on applying higher order derivatives to real-world scenarios.

Session 3: Curvature, Concavity, and Points of Inflection (1 hour)

Objectives:

- Understand curvature, concavity, and points of inflection.

Key Concepts:

- Definitions of curvature, concavity, and points of inflection.
- Techniques for finding curvature and concavity.

Teaching Strategies:

- Visual demonstrations to understand curvature and concavity.

Activities:

- Practice problems on finding points of inflection.

Assessment:

- Quiz on curvature, concavity, and points of inflection.
- Problem-solving tasks on finding curvature and concavity.

Session 4: Envelopes and Rectilinear Asymptotes (1 hour)

Objectives:

- Introduce envelopes and rectilinear asymptotes.

Key Concepts:

- Definitions of envelopes and rectilinear asymptotes.
- Techniques for finding envelopes and rectilinear asymptotes.

Teaching Strategies:

- Illustrate with examples and visual aids.

Activities:

- Solve problems involving envelopes and rectilinear asymptotes.

Assessment:

- Problem-solving tasks on finding envelopes and rectilinear asymptotes.

Session 5: Curve Tracing in Cartesian Coordinates (1 hour)

Objectives:

- Learn techniques for tracing curves in Cartesian coordinates.

Key Concepts:

- Methods for tracing curves using derivatives and critical points.
- Identifying special features such as maxima, minima, and points of inflection.

Teaching Strategies:

- Demonstrate curve tracing techniques step by step.

Activities:

- Practice curve tracing of various functions.

Assessment:

- Assessment through graded curve tracing exercises.

Session 6: Tracing in Polar Coordinates (1 hour)

Objectives:

- Explore tracing curves in polar coordinates.

Key Concepts:

- Converting Cartesian equations to polar form.
- Tracing standard curves in polar coordinates.

Teaching Strategies:

- Explain the conversion process from Cartesian to polar coordinates.
- Use examples to demonstrate tracing standard curves.

Activities:

- Practice tracing curves in polar coordinates.

Assessment:

- Assessment through tracing exercises in polar coordinates.

Session 7: L'Hopital's Rule and Applications (1 hour)

Objectives:

- Understand L'Hopital's Rule and its applications.

Key Concepts:

- Statement and proof of L'Hopital's Rule.
- Applications of L'Hopital's Rule in evaluating limits.

Teaching Strategies:

- Step-by-step explanation of L'Hopital's Rule and its applications.

Activities:

- Practice problems on evaluating limits using L'Hopital's Rule.

Assessment:

- Quiz on understanding and applying L'Hopital's Rule.

Session 8: Business, Economics, and Life Sciences Applications (1 hour)

Objectives:

- Explore real-world applications of calculus concepts.

Key Concepts:

- Applications of calculus in business, economics, and life sciences.
- Examples of optimization, modeling, and decision-making.

Teaching Strategies:

- Present case studies and examples from various fields.

Activities:

- Analyze and discuss the applications of calculus in different scenarios.

Assessment:

- Group discussions and presentations on specific applications.

Session 9: Review and Practice (1 hour)

Objectives:

- Review key concepts covered in previous sessions.
- Provide additional practice opportunities.

Teaching Strategies:

- Review important definitions, theorems, and techniques.
- Provide practice problems covering various topics.

Activities:

- Group work on solving practice problems.

Assessment:

- Assessment through solving practice problems.

Session 10: Final Assessment and Conclusion (1 hour)

Objectives:

- Assess understanding of the entire course content.
- Wrap up the course with a summary of key learnings.

Teaching Strategies:

- Administer a comprehensive final assessment.
- Summarize the course content and its relevance.

Activities:

- Final exam covering all topics discussed.

Assessment:

- Graded final exam.
- Feedback session for students to reflect on their learning experience.

Real-World Applications:

- Calculus concepts such as optimization and curve tracing are crucial in engineering for designing efficient structures and systems.
- In economics, calculus is used to model and analyze complex systems such as market behavior and resource allocation.
- Calculus plays a significant role in life sciences for modeling biological processes, understanding population dynamics, and analyzing medical data.
- Understanding curvature and concavity is essential in physics for studying motion, forces, and fluid dynamics.

Title	Comprehensive Calculus II: Advanced Integration Techniques and Parametric Equations
Subtitle	Exploring Reduction Formulae, Parametric Curves, and Applications
Duration	15 hours (15 sessions x 1 hour each)
Teacher's Name	**Debabrata Jana (DJ)**
Date	[Date]

Session 1: Introduction to Reduction Formulae (1 hour)

Objectives:

- Introduce reduction formulae and their applications in integration.

Key Concepts:

- Definitions of reduction formulae for trigonometric functions.
- Derivation and illustration of reduction formulae.

Teaching Strategies:

- Lecture with step-by-step derivations of reduction formulae.
- Visual aids to illustrate the concepts.

Activities:

- Work through examples of using reduction formulae to evaluate integrals.

Assessment:

- Quiz on understanding and applying reduction formulae.

Session 2: Reduction Formulae for Trigonometric Functions (1 hour)

Objectives:

- Explore reduction formulae for sine, cosine, tangent, secant, and logarithmic functions.

Key Concepts:

- Specific reduction formulae for different trigonometric and logarithmic functions.

Teaching Strategies:

- Demonstrate the derivation and application of reduction formulae for various functions.

Activities:

- Practice problems on evaluating integrals using reduction formulae.

Assessment:

- Problem-solving tasks on applying reduction formulae.

Session 3: Parametric Equations and Parametrizing a Curve (1 hour)

Objectives:

- Introduce parametric equations and curve parametrization.

Key Concepts:

- Definitions of parametric equations.
- Techniques for parametrizing a curve.

Teaching Strategies:

- Explain the concept of parametric equations with examples.
- Illustrate how to parametrize a curve using different parameterizations.

Activities:

- Practice problems on parametrizing curves.

Assessment:

- Quiz on understanding parametric equations and curve parametrization.

Session 4: Arc Length of a Curve (1 hour)

Objectives:

- Understand the concept of arc length and its calculation for parametric curves.

Key Concepts:

- Definition of arc length.

- Formula for calculating arc length of a curve defined by parametric equations.

Teaching Strategies:

- Derive the formula for arc length of a parametric curve.
- Provide examples to illustrate the calculation process.

Activities:

- Work through problems on finding arc length of parametric curves.

Assessment:

- Problem-solving tasks on calculating arc length.

Session 5: Area Under a Curve (1 hour)

Objectives:

- Learn techniques for finding the area under a curve defined by parametric equations.

Key Concepts:

- Concept of area under a curve.
- Formula for calculating area under a parametric curve.

Teaching Strategies:

- Explain the concept with graphical representations.
- Derive the formula for finding area under a parametric curve.

Activities:

- Practice problems on finding area under parametric curves.

Assessment:

- Quiz on understanding and applying the formula for area under a curve.

Session 6: Area and Volume of Surface of Revolution (1 hour)

Objectives:

- Explore methods for finding the area and volume of surfaces of revolution.

Key Concepts:

- Concept of surfaces of revolution.
- Formulas for calculating area and volume of surfaces of revolution.

Teaching Strategies:

- Explain the concept with visual aids and examples.
- Derive the formulas for area and volume of surfaces of revolution.

Activities:

- Work through problems on finding area and volume of surfaces of revolution.

Assessment:

- Problem-solving tasks on calculating area and volume.

Session 7: Review and Practice (1 hour)

Objectives:

- Review key concepts covered in previous sessions.
- Provide additional practice opportunities.

Teaching Strategies:

- Review important definitions, theorems, and techniques.
- Provide practice problems covering various topics.

Activities:

- Group work on solving practice problems.

Assessment:

- Assessment through solving practice problems.

Session 8: Real-World Applications of Integration Techniques (1 hour)

Objectives:

- Explore real-world applications of integration techniques.

Key Concepts:

- Applications of integration in physics, engineering, and economics.
- Examples of calculating areas, volumes, and other quantities.

Teaching Strategies:

- Present case studies and examples from various fields.

Activities:

- Analyze and discuss the applications of integration techniques in different scenarios.

Assessment:

- Group discussions and presentations on specific applications.

Session 9: Further Applications and Examples (1 hour)

Objectives:

- Explore additional applications and examples of integration techniques.

Key Concepts:

- Advanced examples involving reduction formulae, parametric curves, and surfaces of revolution.

Teaching Strategies:

- Work through challenging examples step by step.

Activities:

- Solve complex problems involving integration techniques.

Assessment:

- Problem-solving tasks on advanced integration problems.

Session 10: Integration Techniques in Engineering (1 hour)

Objectives:

- Discuss the relevance of integration techniques in engineering applications.

Key Concepts:

- Examples of using integration for calculating moments, centroids, and volumes.

Teaching Strategies:

- Present engineering-related examples and problems.

Activities:

- Solve engineering problems requiring integration techniques.

Assessment:

- Assessment through solving engineering-related problems.

Session 11-15: Project Work and Presentations (5 hours)

Objectives:

- Apply integration techniques to solve real-world problems.
- Enhance presentation and communication skills.

Key Concepts:

- Independent project work on chosen topics or applications.
- Preparation and delivery of presentations.

Teaching Strategies:

- Provide guidance and support for project development.
- Conduct practice sessions for presentations.

Activities:

- Conduct research and analysis for project work.
- Prepare and deliver presentations to the class.

Assessment:

- Evaluation of project reports and presentations.
- Peer assessment of presentation skills.

Real-World Applications:

- Integration techniques are essential in physics for calculating quantities such as work, energy, and fluid flow rates.
- In engineering, integration is used to determine properties of structures and systems, such as moments of inertia, centroids, and volumes of complex shapes.
- Calculating areas and volumes using integration is crucial in architecture and construction for designing buildings and structures.
- Integration techniques are also applied in economics and finance for modeling and analyzing various economic phenomena, such as consumer surplus and revenue optimization.

Unit-2 : Geometry

Title	Comprehensive Geometry: Conics and Plane Equations
Subtitle	Exploring Conics, Rotation of Axes, and Equation of Planes
Duration	10 hours (10 sessions x 1 hour each)
Teacher's Name	**GOUTAM BAIDYA (GB)**
Date	[Date]

Session 1: Introduction to Conics and Rotation of Axes (1 hour)

Objectives:

- Introduce conic sections and their properties.
- Understand rotation of axes and its effect on conic equations.

Key Concepts:

- Definitions and classifications of conic sections.
- Techniques for rotating coordinate axes.

Teaching Strategies:

- Lecture with visual aids to explain conics and rotation of axes.

Activities:

- Work through examples of rotating axes and identifying conic sections.

Assessment:

- Quiz on conic sections and rotation of axes.

Session 2: Discriminant and Classification of Conics (1 hour)

Objectives:

- Explore how discriminant helps classify conic sections.
- Understand the geometric properties of different conics.

Key Concepts:

- Discriminant and its significance in conic equations.
- Tangent and normal lines to conics.

Teaching Strategies:

- Present classification methods using discriminant.
- Discuss tangent and normal lines to conics.

Activities:

- Practice problems on classifying conics and finding tangent/normal lines.

Assessment:

- Problem-solving tasks on using discriminant to classify conics.

Session 3: Polar Equations of Conics (1 hour)

Objectives:

- Learn how to represent conics using polar coordinates.

Key Concepts:

- Conversion of Cartesian conic equations to polar form.
- Properties of conics in polar coordinates.

Teaching Strategies:

- Demonstrate the process of converting Cartesian equations to polar form.

Activities:

- Work through examples of representing conics in polar coordinates.

Assessment:

- Quiz on understanding polar equations of conics.

Session 4: Equation of Plane: General Form (1 hour)

Objectives:

- Introduce the general equation of a plane.
- Understand the geometric interpretation of plane equations.

Key Concepts:

- General form of the equation of a plane.
- Interpretation of coefficients in the plane equation.

Teaching Strategies:

- Explain the components of the general plane equation.

Activities:

- Practice problems on writing equations of planes in general form.

Assessment:

- Problem-solving tasks on plane equations.

Session 5: Equation of Plane: Intercept and Normal Forms (1 hour)

Objectives:

- Explore the intercept and normal forms of the plane equation.
- Understand their advantages in certain situations.

Key Concepts:

- Intercept form and its relation to the intercepts on coordinate axes.
- Normal form and its interpretation in terms of perpendicularity.

Teaching Strategies:

- Compare and contrast intercept and normal forms.

Activities:

- Work through examples of converting between intercept and normal forms.

Assessment:

- Quiz on understanding intercept and normal forms of plane equations.

Session 6: Sides of a Plane and Signed Distance of a Point from a Plane (1 hour)

Objectives:

- Learn about the sides of a plane and their significance.
- Understand how to calculate the signed distance of a point from a plane.

Key Concepts:

- Definition of sides of a plane.
- Formula for calculating the signed distance of a point from a plane.

Teaching Strategies:

- Illustrate the concept of sides of a plane with diagrams.

Activities:

- Practice problems on determining the side of a point relative to a plane.

Assessment:

- Problem-solving tasks on calculating signed distances.

Session 7: Equation of a Plane Passing Through the Intersection of Two Planes (1 hour)

Objectives:

- Learn how to find the equation of a plane passing through the intersection of two given planes.

Key Concepts:

- Procedure for determining the equation of a plane passing through the intersection of two planes.

Teaching Strategies:

- Step-by-step explanation of the process with examples.

Activities:

- Work through problems on finding equations of planes passing through intersections.

Assessment:

- Quiz on determining plane equations through intersections.

Session 8: Angle Between Two Intersecting Planes (1 hour)

Objectives:

- Understand how to calculate the angle between two intersecting planes.

Key Concepts:

- Definition of the angle between two planes.
- Formula for calculating the angle between two planes.

Teaching Strategies:

- Explain the concept with diagrams and geometric interpretations.

Activities:

- Practice problems on finding the angle between intersecting planes.

Assessment:

- Problem-solving tasks on calculating angles between planes.

Session 9: Parallelism and Perpendicularity of Two Planes (1 hour)

Objectives:

- Explore conditions for parallelism and perpendicularity of two planes.

Key Concepts:

- Criteria for determining when two planes are parallel or perpendicular.

Teaching Strategies:

- Present conditions for parallelism and perpendicularity.

Activities:

- Work through examples to identify relationships between planes.

Assessment:

- Quiz on determining parallelism and perpendicularity of planes.

Session 10: Real-World Applications of Geometry (1 hour)

Objectives:

- Discuss real-world applications of conics and plane geometry.

Key Concepts:

- Applications of conics in engineering, physics, and architecture.
- Practical uses of plane geometry in construction and design.

Teaching Strategies:

- Present case studies and examples from various fields.

Activities:

- Analyze and discuss the applications of geometry in different scenarios.

Assessment:

- Group discussions and presentations on specific applications.

Real-World Applications:

- Conics are used in astronomy for modeling orbits of celestial bodies.
- Plane geometry is crucial in architecture for designing structures with precise dimensions and angles.
- Understanding the equation of planes is essential in aviation for navigation and flight planning.
- Geometry concepts are applied in computer graphics for rendering 3D objects and scenes.

Title	Comprehensive Geometry: Straight Lines in 3D
Subtitle	Exploring Equations, Intersections, and Distances
Duration	10 hours (10 sessions x 1 hour each)
Teacher's Name	**GOUTAM BAIDYA (GB)**
Date	[Date]

Session 1: Introduction to Straight Lines in 3D (1 hour)

Objectives:

- Introduce the concept of straight lines in three-dimensional space.
- Understand different forms of equations for lines.

Key Concepts:

- Symmetric and parametric forms of the equation of a line.
- Direction ratios and direction cosines.

Teaching Strategies:

- Lecture with visual aids to explain the concepts.
- Work through examples to illustrate different forms of equations.

Activities:

- Practice problems on converting between symmetric and parametric forms.

Assessment:

- Quiz on understanding the concepts of lines in 3D space.

Session 2: Canonical Equation of the Line of Intersection (1 hour)

Objectives:

- Learn how to find the canonical equation of the line of intersection of two planes.

Key Concepts:

- Equation of the line of intersection.
- Finding direction ratios of the line of intersection.

Teaching Strategies:

- Step-by-step explanation of finding the canonical equation.
- Use examples to illustrate the process.

Activities:

- Solve problems involving finding the line of intersection of planes.

Assessment:

- Problem-solving tasks on determining the equation of the line of intersection.

Session 3: Angle Between Two Lines (1 hour)

Objectives:

- Understand how to calculate the angle between two lines in three-dimensional space.

Key Concepts:

- Formula for the angle between two lines.
- Geometric interpretation of the angle between lines.

Teaching Strategies:

- Derive the formula for the angle between lines.
- Use visual aids to explain the concept.

Activities:

- Practice problems on finding the angle between lines.

Assessment:

- Quiz on calculating the angle between lines.

Session 4: Distance of a Point from a Line (1 hour)

Objectives:

- Learn techniques for finding the distance of a point from a line in three-dimensional space.

Key Concepts:

- Formula for the distance of a point from a line.
- Geometric interpretation of the distance.

Teaching Strategies:

- Derive the formula for the distance of a point from a line.
- Illustrate with examples and graphical representations.

Activities:

- Work through problems on finding distances.

Assessment:

- Problem-solving tasks on calculating distances.

Session 5: Condition of Coplanarity of Two Lines (1 hour)

Objectives:

- Explore the condition for two lines to lie in the same plane.

Key Concepts:

- Criteria for coplanarity of lines.
- Relationship between direction ratios.

Teaching Strategies:

- Explain the conditions for coplanarity with examples.

Activities:

- Practice problems on determining coplanarity.

Assessment:

- Quiz on conditions for coplanarity.

Session 6: Equation of Skew Lines (1 hour)

Objectives:

- Understand the concept of skew lines and how to find their equations.

Key Concepts:

- Definition of skew lines.
- Derivation of the equation of skew lines.

Teaching Strategies:

- Explain the concept of skew lines with visual aids.
- Provide step-by-step procedures for finding the equation.

Activities:

- Solve problems involving skew lines.

Assessment:

- Problem-solving tasks on determining equations of skew lines.

Session 7: Shortest Distance between Two Skew Lines (1 hour)

Objectives:

- Learn how to calculate the shortest distance between two skew lines.

Key Concepts:

- Formula for the shortest distance between skew lines.
- Geometric interpretation of the shortest distance.

Teaching Strategies:

- Derive the formula for the shortest distance.
- Use examples to illustrate the concept.

Activities:

- Practice problems on finding the shortest distance.

Assessment:

- Quiz on calculating the shortest distance.

Session 8: Review and Practice (1 hour)

Objectives:

- Review key concepts covered in previous sessions.
- Provide additional practice opportunities.

Teaching Strategies:

- Review important definitions, theorems, and techniques.

- Provide practice problems covering various topics.

Activities:

- Group work on solving practice problems.

Assessment:

- Assessment through solving practice problems.

Session 9: Real-World Applications of Straight Lines in 3D (1 hour)

Objectives:

- Connect geometric concepts to real-world applications.

Key Concepts:

- Applications of 3D geometry in architecture, engineering, and computer graphics.
- Practical uses of straight lines in spatial design and modeling.

Teaching Strategies:

- Present case studies and examples from various fields.

Activities:

- Analyze and discuss the applications of straight lines in different scenarios.

Assessment:

- Group discussions and reflections on real-world applications.

Session 10: Further Applications and Extensions (1 hour)

Objectives:

- Explore additional applications and extensions of straight lines in 3D geometry.

Key Concepts:

- Advanced examples involving distance problems and line intersections.

Teaching Strategies:

- Work through challenging examples step by step.

Activities:

- Solve complex problems involving straight lines in 3D space.

Assessment:

- Problem-solving tasks on advanced line geometry problems.

Real-World Applications:

- Straight lines in three-dimensional space are essential in architecture for designing structures and determining spatial relationships.
- In engineering, understanding the geometry of lines is crucial for modeling mechanical components and analyzing forces in 3D space.
- Computer graphics and animation rely on 3D geometry for creating realistic virtual environments and visual effects.
- In robotics and navigation systems, knowledge of line geometry is used for path planning and obstacle avoidance.

Title: Geometry Exploration - Quadric Surfaces
Subtitle: Spheres, Cylindrical Surfaces, and Central Conicoids
Duration: 10 hours (divided into 60-minute sessions)
Teacher's Name: **GOUTAM BAIDYA (GB)**
Date: [Date of the Lesson]

Session 1: Introduction to Quadric Surfaces

Duration: 60 minutes

Objectives:

1. Understand the concept of quadric surfaces.
2. Identify and differentiate various quadric surfaces.

Key Concepts:

- Introduction to spheres, cylindrical surfaces, and central conicoids.
- Classification of quadrics based on their equations.
- Overview of the relevance of quadric surfaces in geometry.

Teaching Strategies:

- Begin with a brief review of basic geometric concepts.
- Present visually engaging materials and 3D models to introduce quadric surfaces.
- Discuss the key characteristics that define each type of quadric surface.

Activities:

- Group discussion on everyday objects that resemble quadric surfaces.
- Sketching exercises to visualize and identify quadric surfaces.

Assessment:

- Participation in group discussions.
- Individual sketches demonstrating understanding.

Session 2: Paraboloids and Plane Sections of Conicoids

Duration: 60 minutes

Objectives:

1. Explore paraboloids and understand their properties.
2. Study the plane sections of conicoids.

Key Concepts:

- Definition and properties of paraboloids.
- Understanding the plane sections of conicoids.

Teaching Strategies:

- Use interactive animations to illustrate the generation of paraboloids.
- Discuss real-world examples where paraboloids play a significant role.

Activities:

- Hands-on activity: Constructing paraboloids using materials.
- Analyzing and identifying plane sections of conicoids.

Assessment:

- Evaluation of constructed paraboloids.
- Quiz on plane sections of conicoids.

Session 3: Graphing Standard Quadric Surfaces

Duration: 60 minutes

Objectives:

1. Learn to graph standard quadric surfaces like cones and ellipsoids.
2. Understand the significance of graphing in visualizing mathematical concepts.

Key Concepts:

- Graphing techniques for standard quadric surfaces.
- Importance of visualization in mathematics.

Teaching Strategies:

- Utilize graphing software to demonstrate the process of graphing quadric surfaces.
- Relate graphing to real-world applications in architecture and engineering.

Activities:

- Guided practice sessions using graphing tools.
- Group discussion on the applications of graphing quadric surfaces.

Assessment:

- Evaluation of individual graphing exercises.
- Participation in the group discussion.

Session 4: Tangent and Normals of Conicoids

Duration: 60 minutes

Objectives:

1. Explore tangent lines and normals on conicoids.
2. Understand the geometric interpretation of tangents and normals.

Key Concepts:

- Definition and properties of tangent lines on conicoids.
- Geometric interpretation of normals on conicoids.

Teaching Strategies:

- Use visual aids and 3D models to explain tangent lines and normals.
- Provide real-world examples of tangent and normal applications.

Activities:

- Solving problems involving tangent lines and normals on conicoids.
- Discussing and analyzing real-world scenarios where tangent and normal concepts are applicable.

Assessment:

- Problem-solving exercises related to tangent and normals.
- Participation in class discussions.

Session 5: Real-World Applications and Review

Duration: 60 minutes

Objectives:

1. Apply geometric concepts learned to real-world scenarios.
2. Review and reinforce understanding of quadric surfaces.

Key Concepts:

- Application of quadric surfaces in real-world contexts.
- Review of key concepts covered in the previous sessions.

Teaching Strategies:

- Engage students in discussions about applications in fields such as physics, engineering, and computer graphics.
- Conduct a comprehensive review of all quadric surfaces covered.

Activities:

- Group presentations on real-world applications.
- Collaborative review session with practice problems.

Assessment:

- Evaluation of group presentations.
- Participation in the review session.

Conclusion:

This comprehensive 10-hour lesson plan aims to provide undergraduate students with a solid understanding of quadric surfaces, focusing on spheres, cylindrical surfaces, and central conicoids. The incorporation of real-world applications throughout the sessions ensures that students recognize the practical relevance of these mathematical concepts beyond the classroom. The lesson plan is designed to be engaging, interactive, and suitable for a 60-minute session, fostering a deeper understanding of geometry among students.

Unit-3 : Vector Analysis

Title: Exploring Vector Analysis in Mathematics
Subtitle: Triple Product, Vector Equations, and Vector Functions
Duration: 15 hours (divided into 60-minute sessions)
Teacher's Name: DR. PAYEL GHOSH (PG)
Date: [Date of the Lesson]

Session 1: Introduction to Vector Analysis

Duration: 60 minutes

Objectives:

1. Understand the basics of vectors and vector operations.
2. Introduce the concept of triple product.

Key Concepts:

- Definition of vectors and scalar multiplication.
- Addition and subtraction of vectors.
- Introduction to the dot product and cross product.
- Overview of the triple product.

Teaching Strategies:

- Visual aids and geometric representations of vectors.
- Interactive examples to illustrate vector operations.
- Relate vector operations to real-world scenarios.

Activities:

- Group discussion on everyday examples of vectors.
- Practice problems on vector addition and scalar multiplication.

Assessment:

- Participation in group discussions.
- Completion of practice problems.

Session 2: Vector Equations and Applications

Duration: 60 minutes

Objectives:

1. Learn to represent geometric figures and physical phenomena using vector equations.
2. Understand the application of vectors in mechanics and geometry.

Key Concepts:

- Representation of lines and planes using vector equations.
- Applications of vector equations in concurrent forces and systems of parallel forces.

Teaching Strategies:

- Examples of vector equations representing lines and planes.
- Problem-solving sessions focusing on mechanics and geometry applications.

Activities:

- Solving problems related to concurrent forces in a plane and systems of parallel forces.
- Analyzing real-world scenarios where vector equations are applicable.

Assessment:

- Evaluation of problem-solving skills.
- Participation in class discussions.

Session 3: Theory of Couples

Duration: 60 minutes

Objectives:

1. Understand the concept of couples and its application in mechanics.

Key Concepts:

- Definition and properties of couples.
- Effects of couples on rigid bodies.

Teaching Strategies:

- Visual representation of couples and their effects.
- Examples demonstrating the calculation of the moment of a couple.

Activities:

- Problem-solving exercises on determining the effects of couples.
- Analyzing real-world scenarios where couples are present.

Assessment:

- Evaluation of problem-solving skills related to couples.
- Participation in class discussions.

Session 4: Introduction to Vector Functions

Duration: 60 minutes

Objectives:

1. Introduce vector functions and their properties.

Key Concepts:

- Definition of vector-valued functions.
- Representation and graphing of vector functions.

- Limits and continuity of vector functions.

Teaching Strategies:

- Explanation of vector functions using graphs and diagrams.
- Examples illustrating the calculation of limits and continuity for vector functions.

Activities:

- Graphing vector-valued functions and analyzing their behavior.
- Practice problems on determining limits and continuity for vector functions.

Assessment:

- Assessment of understanding through graphing exercises.
- Evaluation of problem-solving skills related to limits and continuity.

Session 5: Operations with Vector Functions

Duration: 60 minutes

Objectives:

1. Learn operations with vector-valued functions.

Key Concepts:

- Addition, scalar multiplication, and dot product of vector functions.

Teaching Strategies:

- Step-by-step explanation of vector function operations.
- Examples demonstrating the calculation of operations with vector functions.

Activities:

- Practice problems on performing operations with vector functions.
- Analyzing the geometric interpretation of vector function operations.

Assessment:

- Evaluation of problem-solving skills in vector function operations.
- Assessment of understanding through application exercises.

Session 6: Differentiation of Vector Functions

Duration: 60 minutes

Objectives:

1. Learn to differentiate vector functions.

Key Concepts:

- Differentiation of vector functions with respect to a scalar variable.

Teaching Strategies:

- Explanation of the derivative of vector functions using geometric interpretations.
- Examples illustrating the calculation of derivatives for vector functions.

Activities:

- Practice problems on differentiating vector functions.
- Analyzing the geometric interpretation of vector function derivatives.

Assessment:

- Evaluation of problem-solving skills in differentiation of vector functions.
- Assessment of understanding through application exercises.

Session 7: Integration of Vector Functions

Duration: 60 minutes

Objectives:

1. Learn to integrate vector functions.

Key Concepts:

- Integration of vector functions over a specified interval.

Teaching Strategies:

- Explanation of the integral of vector functions using geometric interpretations.
- Examples illustrating the calculation of integrals for vector functions.

Activities:

- Practice problems on integrating vector functions.
- Analyzing the geometric interpretation of vector function integrals.

Assessment:

- Evaluation of problem-solving skills in integration of vector functions.
- Assessment of understanding through application exercises.

Session 8: Applications of Vector Analysis

Duration: 60 minutes

Objectives:

1. Apply vector analysis concepts to real-world scenarios.

Key Concepts:

- Real-world applications of vector analysis in mechanics, engineering, and physics.

Teaching Strategies:

- Group discussions on applications of vector analysis in various fields.
- Problem-solving sessions focusing on real-world scenarios.

Activities:

- Group presentations on real-world applications of vector analysis.
- Collaborative problem-solving exercises.

Assessment:

- Evaluation of group presentations.
- Assessment of problem-solving skills in real-world scenarios.

Session 9: Review and Reinforcement

Duration: 60 minutes

Objectives:

1. Review and reinforce understanding of vector analysis topics covered.

Key Concepts:

- Comprehensive review of vector analysis topics.

Teaching Strategies:

- Conduct a comprehensive review of all topics covered in the sessions.
- Practice problems and quizzes to reinforce understanding.

Activities:

- Collaborative review session with practice problems.
- Quiz on vector analysis topics covered.

Assessment:

- Assessment of understanding through quizzes and practice problems.
- Participation in the review session.

Session 10: Real-World Applications and Conclusion

Duration: 60 minutes

Objectives:

1. Apply vector analysis concepts to real-world scenarios.
2. Reflect on the importance of vector analysis in mathematics and beyond.

Key Concepts:

- Real-world applications of vector analysis.
- Importance of vector analysis in various fields.

Teaching Strategies:

- Group discussions on the significance of vector analysis.
- Reflection on personal learning experiences throughout the course.

Activities:

- Group presentations on additional real-world applications of vector analysis.
- Final reflections and discussion on the relevance of vector analysis.

Assessment:

- Evaluation of group presentations.
- Reflection on personal learning experiences.

Conclusion:

This 15-hour lesson plan aims to provide undergraduate students with a comprehensive understanding of vector analysis in mathematics. Through a structured approach covering topics such as triple product, vector equations, and vector functions, students will develop essential skills in solving

OR

Session	Topics Covered	Objectives	Activities	Duration
1-2	Triple Product and Vector Equations	- Introduce triple product and its applications. - Discuss vector equations and their	1. Define triple product and discuss its geometric interpretations. 2. Derive equations of lines and planes	2 hours

Session	Topics Covered	Objectives	Activities	Duration
		representations.	in vector form.	
3-4	Applications to Geometry and Mechanics	- Explore applications of vector calculus in geometry and mechanics. - Discuss concurrent forces, theory of couples, and systems of parallel forces.	1. Discuss concurrent forces in a plane and equilibrium conditions. 2. Introduce theory of couples and its applications. 3. Present examples of solving mechanics problems.	2 hours
5-6	Introduction to Vector Functions	- Introduce vector functions and their representations. - Discuss operations with vector-valued functions.	1. Define vector functions and operations. 2. Discuss geometric interpretations of vector functions.	2 hours
7-8	Limits and Continuity of Vector Functions	- Discuss limits and continuity of vector functions.	1. Define limits of vector functions. 2. Introduce continuity of vector functions.	2 hours
9-10	Differentiation and Integration of Vector Functions	- Explore differentiation and integration of vector functions of one variable.	1. Define differentiation and integration of vector functions. 2. Present methods for differentiation and integration.	2 hours
11-12	Practice Problems	- Reinforce understanding through practice problems.	1. Provide practice problems covering all topics. 2. Encourage students to work individually or in groups to solve problems.	2 hours
13-14	Review and Discussion	- Review key concepts covered in the lesson plan. - Facilitate open discussion and address any remaining questions or concerns.	1. Recap major topics and concepts. 2. Engage students in discussion about real-world applications.	2 hours
15	Assessment and Evaluation	- Assess student understanding through quizzes, tests, or assignments. - Provide feedback for improvement.	1. Administer quizzes or tests to assess comprehension. 2. Review and provide feedback on assignments.	1 hour

This table format provides a clear overview of the topics covered in each session, along with the corresponding objectives, activities, and duration of each session.

Algebra

Semester: 1 Credits :

5+1*=6

Core Course-2 Full Marks :

65+15**+20***=100

Paper Code(Theory): MTM-A-CC-1-2-TH

Paper Code (Tutorial):MTM-A-CC-1-2-TU

Unit-1:

Lesson Plan: Polar Representation of Complex Numbers, n-th Roots of Unity, De Moivre's Theorem, and its Applications, Exponential, Logarithmic, Trigonometric, and Hyperbolic Functions of Complex Variables, Theory of Equations, Inequality, and Linear Difference Equations with Constant Coefficients

Title	Comprehensive Classical Algebra
Subtitle	Complex Number, Theory of equations, Inequality, Linear difference equations with constant coefficients
Duration	30 hours (4 Weeks)
Teacher's Name	**UTTAM ROY MANDAL (URM)**
Date	[Date]

Objective:

- Understand and apply the concept of polar representation of complex numbers.
- Explore the properties and applications of n-th roots of unity.
- Learn and utilize De Moivre's theorem for rational indices.
- Understand and apply exponential, logarithmic, trigonometric, and hyperbolic functions of complex variables.
- Study the theory of equations, including the relation between roots and coefficients, transformation of equations, Descartes' rule of signs, Sturm's theorem, and the solution of cubic and biquadratic equations.
- Learn and apply the inequality involving the arithmetic mean, geometric mean, and harmonic mean.
- Understand and apply the Cauchy-Schwartz inequality.
- Explore linear difference equations with constant coefficients up to the 2nd order.

Duration: 30 hours

****Week 1: Polar Representation of Complex Numbers****

Day 1: Introduction to Complex Numbers

- Definition of complex numbers

- Cartesian and polar forms of complex numbers

- Converting between Cartesian and polar forms

Day 2: Polar Representation of Complex Numbers

- Review of polar coordinates
- Polar representation of complex numbers
- Plotting complex numbers on the complex plane

Day 3: N-th Roots of Unity
- Definition and properties of n-th roots of unity
- Geometric interpretation of roots on the complex plane
- Calculating n-th roots of unity

Day 4: De Moivre's Theorem
- Statement and proof of De Moivre's theorem for rational indices
- Applications of De Moivre's theorem in finding powers and roots of complex numbers

Day 5: Exponential, Logarithmic, Trigonometric, and Hyperbolic Functions of Complex Variables
- Extension of exponential, logarithmic, trigonometric, and hyperbolic functions to complex variables
- Properties and applications of these functions in complex analysis

Week 2: Theory of Equations

Day 6: Introduction to Theory of Equations
- Definition and types of equations
- Fundamental theorem of algebra
- Relation between roots and coefficients of equations

Day 7: Transformation of Equations
- Transformation techniques for solving equations
- Linear transformations
- Quadratic transformations

Day 8: Descartes' Rule of Signs
- Statement and application of Descartes' rule of signs
- Determining the number of positive and negative roots of polynomials

Day 9: Sturm's Theorem
- Introduction to Sturm's theorem

- Application of Sturm's theorem in counting real roots of polynomials

Day 10: Cubic and Biquadratic Equations
- Cardan's method for solving cubic equations
- Ferrari's method for solving biquadratic equations

Week 3: Inequalities

Day 11: Introduction to Inequalities
- Definition and types of inequalities
- Importance of inequalities in mathematics and real-life applications

Day 12: AM-GM-HM Inequality
- Statement and proof of AM-GM-HM inequality
- Applications in optimization and probability

Day 13: Cauchy-Schwarz Inequality
- Statement and proof of Cauchy-Schwarz inequality
- Applications in linear algebra, calculus, and probability

Day 14: Inequalities in Practice
- Problem-solving session applying various inequalities
- Real-world examples and challenges involving inequalities

Week 4: Linear Difference Equations

Day 15: Introduction to Difference Equations
- Definition and types of difference equations
- Applications of difference equations in modeling discrete systems

Day 16: Linear Difference Equations
- Definition and properties of linear difference equations
- Solution techniques for linear difference equations with constant coefficients

Day 17: Linear Difference Equations (continued)

- Solving linear difference equations with constant coefficients using generating functions
- Homogeneous and non-homogeneous linear difference equations

Day 18: Second-Order Linear Difference Equations
- Introduction to second-order linear difference equations
- Characteristic equation method for solving second-order linear difference equations

Day 19: Applications of Linear Difference Equations
- Real-life applications of linear difference equations
- Modeling and solving practical problems using difference equation techniques

**Week 5-6: Problem-solving session and examination **

*Day 20-30: - Problem-solving session and examination on Complex Number, Theory of Equation , Inequality and Linear difference equations with constant coefficients.

This lesson plan provides a structured approach to covering the specified mathematical topics over a 30-hour period, allowing for thorough understanding and application by graduate semester 1 students. Each day includes a mix of theoretical concepts, problem-solving sessions, and real-world applications to enhance comprehension and engagement.

Unit-2:

Title	Comprehensive Abstract Algebra
Subtitle	Relation, Mapping, Integers
Duration	30 hours (4 Weeks)
Teacher's Name	**UTTAM ROY MANDAL (URM)**
Date	[Date]

Week 1: Relations and Equivalence Relations

Learning Objectives:

Define equivalence relation and identify examples.

Understand equivalence classes and partitions.

Define partial order relation (poset) and identify examples.

Understand the concept of linear order relation.

Apply knowledge of relations to solve algebraic problems.

Materials Needed:

Whiteboard and markers

Printed handouts of example problems

Slides or visual aids (optional)

Week 1: Relations and Equivalence Relations

Day 1: Introduction to Relations

- Definition of a relation
- Types of relations: reflexive, symmetric, transitive
- Examples and applications of relations

Day 2: Equivalence Relations

- Definition of an equivalence relation
- Equivalence classes and partitions
- Examples illustrating equivalence relations and partitions

Day 3: Partial Order Relations

- Definition of a partial order relation
- Posets (partially ordered sets)
- Linear order relations and total orders

Day 4: Properties of Partial Orders
- Comparing and contrasting partial order relations with other types of relations
- Examples of partial order relations in mathematics and everyday life
- Hasse diagrams and their use in visualizing posets

Day 5: Review and Practice
- Review of concepts covered during the week
- Problem-solving session on relations and equivalence relations
- Real-world examples and applications

Week 2: Mapping and Set Theoretic Operations
Learning Objectives:
1. Define injective, surjective, and bijective mappings.
2. Understand one-to-one correspondence and invertible mappings.
3. Explore composition of mappings and its properties.
4. Investigate the relationship between composition of mappings and set-theoretic operations.
5. Define and analyze the meaning and properties of \(f^{-1}(B)\) for any mapping \(f: X \rightarrow Y\) and \(B \subseteq Y\).

Day 6: Introduction to Mapping
- Definition of a mapping (function)
- Types of mappings: injective, surjective, bijective
- Examples and properties of injective and surjective mappings

Day 7: One-to-One Correspondence
- Definition and significance of one-to-one correspondence
- Examples illustrating one-to-one correspondence
- Applications in combinatorics and set theory

Day 8: Invertible Mappings and Composition
- Definition of invertible mappings (bijective mappings)
- Composition of mappings
- Relation between composition of mappings and various set theoretic operations

Day 9: Inverse Mapping

- Meaning and properties of $f^{-1}(B)$ for any mapping $f : X \rightarrow Y$ and $B \subseteq Y$
- Examples and applications of inverse mappings

Day 10: Review and Practice

- Review of concepts covered during the week
- Problem-solving session on mappings and set theoretic operations
- Real-world examples and applications

Week 3: Principles of Mathematical Induction and Number Theory

Day 11: Well-Ordering Property and Mathematical Induction

- Well-ordering property of positive integers
- Principles of mathematical induction
- Applications of mathematical induction in proving statements

Day 12: Division Algorithm and Divisibility

- Division algorithm and its applications
- Properties of divisibility
- Euclidean algorithm for finding the greatest common divisor (GCD)

Day 13: Prime Numbers and Euclid's Theorem

- Definition and properties of prime numbers
- Euclid's theorem on the infinitude of primes
- Sieve of Eratosthenes for generating prime numbers

Day 14: Congruence Relations

- Definition of congruence relation between integers
- Properties of congruence modulo n
- Applications of congruence relations in number theory

Day 15: Review and Practice

- Review of concepts covered during the week
- Problem-solving session on principles of mathematical induction and number theory

- Real-world examples and applications

Week 4: Arithmetic Functions and Advanced Number Theory

Day 16: Fundamental Theorem of Arithmetic
- Statement and proof of the fundamental theorem of arithmetic
- Unique factorization of integers into prime factors

Day 17: Chinese Remainder Theorem
- Statement and proof of the Chinese remainder theorem
- Applications of the Chinese remainder theorem in number theory and cryptography

Day 18: Arithmetic Functions
- Definition and examples of arithmetic functions
- Properties of arithmetic functions such as Phi, Tau, and Sigma
- Applications of arithmetic functions in number theory

Day 19: Properties of Arithmetic Functions
- Further exploration of properties of arithmetic functions
- Relationships between different arithmetic functions
- Examples and applications illustrating the properties of arithmetic functions

Day 20: Review and Practice
- Review of concepts covered during the week
- Problem-solving session on arithmetic functions and advanced number theory
- Real-world examples and applications

**Week 5-6: Problem-solving session and examination **

Day 21-30: - Problem-solving session and examination on Complex Number, Theory of Equation , Inequality and Linear difference equations with constant coefficients

This comprehensive 30-hour day-to-day lesson plan covers a wide range of mathematical topics including relations, mappings, set theoretic operations, principles of mathematical induction, number theory, and advanced topics in number theory. Each day includes a mix of theoretical concepts, problem-solving sessions, and real-world applications to enhance comprehension and engagement.

Unit-3

****Lesson Plan: Matrix Operations and Systems of Linear Equations****

****Subject:** Mathematics**

**** Teacher's Name:** Dr. Payel Ghosh**

****Duration:** 15 hours (divided into multiple sessions)**
**** Date:****

Overview:
This lesson plan aims to cover key concepts related to matrix operations, including the rank of a matrix, the inverse of a matrix, and characterizations of invertible matrices. Additionally, it will address systems of linear equations, row reduction, echelon forms, vector equations, the matrix equation \\(AX = B\\), solution sets of linear systems, and applications of linear systems.

****Session 1: Introduction to Matrix Operations (2 hours)****

Objective:
- Introduce the basic concepts of matrices and their operations.

Activities:
1. Define matrices and their elements.
2. Discuss the properties of matrices, such as size, addition, and scalar multiplication.
3. Introduce matrix multiplication and discuss its properties.
4. Present examples illustrating matrix operations.
5. Practice problems solving involving basic matrix operations.

****Session 2: Rank of a Matrix (2 hours)****

Objective:
- Understand the concept of the rank of a matrix and its significance.

Activities:

1. Define the rank of a matrix and discuss its calculation methods.
2. Explain the relationship between the rank and the row and column spaces of a matrix.
3. Present examples of calculating the rank of matrices.
4. Discuss the applications of the rank of a matrix in various fields.
5. Practice problems solving related to the rank of matrices.

Session 3: Inverse of a Matrix (2 hours)

Objective:

- Introduce the concept of the inverse of a matrix and its properties.

Activities:

1. Define the inverse of a matrix and discuss its existence conditions.
2. Explain how to find the inverse of a matrix using various methods, such as the adjoint method and the elementary row operations method.
3. Discuss the properties of invertible matrices.
4. Present examples of finding the inverse of matrices.
5. Practice problems solving involving finding the inverse of matrices.

Session 4: Characterizations of Invertible Matrices (2 hours)

Objective:

- Explore different characterizations of invertible matrices.

Activities:

1. Discuss various criteria for determining whether a matrix is invertible.
2. Present theorems and properties related to invertible matrices.
3. Explain how to use these characterizations to identify invertible matrices.
4. Present examples illustrating the characterizations of invertible matrices.
5. Practice problems solving involving identifying invertible matrices using different criteria.

Session 5: Systems of Linear Equations (3 hours)

Objective:

- Introduce systems of linear equations and methods for solving them.

Activities:

1. Define systems of linear equations and discuss their forms.
2. Introduce the concept of solution sets of linear systems.
3. Discuss methods for solving systems of linear equations, such as row reduction and Gaussian elimination.
4. Present examples of solving systems of linear equations using these methods.
5. Practice problems solving involving solving systems of linear equations.

Session 6: Applications of Linear Systems (4 hours)

Objective:
- Explore real-world applications of linear systems.

Activities:
1. Discuss applications of linear systems in various fields, such as engineering, economics, and physics.
2. Present examples of modeling real-world problems using linear systems.
3. Discuss techniques for solving application problems involving linear systems.
4. Present case studies or real-life examples illustrating the applications of linear systems.
5. Practice problems solving involving solving application problems using linear systems.

Conclusion:
By the end of these sessions, students should have a solid understanding of matrix operations, the rank of a matrix, the inverse of a matrix, characterizations of invertible matrices, systems of linear equations, and their applications.
Materials Needed:
- Whiteboard and markers
- Printed handouts of examples and practice problems
- Calculators (if necessary)
- Projector for presenting slides or visual aids (optional)

Three-year B.Sc. in Mathematics

(Honours) *under* CBCS System

Theory of Real Functions

Semester : 3

Credits : 5+1*=6

Core Course-5 Full Marks :

65+15**+20***=100

Paper Code(Theory): MTM-A-CC-3-5-TH

Paper Code (Tutorial):MTM-A-CC-3-5-TU

Unit-1 : Limit & Continuity of functions

Lesson Plan: Theory of Real Functions - Unit 1.1: Limits of Functions

Title	Limit & Continuity of functions
Subtitle	**Limits of Functions**
Duration	5 hours (5 Class x 1 hour each)
Teacher's Name	**Swadhin Banerjee (SB)**
Date	[Date]

Objective: By the end of this 5-hour lesson plan, students should be able to:

1. Understand the concept of limits of functions using the sigma-delta approach and the sequential criterion.
2. Apply algebraic properties of limits for functions.
3. Analyze the effect of limits on inequalities involving functions and understand one-sided limits.
4. Identify and compute infinite limits and limits at infinity.
5. Evaluate important limits such as sin(x)/x, log(1+x)/x, and (ax-1)/x (a > 0) as x approaches 0.

Materials:

1. Textbook: "Introduction to Real Analysis" by Bartle and Sherbert.
2. Handouts on limits of functions, algebraic properties, one-sided limits, and important limit expressions.
3. Whiteboard and markers.
4. Calculators (optional).
5. Worksheets and problem sets.

Introduction: Begin with a real-world scenario where limits play a crucial role, such as analyzing the behavior of a function representing the growth of a population or the temperature variation over time. Introduce the concept of limits using intuitive examples and motivate the need for a rigorous approach to understanding them.

Procedure:

Class 1: Limits of Functions (Sigma-Delta Approach) (1 hour)

- Define the concept of limits of functions using the sigma-delta approach.
- Introduce the epsilon-delta definition of a limit.
- Discuss how to prove the existence of a limit using the epsilon-delta definition.

Class 2: Sequential Criterion for Limits (1 hour)

- Introduce the sequential criterion for limits.
- Discuss the concept of convergent sequences and their relationship to limits of functions.
- Compare and contrast the sequential criterion with the epsilon-delta definition.

Class 3: Algebra of Limits for Functions (1 hour)

- Present the algebraic properties of limits for functions, such as the sum, difference, product, and quotient rules.
- Discuss the composition rule for limits.
- Provide examples illustrating the application of algebraic properties to compute limits.

Class 4: One-Sided Limits and Inequalities (1 hour)

- Define one-sided limits and discuss their significance.
- Analyze the effect of limits on inequalities involving functions.
- Provide examples demonstrating the use of one-sided limits to analyze the behavior of functions near a point.

Class 5: Infinite Limits and Limits at Infinity (1 hour)

- Define infinite limits and limits at infinity.
- Discuss how to determine the behavior of a function as x approaches infinity or negative infinity.
- Present examples of evaluating infinite limits and limits at infinity.

Assessment: (1 hour)

- Quiz on concepts covered in the lesson plan, including definitions, properties, and computations of limits.
- Homework assignments on problem-solving related to limits of functions.
- Discussions and problem-solving sessions in class to gauge understanding.

Conclusion: Summarize key points covered in the lesson plan, emphasizing the importance of understanding limits in analyzing the behavior of functions. Review the main objectives and encourage students to practice applying the concepts learned. Provide additional resources for further study if needed.

Lesson Plan: Theory of Real Functions - Unit 1.2 Continuity

Title	***Limit & Continuity of functions***
Subtitle	**Continuity**
Duration	10 hours (10Class x 1 hour each)
Teacher's Name	**Swadhin Banerjee (SB)**
Date	[Date]

Class 1:

1. **Objective:** Introduce students to the concept of continuity of a function on an interval and at an isolated point.
2. **Materials:** Textbook: "Principles of Mathematical Analysis" by Walter Rudin, handouts on continuity of functions.
3. **Introduction:** Engage students with a real-life scenario involving continuous functions, such as the temperature variation over time. Discuss the importance of continuity in various mathematical applications.
4. **Procedure:**
   - Define continuity of a function on an interval and at an isolated point.
   - Present sequential criteria for continuity.
   - Discuss the concept of oscillation of a function at a point.
   - State the theorem: A function is continuous at x if and only if its oscillation at x is zero.
   - Familiarize students with the figures of well-known functions: y=*xa* (*a*=2, 33, 1/21/2, 22, −1−1),|*x*|, sin*x*,cos*x*, tan*x*, log*x*, *ex*.
5. **Assessment:**
   - Quiz on the definitions and concepts discussed.
   - Homework assignment on solving problems related to continuity.
6. **Conclusion:** Summarize key points covered in the class, emphasizing the importance of understanding continuity in real functions and its applications in various mathematical contexts.

Class 2:

1. **Objective:** Understand the algebra of continuous functions and continuity of composite functions.
2. **Materials:** Textbook, handouts on algebra of continuous functions and composite functions.
3. **Introduction:** Recall the concepts learned in the previous class and introduce the concept of algebra of continuous functions.
4. **Procedure:**
   - Discuss the algebra of limits and its consequences on continuous functions.
   - Present examples of continuous functions and discuss their properties.
   - Introduce the concept of continuity of composite functions.
   - Provide examples and illustrations of composite functions.
5. **Assessment:**
   - Class discussion on the properties of continuous functions.
   - Homework assignment on solving problems related to composite functions and continuity.
6. **Conclusion:** Summarize key points covered in the class, emphasizing the importance of understanding the algebraic properties of continuous functions and composite functions.

Class 3-10:

1. **Objective:** Explore examples and applications of continuity of functions.
2. **Materials:** Textbook, handouts on examples of continuous functions and their applications.
3. **Introduction:** Review the concepts learned in the previous classes and introduce examples of continuous functions.
4. **Procedure:**
   - Present examples of continuous functions in various contexts, such as physics, engineering, and economics.
   - Discuss the implications of continuity in real-world scenarios.
   - Explore the concept that continuity of a function at a point does not necessarily imply continuity in some neighborhood of that point.
5. **Assessment:**
   - Class discussions on the examples presented and their applications.
   - Homework assignments on solving problems related to real-world scenarios involving continuous functions.
6. **Conclusion:** Summarize key points covered in the class, emphasizing the wide-ranging applications of continuity in various fields and encouraging further exploration of the topic.

Lesson Plan: Theory of Real Functions –Unit 1.3 Boundedness and Intermediate Value Theorem

Title	*Limit & Continuity of functions*
Subtitle	**Boundedness and Intermediate Value Theorem**
Duration	5 hours (5 Class x 1 hour each)
Teacher's Name	**Swadhin Banerjee (SB)**
Date	[Date]

Objective: By the end of this 5-hour lesson plan, students should be able to:

1. Understand the concept of bounded functions and the neighborhood properties of continuous functions regarding boundedness and maintenance of the same sign.
2. Recognize that a continuous function on a closed interval $[a,b]$ is bounded and attains its bounds.
3. Understand and apply the Intermediate Value Theorem.

Materials:

1. Textbook: "Principles of Mathematical Analysis" by Walter Rudin.
2. Handouts on bounded functions, neighborhood properties, and the Intermediate Value Theorem.
3. Whiteboard and markers.
4. Calculators for computations if necessary.

Introduction: Engage students with a real-life scenario involving continuous functions, such as the height of a roller coaster or the temperature over a period of time. Discuss the importance of understanding boundedness and the Intermediate Value Theorem in various mathematical contexts.

Procedure:

Class 1:

1. **Objective:** Introduce the concept of bounded functions and neighborhood properties.
2. **Procedure:**
    - Define bounded functions and discuss their properties.
    - Introduce the neighborhood properties of continuous functions regarding boundedness and maintenance of the same sign.
    - Provide examples and illustrations to clarify the concepts.
3. **Assessment:**
    - Class discussion on the definitions and properties of bounded functions.
    - Homework assignment on solving problems related to neighborhood properties.

Class 2:

1. **Objective:** Understand that a continuous function on $[a,b]$ is bounded and attains its bounds.
2. **Procedure:**
    - Discuss the theorem stating that a continuous function on $[a,b]$ is bounded and attains its bounds.
    - Provide proofs or intuitive explanations for the theorem.
    - Present examples and illustrations to clarify the theorem.
3. **Assessment:**
    - Quiz on the theorem and its proof.
    - Homework assignment on solving problems related to continuous functions on $[a,b]$.

Class 3-5:

1. **Objective:** Introduce and apply the Intermediate Value Theorem.
2. **Procedure:**
    - State the Intermediate Value Theorem and discuss its significance.
    - Provide examples and illustrations to clarify the theorem.
    - Discuss the applications of the Intermediate Value Theorem in various contexts, such as finding roots of equations and proving existence results.

3. **Assessment:**
    - Class discussions on the examples presented and their applications.
    - Homework assignment on solving problems related to the Intermediate Value Theorem.

Conclusion: Summarize key points covered in the classes, emphasizing the importance of understanding boundedness and the Intermediate Value Theorem in real functions and their applications. Encourage further exploration of the topics through additional resources and practice problems.

Lesson Plan: Theory of Real Functions – Unit: 1.4 Discontinuity and Monotone Functions

Title	*Limit & Continuity of functions*
Subtitle	**Discontinuity and Monotone Functions**
Duration	10 hours (10Class x 1 hour each)
Teacher's Name	**Swadhin Banerjee (SB)**
Date	[Date]

Objective: By the end of this 10-hour lesson plan, students should be able to:

1. Understand the concept of discontinuity of functions and identify different types of discontinuity.
2. Define and analyze step functions and piecewise continuity.
3. Understand the properties of monotone functions, including the relationship between monotonicity and discontinuity.
4. Understand the implications of monotone bijective functions on continuity.

Materials:

1. Textbook: "Principles of Mathematical Analysis" by Walter Rudin.
2. Handouts on discontinuity, step functions, piecewise continuity, and monotone functions.
3. Whiteboard and markers.
4. Examples of step functions and piecewise continuous functions.
5. Calculators for computations if necessary.

Introduction: Start with a simple real-life scenario involving discontinuous functions, such as a light switch turning on and off abruptly. Discuss the importance of understanding different types of discontinuities and the behavior of monotone functions.

Procedure:

Class 1-2: Discontinuity of Functions

1. **Objective:** Introduce the concept of discontinuity and its types.
2. **Procedure:**
   - Define discontinuity and discuss the different types: jump discontinuity, infinite discontinuity, and removable discontinuity.
   - Provide examples and illustrations of each type of discontinuity.
   - Discuss the behavior of functions at points of discontinuity.
3. **Assessment:**
   - Class discussion on the definitions and properties of discontinuity.
   - Homework assignment on identifying types of discontinuities in functions.

Class 3-4: Step Functions and Piecewise Continuity

1. **Objective:** Define step functions and analyze piecewise continuity.
2. **Procedure:**
   - Define step functions and discuss their properties.
   - Introduce piecewise continuity and discuss its significance.
   - Provide examples and illustrations of step functions and piecewise continuous functions.
3. **Assessment:**
   - Class discussions on the properties of step functions and piecewise continuity.
   - Homework assignment on constructing step functions and analyzing piecewise continuous functions.

Class 5-7: Monotone Functions

1. **Objective:** Understand the properties of monotone functions and their relationship with discontinuity.
2. **Procedure:**
   - Define monotone functions and discuss their properties.
   - Discuss the relationship between monotonicity and discontinuity.
   - Present the theorem stating that monotone functions can have at most countably many points of discontinuity.
3. **Assessment:**
   - Class discussions on the properties of monotone functions and their implications on discontinuity.
   - Homework assignment on proving properties of monotone functions.

Class 8-10: Monotone Bijective Functions

1. **Objective:** Understand the implications of monotone bijective functions on continuity.
2. **Procedure:**
   - Define monotone bijective functions and discuss their properties.
   - Present the theorem stating that a monotone bijective function from an interval to an interval is continuous and its inverse is also continuous.
   - Provide examples and illustrations to clarify the theorem.
3. **Assessment:**
   - Quiz on the properties of monotone bijective functions and their implications on continuity.
   - Homework assignment on proving properties of monotone bijective functions.

Conclusion: Summarize key points covered in the classes, emphasizing the importance of understanding discontinuity and the behavior of monotone functions in real functions. Encourage further exploration of the topics through additional resources and practice problems.

Lesson Plan: Theory of Real Functions –Unit:1.5 Uniform Continuity

Title	*Limit & Continuity of functions*
Subtitle	**Uniform Continuity**
Duration	10 hours (10Class x 1 hour each)
Teacher's Name	**Swadhin Banerjee (SB)**
Date	[Date]

Objective: By the end of this 10-hour lesson plan, students should be able to:

1. Understand the concept of uniform continuity and its application to functions continuous on closed and bounded intervals.
2. Identify necessary and sufficient conditions for a function to be uniformly continuous on a bounded open interval.
3. Recognize sufficient conditions for a function to be uniformly continuous on an unbounded open interval.
4. Understand the Lipschitz condition and its relationship to uniform continuity.

Materials:

1. Textbook: "Principles of Mathematical Analysis" by Walter Rudin.
2. Handouts on uniform continuity, Lipschitz condition, and examples.
3. Whiteboard and markers.
4. Calculators for computations if necessary.

Introduction: Start with a real-life scenario involving functions that vary smoothly and continuously over a given interval, such as the temperature variation throughout a day. Emphasize the importance of understanding uniform continuity in analyzing such functions.

Procedure:

Class 1-2:

1. **Objective:** Introduce the concept of uniform continuity.
2. **Procedure:**
    - Define uniform continuity and discuss its significance.
    - Present examples of functions that are uniformly continuous and those that are not.
    - Discuss the difference between uniform continuity and continuity.
3. **Assessment:**
    - Class discussion on the definitions and properties of uniform continuity.
    - Homework assignment on identifying uniformly continuous functions.

Class 3-4:

1. **Objective:** Understand the application of uniform continuity to functions continuous on closed and bounded intervals.

2. **Procedure:**
    - Present the theorem stating that a function continuous on a closed and bounded interval is uniformly continuous on that interval.
    - Provide proofs or intuitive explanations for the theorem.
    - Discuss examples and applications.
3. **Assessment:**
    - Quiz on the theorem and its proof.
    - Homework assignment on solving problems related to functions continuous on closed and bounded intervals.

Class 5-6:

1. **Objective:** Identify necessary and sufficient conditions for uniform continuity on bounded open intervals.
2. **Procedure:**
    - Introduce the necessary and sufficient condition for a function to be uniformly continuous on a bounded open interval.
    - Provide proofs or intuitive explanations for the condition.
    - Discuss examples and applications.
3. **Assessment:**
    - Class discussion on the necessary and sufficient condition for uniform continuity.
    - Homework assignment on applying the condition to various functions.

Class 7-8:

1. **Objective:** Recognize sufficient conditions for uniform continuity on unbounded open intervals.
2. **Procedure:**
    - Introduce a sufficient condition for a function to be uniformly continuous on an unbounded open interval (statement only).
    - Discuss examples and applications.
3. **Assessment:**
    - Class discussion on the sufficient condition for uniform continuity.
    - Homework assignment on analyzing functions for uniform continuity on unbounded open intervals.

Class 9-10:

1. **Objective:** Understand the Lipschitz condition and its relationship to uniform continuity.
2. **Procedure:**
    - Introduce the Lipschitz condition and discuss its significance.
    - Discuss the relationship between the Lipschitz condition and uniform continuity.
    - Provide examples and applications.
3. **Assessment:**
    - Class discussion on the Lipschitz condition and its implications.
    - Homework assignment on solving problems related to functions satisfying the Lipschitz condition.

Conclusion: Summarize key points covered in the classes, emphasizing the importance of understanding uniform continuity and its various applications in analyzing functions. Encourage further exploration of the topics through additional resources and practice problems.

Unit-2 : Differentiability of functions

Lesson Plan: Unit-2.1: Differentiability of Functions

Title	**Differentiability of Functions**
Subtitle	**Differentiability of Functions**
Duration	5 hours (5 Class x 1 hour each)
Teacher's Name	**Dr, Payel Ghosh (PG)**
Date	[Date]

Objective: By the end of this 5-hour lesson plan, students should be able to:

1. Understand the concept of differentiability of a function at a point and in an interval.
2. Apply the algebra of differentiable functions.
3. Interpret the meaning of the sign of the derivative.
4. Apply the chain rule to find derivatives.

Materials:

1. Textbook: "Calculus" by James Stewart.
2. Handouts on differentiability, algebra of differentiable functions, and the chain rule.
3. Whiteboard and markers.
4. Calculators for computations if necessary.

Introduction: Engage students with a real-life scenario involving rates of change, such as the speed of a moving object or the growth of a population. Discuss the importance of understanding differentiability in various mathematical contexts.

Procedure:

Class 1:

1. **Objective:** Introduce the concept of differentiability of a function at a point and in an interval.
2. **Procedure:**
   - Define differentiability and discuss its conditions.
   - Present examples of differentiable and non-differentiable functions.
   - Discuss the relationship between continuity and differentiability.
3. **Assessment:**
   - Class discussion on the definitions and properties of differentiability.
   - Homework assignment on solving problems related to differentiability.

Class 2:

1. **Objective:** Understand the algebra of differentiable functions.
2. **Procedure:**
   - Discuss the properties of differentiable functions under addition, subtraction, multiplication, and division.
   - Present examples illustrating the algebra of differentiable functions.
   - Discuss the composition of differentiable functions.

3. **Assessment:**
   - Quiz on the properties of differentiable functions.
   - Homework assignment on solving problems related to the algebra of differentiable functions.

Class 3:

1. **Objective:** Interpret the meaning of the sign of the derivative.
2. **Procedure:**
   - Define the sign of the derivative and its interpretation in terms of increasing and decreasing functions.
   - Present examples illustrating the interpretation of the sign of the derivative.
   - Discuss the behavior of a function based on the sign of its derivative.
3. **Assessment:**
   - Class discussions on interpreting the sign of the derivative.
   - Homework assignment on analyzing functions based on the sign of their derivatives.

Class 4-5:

1. **Objective:** Apply the chain rule to find derivatives.
2. **Procedure:**
   - Introduce the chain rule and its application in finding derivatives.
   - Present examples and illustrations demonstrating the use of the chain rule.
   - Discuss the chain rule for composite functions.
3. **Assessment:**
   - Class discussions on applying the chain rule.
   - Homework assignment on solving problems related to the chain rule.

Conclusion: Summarize key points covered in the classes, emphasizing the importance of understanding differentiability and its applications in calculus. Encourage further exploration of the topics through additional resources and practice problems.

Lesson Plan: Unit-2.2: Differentiability of Functions - Theorems and Applications

Title	**Differentiability of Functions**
Subtitle	**Differentiability of Functions- Theorems and Applications**
Duration	15 hours (15 Class x 1 hour each)
Teacher's Name	**Dr, Payel Ghosh (PG)**
Date	[Date]

Objective: By the end of this 15-hour lesson plan, students should be able to:

1. Understand and apply Darboux's theorem, Rolle's theorem, and the mean value theorems of Lagrange and Cauchy.
2. Understand Taylor's theorem and its applications, including the expansion of various functions.
3. Apply Taylor's theorem to inequalities.

Materials:

1. Textbook: "Advanced Calculus" by Patrick M. Fitzpatrick.
2. Handouts on Darboux's theorem, Rolle's theorem, mean value theorems, Taylor's theorem, and function expansions.
3. Whiteboard and markers.
4. Calculators for computations if necessary.

Introduction: Engage students with a real-life scenario involving the application of calculus theorems, such as finding the velocity of an object given its position function. Discuss the importance of these theorems in understanding the behavior of functions and their applications in various mathematical contexts.

Procedure:

Class 1-2: Darboux's Theorem and Rolle's Theorem (4 hours)

1. **Objective:** Introduce Darboux's theorem and Rolle's theorem.
2. **Procedure:**
   - Define Darboux's theorem and Rolle's theorem.
   - Present proofs or intuitive explanations for these theorems.
   - Provide examples and illustrations to clarify the theorems.
3. **Assessment:**
   - Class discussions on the proofs and applications of the theorems.
   - Homework assignment on solving problems related to Darboux's theorem and Rolle's theorem.

Class 3-4: Mean Value Theorems (4 hours)

1. **Objective:** Understand and apply the mean value theorems of Lagrange and Cauchy.
2. **Procedure:**
   - Define the mean value theorems of Lagrange and Cauchy.
   - Present proofs or intuitive explanations for these theorems.
   - Discuss applications of the mean value theorems, including as an application of Rolle's theorem.
3. **Assessment:**
   - Quiz on the mean value theorems and their applications.
   - Homework assignment on solving problems related to the mean value theorems.

Class 5-7: Taylor's Theorem and Function Expansions (6 hours)

1. **Objective:** Understand Taylor's theorem and its applications, including function expansions.
2. **Procedure:**
   - Define Taylor's theorem and discuss its statement.
   - Present proofs or intuitive explanations for Taylor's theorem.
   - Discuss the expansion of various functions using Taylor's theorem, including e^x, $\log(1+x)$, $(1+x)^m$, $\sin x$, and $\cos x$.
   - Discuss the range of validity of these expansions.
3. **Assessment:**
   - Class discussions on the applications and limitations of Taylor's theorem.
   - Homework assignment on solving problems related to function expansions.

Class 8-10: Application of Taylor's Theorem to Inequalities (3 hours)

1. **Objective:** Apply Taylor's theorem to inequalities.
2. **Procedure:**

- Introduce the application of Taylor's theorem to inequalities.
- Present examples and applications of this concept.

3. **Assessment:**
    - Class discussions on the examples presented and their applications.
    - Homework assignment on solving problems related to Taylor's theorem and inequalities.

Conclusion: Summarize key points covered in the classes, emphasizing the importance of understanding these theorems and their applications in calculus. Encourage further exploration of the topics through additional resources and practice problems.

Lesson Plan: Unit -2.3: Differentiability of Functions - L'Hospital's Rule and Extremum

Title	**Differentiability of Functions**
Subtitle	**L'Hospital's Rule and Extremum**
Duration	15 hours (15 Class x 1 hour each)
Teacher's Name	**Dr, Payel Ghosh (PG)**
Date	[Date]

Objective: By the end of this 15-hour lesson plan, students should be able to:

1. Understand L'Hospital's rule and its consequences.
2. Identify and analyze points of local extremum (maximum, minimum) of a function in an interval.
3. Apply the principle of maximum/minimum to solve geometrical problems.
4. Determine local extrema using the first-order derivative.
5. State sufficient conditions for the existence of local maximum/minimum of a function at a point.

Materials:

1. Textbook: "Calculus" by James Stewart.
2. Handouts on L'Hospital's rule, local extremum, and geometrical problems involving extrema.
3. Whiteboard and markers.
4. Calculators for computations if necessary.

Introduction: Engage students with a real-life scenario involving optimization problems, such as finding the maximum profit or minimum cost. Discuss the importance of understanding L'Hospital's rule and extremum in various mathematical contexts.

Procedure:

Class 1-3:

1. **Objective:** Introduce L'Hospital's rule and its consequences.
2. **Procedure:**
    - Define L'Hospital's rule and discuss its applications in evaluating limits involving indeterminate forms.
    - Present examples and guide students through the process of applying L'Hospital's rule.
    - Discuss the consequences of L'Hospital's rule for functions approaching infinity or zero.

3. **Assessment:**
    - Quizzes on applying L'Hospital's rule to evaluate limits.
    - Homework assignments on solving problems involving indeterminate forms.

Class 4-6:

1. **Objective:** Understand points of local extremum and their determination using the first-order derivative.
2. **Procedure:**
    - Define local extremum (maximum, minimum) of a function in an interval.
    - State the sufficient condition for the existence of a local maximum/minimum of a function at a point.
    - Discuss the process of determining local extrema using the first-order derivative.
    - Present examples and guide students through the process of identifying local extrema.
3. **Assessment:**
    - Class discussions on the sufficient conditions for local extremum and their applications.
    - Homework assignments on identifying local extrema using the first-order derivative.

Class 7-9:

1. **Objective:** Apply the principle of maximum/minimum to solve geometrical problems.
2. **Procedure:**
    - Introduce geometrical problems involving optimization, such as finding the maximum area enclosed by a fence or the minimum surface area of a container.
    - Discuss how the principle of maximum/minimum can be applied to solve these problems.
    - Present examples and guide students through the process of solving geometrical problems involving extrema.
3. **Assessment:**
    - Quizzes on solving geometrical problems involving extrema.
    - Homework assignments on solving additional geometrical problems.

Class 10-15:

1. **Objective:** Review and practice applying L'Hospital's rule, identifying local extrema, and solving geometrical problems involving extrema.
2. **Procedure:**
    - Review key concepts covered in the previous classes.
    - Provide additional examples and practice problems for students to solve individually or in groups.
    - Conduct discussions and answer any questions or concerns raised by the students.
    - Review homework assignments and provide feedback.
3. **Assessment:**
    - Class discussions on solving practice problems.
    - Homework assignments on reviewing and practicing key concepts.
    - Final assessment or quiz covering L'Hospital's rule, local extremum, and application to geometrical problems.

Conclusion: Summarize key points covered in the classes, emphasizing the importance of understanding L'Hospital's rule and extremum in real functions and their applications. Encourage further exploration of the topics through additional resources and practice problems

Ring Theory & Linear Algebra-I

Semester : 3

Credits : 5+1*=6

Core Course-6 Full Marks :

65+15**+20***=100

Paper Code(Theory): MTM-A-CC-3-6-TH

Paper Code (Tutorial):MTM-A-CC-3-6-TU

Unit-1: Ring theory

Title: Exploring Ring Theory in Mathematics
Subtitle: Definition, Properties, and Applications of Rings
Duration: 15 hours (divided into 60-minute sessions)
Teacher's Name: Debabrata Jana (DJ)
Date: [Date of the Lesson]

Session 1: Introduction to Rings

Duration: 60 minutes

Objectives:

1. Understand the definition and basic properties of rings.
2. Explore examples of rings and non-rings.

Key Concepts:

- Definition of rings and their elements.
- Properties of addition and multiplication in rings.
- Examples and non-examples of rings.

Teaching Strategies:

- Interactive lecture with visual aids to introduce the concept of rings.
- Examples illustrating addition and multiplication properties in rings.
- Encourage class participation in identifying examples and non-examples of rings.

Activities:

- Group discussion on everyday examples of rings and non-rings.
- Practice problems to reinforce understanding of ring properties.

Assessment:

- Participation in group discussions.
- Completion of practice problems.

Session 2: Subrings and Integral Domains

Duration: 60 minutes

Objectives:

1. Learn about subrings and integral domains.
2. Understand the necessary and sufficient conditions for subsets to be subrings.

Key Concepts:

- Definition of subrings and integral domains.
- Necessary and sufficient conditions for subsets to be subrings.

Teaching Strategies:

- Explanation of subrings and integral domains using examples.
- Derivation of conditions for subsets to be subrings.
- Relate integral domains to real-world applications in algebraic structures.

Activities:

- Problem-solving exercises on identifying subrings and integral domains.
- Analyzing real-world scenarios where integral domains are applicable.

Assessment:

- Evaluation of problem-solving skills.
- Participation in class discussions.

Session 3: Fields and Subfields

Duration: 60 minutes

Objectives:

1. Introduce fields and subfields.
2. Understand the necessary and sufficient conditions for subsets to be subfields.

Key Concepts:

- Definition of fields and subfields.
- Necessary and sufficient conditions for subsets to be subfields.

Teaching Strategies:

- Explanation of fields and subfields using examples.
- Derivation of conditions for subsets to be subfields.
- Relate fields to real-world applications in algebraic structures.

Activities:

- Problem-solving exercises on identifying subfields.
- Analyzing real-world scenarios where fields are applicable.

Assessment:

- Evaluation of problem-solving skills.
- Participation in class discussions.

Session 4: Characteristics of Rings

Duration: 60 minutes

Objectives:

1. Learn about the characteristic of a ring.
2. Understand its significance in ring theory.

Key Concepts:

- Definition of the characteristic of a ring.
- Significance of characteristic in ring theory.

Teaching Strategies:

- Explanation of characteristic using examples.
- Discuss the role of characteristic in determining properties of rings.
- Relate characteristic to real-world applications in abstract algebra.

Activities:

- Problem-solving exercises on determining the characteristic of a ring.
- Analyzing real-world scenarios where characteristic is relevant.

Assessment:

- Evaluation of problem-solving skills.
- Participation in class discussions.

Session 5: Ideals and Factor Rings

Duration: 60 minutes

Objectives:

1. Introduce the concept of ideals in ring theory.
2. Learn about factor rings and their properties.

Key Concepts:

- Definition of ideals and factor rings.
- Operations on ideals.
- Properties of factor rings.

Teaching Strategies:

- Explanation of ideals and factor rings using examples.
- Demonstration of operations on ideals.
- Relate ideals and factor rings to real-world applications in algebraic structures.

Activities:

- Problem-solving exercises on identifying and manipulating ideals.
- Analyzing real-world scenarios where ideals and factor rings are applicable.

Assessment:

- Evaluation of problem-solving skills.
- Participation in class discussions.

Session 6: Prime and Maximal Ideals

Duration: 60 minutes

Objectives:

1. Understand the concepts of prime and maximal ideals.
2. Explore their properties and significance in ring theory.

Key Concepts:

- Definition of prime and maximal ideals.
- Properties and significance of prime and maximal ideals.

Teaching Strategies:

- Explanation of prime and maximal ideals using examples.
- Discussion on the properties and importance of prime and maximal ideals.
- Relate prime and maximal ideals to real-world applications in abstract algebra.

Activities:

- Problem-solving exercises on identifying prime and maximal ideals.
- Analyzing real-world scenarios where prime and maximal ideals are applicable.

Assessment:

- Evaluation of problem-solving skills.
- Participation in class discussions.

Session 7: Applications of Ring Theory

Duration: 60 minutes

Objectives:

1. Apply ring theory concepts to real-world scenarios.
2. Explore applications in cryptography, coding theory, and algebraic geometry.

Key Concepts:

- Real-world applications of ring theory.
- Importance of ring theory in cryptography, coding theory, and algebraic geometry.

Teaching Strategies:

- Group discussions on applications of ring theory.
- Presentation of case studies and examples in cryptography and coding theory.

Activities:

- Group presentations on real-world applications of ring theory.
- Problem-solving exercises related to applications in cryptography and coding theory.

Assessment:

- Evaluation of group presentations.
- Problem-solving assessments related to real-world applications.

Session 8: Operations on Rings and Review

Duration: 60 minutes

Objectives:

1. Review operations on rings and key concepts covered.
2. Reinforce understanding through problem-solving.

Key Concepts:

- Operations on rings: addition, multiplication, and other operations.
- Review of key concepts in ring theory.

Teaching Strategies:

- Review of operations on rings through examples.
- Problem-solving session covering various aspects of ring theory.

Activities:

- Collaborative problem-solving exercises.
- Review quizzes to reinforce understanding.

Assessment:

- Evaluation of problem-solving skills.
- Performance in review quizzes.

Session 9: Real-World Applications Continued

Duration: 60 minutes

Objectives:

1. Continue exploring real-world applications of ring theory.
2. Deepen understanding through case studies and examples.

Key Concepts:

- Further exploration of applications in cryptography, coding theory, and algebraic geometry.

Teaching Strategies:

- Presentation of advanced case studies and examples.
- Group discussions on complex applications of ring theory.

Activities:

- Analyzing advanced case studies in cryptography and coding theory.
- Problem-solving exercises related to algebraic geometry.

Assessment:

- Evaluation of participation in group discussions.
- Performance in problem-solving exercises.

Session 10: Advanced Topics in Ring Theory

Duration: 60 minutes

Objectives:

1. Introduce advanced topics in ring theory.
2. Explore topics such as ring homomorphisms, quotient rings, and Noetherian rings.

Key Concepts:

- Ring homomorphisms and isomorphisms.
- Quotient rings and their properties.
- Noetherian rings and their significance.

Teaching Strategies:

- Explanation of advanced topics using examples and proofs.
- Derivation of key results in ring theory.

Activities:

- Problem-solving exercises on ring homomorphisms and quotient rings.
- Analyzing properties of Noetherian rings.

Assessment:

- Evaluation of problem-solving skills.
- Performance in understanding key results in advanced topics.

Session 11: Ring Homomorphisms and Isomorphisms

Duration: 60 minutes

Objectives:

1. Understand the concepts of ring homomorphisms and isomorphisms.
2. Explore their properties and applications.

Key Concepts:

- Definition of ring homomorphisms and isomorphisms.
- Properties and significance of ring homomorphisms and isomorphisms.

Teaching Strategies:

- Explanation of ring homomorphisms and isomorphisms using examples.
- Discussion on the properties and applications of ring homomorphisms and isomorphisms.

Activities:

- Problem-solving exercises on identifying and analyzing ring homomorphisms and isomorphisms.
- Analyzing real-world scenarios where ring homomorphisms and isomorphisms are applicable.

Assessment:

- Evaluation of problem-solving skills.
- Participation in class discussions.

Session 12: Quotient Rings and Noetherian Rings

Duration: 60 minutes

Objectives:

1. Learn about quotient rings and their properties.
2. Explore the concept of Noetherian rings and their significance.

Key Concepts:

- Definition of quotient rings and their properties.
- Noetherian rings and their significance in ring theory.

Teaching Strategies:

- Explanation of quotient rings using examples and proofs.
- Discussion on the properties and applications of quotient rings.
- Introduction to Noetherian rings and their significance.

Activities:

- Problem-solving exercises on quotient rings and Noetherian rings.
- Analyzing real-world scenarios where quotient rings and Noetherian rings are applicable.

Assessment:

- Evaluation of problem-solving skills.
- Participation in class discussions.

Session 13: Review and Reinforcement

Duration: 60 minutes

Objectives:

1. Review and reinforce understanding of ring theory topics covered.
2. Prepare for assessments and final reflections.

Key Concepts:

- Comprehensive review of ring theory topics.
- Problem-solving sessions to reinforce understanding.

Teaching Strategies:

- Conduct a comprehensive review of all topics covered in the sessions.
- Practice problems and quizzes to reinforce understanding.

Activities:

- Collaborative review session with practice problems.
- Quiz on ring theory topics covered.

Assessment:

- Assessment of understanding through quizzes and practice problems.
- Participation in the review session.

Session 14: Assessments and Final Reflections

Duration: 60 minutes

Objectives:

1. Complete assessments to evaluate understanding of ring theory concepts.
2. Reflect on personal learning experiences throughout the course.

Key Concepts:

- Assessment of understanding through quizzes and problem sets.
- Reflection on personal learning experiences and growth in understanding.

Teaching Strategies:

- Administer assessments to evaluate understanding.
- Facilitate a discussion on personal learning experiences and growth.

Activities:

- Completion of assessments.
- Final reflections and discussion on the relevance of ring theory.

Assessment:

- Performance in assessments.
- Participation in final reflection discussion.

Session 15: Real-World Applications and Conclusion

Duration: 60 minutes

Objectives:

1. Apply ring theory concepts to real-world scenarios.
2. Reflect on the importance of ring theory in mathematics and beyond.

Key Concepts:

- Real-world applications of ring theory.
- Importance of ring theory in various fields.

Teaching Strategies:

- Group discussions on the significance of ring theory.
- Reflection on personal learning experiences throughout the course.

Activities:

- Group presentations on additional real-world applications of ring theory.
- Final reflections and discussion on the relevance of ring theory.

Assessment:

- Evaluation of group presentations.
- Reflection on personal learning experiences.

Conclusion:

This 15-hour lesson plan aims to provide undergraduate students with a comprehensive understanding of ring theory in mathematics. Through a structured approach covering topics such as definitions of rings, properties of rings, subrings, integral domains, fields, ideals, factor rings, prime and maximal ideals, students will develop essential skills in abstract algebra. Real-world applications incorporated throughout the sessions ensure that students recognize the practical relevance of ring theory beyond the classroom. The lesson plan is designed to be engaging, interactive, and suitable for a 60-minute session, fostering a deeper understanding of ring theory among students.

Title: Exploring Advanced Topics in Ring Theory
Subtitle: Ring Homomorphisms, Isomorphism Theorems, and Congruences

Title: Exploring Advanced Topics in Ring Theory
Duration: 20 hours (divided into 60-minute sessions)
Teacher's Name: Debabrata Jana (DJ)
Date: [Date of the Lesson]

Session 1: Introduction to Advanced Ring Theory

Duration: 60 minutes

Objectives:

1. Understand the importance of advanced topics in ring theory.
2. Introduce the concepts of ring homomorphisms and isomorphisms.

Key Concepts:

- Definition of ring homomorphisms.
- Properties of ring homomorphisms.
- Introduction to isomorphisms between rings.

Teaching Strategies:

- Interactive lecture to motivate the study of advanced ring theory.
- Definition and explanation of ring homomorphisms.
- Visual aids and examples to illustrate concepts.

Activities:

- Group discussion on the relevance of advanced ring theory.
- Practice problems on identifying and analyzing ring homomorphisms.

Assessment:

- Participation in group discussions.
- Completion of practice problems.

Session 2: Properties of Ring Homomorphisms

Duration: 60 minutes

Objectives:

1. Explore the properties of ring homomorphisms.
2. Understand the implications of these properties in ring theory.

Key Concepts:

- Ring homomorphism properties: preservation of addition and multiplication.
- Kernel and image of a ring homomorphism.

Teaching Strategies:

- Lecture on the properties of ring homomorphisms with examples.
- Derivation and explanation of the kernel and image of a ring homomorphism.

Activities:

- Problem-solving exercises on identifying kernels and images of ring homomorphisms.
- Analyzing real-world scenarios where ring homomorphism properties are applicable.

Assessment:

- Problem-solving skills in identifying kernels and images.
- Participation in class discussions.

Session 3: First Isomorphism Theorem

Duration: 60 minutes

Objectives:

1. Introduce the First Isomorphism Theorem.
2. Understand its significance in ring theory.

Key Concepts:

- Statement and proof of the First Isomorphism Theorem.
- Application of the First Isomorphism Theorem in ring theory.

Teaching Strategies:

- Explanation of the First Isomorphism Theorem with a step-by-step proof.
- Illustration of examples demonstrating the application of the theorem.

Activities:

- Problem-solving exercises applying the First Isomorphism Theorem to rings.
- Analyzing real-world scenarios where the theorem is applicable.

Assessment:

- Understanding of the First Isomorphism Theorem.
- Problem-solving skills in applying the theorem.

Session 4: Second Isomorphism Theorem

Duration: 60 minutes

Objectives:

1. Introduce the Second Isomorphism Theorem.
2. Understand its implications in ring theory.

Key Concepts:

- Statement and proof of the Second Isomorphism Theorem.
- Application of the Second Isomorphism Theorem in ring theory.

Teaching Strategies:

- Explanation of the Second Isomorphism Theorem with examples.
- Derivation and proof of the theorem.

Activities:

- Problem-solving exercises applying the Second Isomorphism Theorem to rings.
- Analyzing real-world scenarios where the theorem is applicable.

Assessment:

- Understanding of the Second Isomorphism Theorem.
- Problem-solving skills in applying the theorem.

Session 5: Third Isomorphism Theorem

Duration: 60 minutes

Objectives:

1. Introduce the Third Isomorphism Theorem.
2. Understand its significance in ring theory.

Key Concepts:

- Statement and proof of the Third Isomorphism Theorem.
- Application of the Third Isomorphism Theorem in ring theory.

Teaching Strategies:

- Explanation of the Third Isomorphism Theorem with examples.
- Derivation and proof of the theorem.

Activities:

- Problem-solving exercises applying the Third Isomorphism Theorem to rings.
- Analyzing real-world scenarios where the theorem is applicable.

Assessment:

- Understanding of the Third Isomorphism Theorem.
- Problem-solving skills in applying the theorem.

Session 6: Correspondence Theorem

Duration: 60 minutes

Objectives:

1. Introduce the Correspondence Theorem.
2. Understand its implications in ring theory.

Key Concepts:

- Statement and proof of the Correspondence Theorem.
- Application of the Correspondence Theorem in ring theory.

Teaching Strategies:

- Explanation of the Correspondence Theorem with examples.
- Derivation and proof of the theorem.

Activities:

- Problem-solving exercises applying the Correspondence Theorem to rings.
- Analyzing real-world scenarios where the theorem is applicable.

Assessment:

- Understanding of the Correspondence Theorem.
- Problem-solving skills in applying the theorem.

Session 7: Congruence on Rings

Duration: 60 minutes

Objectives:

1. Introduce the concept of congruence on rings.
2. Understand its properties and applications.

Key Concepts:

- Definition of congruence on rings.
- Properties of congruence relations.
- Application of congruences in ring theory.

Teaching Strategies:

- Lecture on congruence relations with examples.
- Explanation of properties and applications of congruences.

Activities:

- Problem-solving exercises on identifying and analyzing congruence relations.
- Analyzing real-world scenarios where congruences are applicable.

Assessment:

- Understanding of congruence relations.
- Problem-solving skills in applying congruences.

Session 8: One-to-One Correspondence between Ideals and Congruences

Duration: 60 minutes

Objectives:

1. Introduce the one-to-one correspondence between ideals and congruences.
2. Understand the relationship between the two concepts.

Key Concepts:

- Relationship between ideals and congruences on rings.
- Derivation and explanation of the one-to-one correspondence.

Teaching Strategies:

- Lecture on the relationship between ideals and congruences.
- Derivation and proof of the one-to-one correspondence.

Activities:

- Problem-solving exercises demonstrating the correspondence between ideals and congruences.
- Analyzing real-world scenarios where the correspondence is applicable.

Assessment:

- Understanding of the relationship between ideals and congruences.
- Problem-solving skills in applying the one-to-one correspondence.

Session 9-15: Real-World Applications and Case Studies

Duration: 60 minutes each

Objectives:

1. Apply advanced topics in ring theory to real-world scenarios.
2. Explore case studies and examples in cryptography, coding theory, and algebraic geometry.

Key Concepts:

- Real-world applications of advanced ring theory concepts.
- Importance of advanced ring theory in cryptography, coding theory, and algebraic geometry.

Teaching Strategies:

- Group discussions on applications of advanced ring theory.
- Presentation of case studies and examples in cryptography and coding theory.

Activities:

- Group presentations on real-world applications of advanced ring theory.
- Problem-solving exercises related to applications in cryptography and coding theory.

Assessment:

- Evaluation of group presentations.
- Problem-solving assessments related to real-world applications.

Session 16-20: Review, Assessments, and Conclusion

Duration: 60 minutes each

Objectives:

1. Review and reinforce understanding of advanced ring theory concepts.
2. Complete assessments to evaluate understanding.
3. Reflect on personal learning experiences throughout the course.

Key Concepts:

- Comprehensive review of advanced ring theory topics.
- Problem-solving sessions to reinforce understanding.
- Assessment of understanding through quizzes and tests.
- Reflection on personal learning experiences and growth.

Teaching Strategies:

- Conduct a comprehensive review of all topics covered in the sessions.
- Practice problems and quizzes to reinforce understanding.
- Administer assessments to evaluate understanding.
- Facilitate a discussion on personal learning experiences and growth.

Activities:

- Collaborative problem-solving exercises.
- Review quizzes to reinforce understanding.
- Completion of assessments.

Assessment:

- Assessment of understanding through quizzes and tests.
- Performance in assessments.
- Participation in final reflection discussion.

Conclusion:

This 20-hour lesson plan aims to provide undergraduate students with a comprehensive understanding of advanced topics in ring theory in mathematics. Through a structured approach covering concepts such as ring homomorphisms, isomorphism theorems, congruences, and the correspondence between ideals and congruences, students will develop essential skills in abstract algebra. Real-world applications incorporated throughout the sessions ensure that students recognize the practical relevance of advanced ring theory beyond the classroom. The lesson plan is designed to be engaging, interactive, and suitable for a 60-minute session, fostering a deeper understanding of advanced ring theory among students.

Unit-2 : Linear algebra

Title: Exploring Linear Algebra Fundamentals
Subtitle: Vector Spaces, Subspaces, and Dimension
Duration: 15 hours (divided into 60-minute sessions)
Teacher's Name: DR. PAYEL GHOSH (PG)
Date: [Date of the Lesson]

Session 1: Introduction to Vector Spaces

Duration: 60 minutes

Objectives:

1. Understand the concept of vector spaces.
2. Identify properties and examples of vector spaces.

Key Concepts:

- Definition of vector spaces.
- Properties of vector spaces.
- Examples of vector spaces.

Teaching Strategies:

- Interactive lecture to introduce vector spaces.
- Illustration of vector space properties using examples.
- Encourage class participation in identifying vector spaces.

Activities:

- Group discussion on everyday examples of vector spaces.
- Practice problems to reinforce understanding of vector space properties.

Assessment:

- Participation in group discussions.
- Completion of practice problems.

Session 2: Subspaces and Algebra of Subspaces

Duration: 60 minutes

Objectives:

1. Learn about subspaces and their properties.
2. Explore operations on subspaces.

Key Concepts:

- Definition of subspaces.
- Properties of subspaces.
- Algebra of subspaces.

Teaching Strategies:

- Explanation of subspaces using examples.
- Derivation of properties of subspaces.
- Demonstration of operations on subspaces.

Activities:

- Problem-solving exercises on identifying and analyzing subspaces.
- Analyzing real-world scenarios where subspaces are applicable.

Assessment:

- Evaluation of problem-solving skills.
- Participation in class discussions.

Session 3: Quotient Spaces

Duration: 60 minutes

Objectives:

1. Introduce the concept of quotient spaces.
2. Understand their properties and applications.

Key Concepts:

- Definition of quotient spaces.
- Properties of quotient spaces.
- Applications of quotient spaces.

Teaching Strategies:

- Lecture on quotient spaces with examples.
- Explanation of properties and applications of quotient spaces.

Activities:

- Problem-solving exercises on identifying and analyzing quotient spaces.
- Analyzing real-world scenarios where quotient spaces are applicable.

Assessment:

- Understanding of quotient spaces.
- Problem-solving skills in applying quotient spaces.

Session 4: Linear Combination of Vectors

Duration: 60 minutes

Objectives:

1. Understand the concept of linear combinations.
2. Explore properties and applications of linear combinations.

Key Concepts:

- Definition of linear combinations.
- Properties of linear combinations.
- Applications of linear combinations.

Teaching Strategies:

- Explanation of linear combinations using examples.
- Derivation of properties of linear combinations.
- Illustration of applications of linear combinations.

Activities:

- Problem-solving exercises on identifying and analyzing linear combinations.
- Analyzing real-world scenarios where linear combinations are applicable.

Assessment:

- Understanding of linear combinations.
- Problem-solving skills in applying linear combinations.

Session 5: Linear Span

Duration: 60 minutes

Objectives:

1. Introduce the concept of linear span.
2. Understand its properties and significance.

Key Concepts:

- Definition of linear span.
- Properties of linear span.
- Significance of linear span in vector spaces.

Teaching Strategies:

- Lecture on linear span with examples.
- Explanation of properties and significance of linear span.

Activities:

- Problem-solving exercises on identifying and analyzing linear spans.
- Analyzing real-world scenarios where linear span is applicable.

Assessment:

- Understanding of linear span.
- Problem-solving skills in applying linear span.

Session 6: Linear Independence

Duration: 60 minutes

Objectives:

1. Understand the concept of linear independence.
2. Explore its properties and applications.

Key Concepts:

- Definition of linear independence.
- Properties of linear independence.
- Applications of linear independence.

Teaching Strategies:

- Explanation of linear independence using examples.
- Derivation of properties of linear independence.
- Illustration of applications of linear independence.

Activities:

- Problem-solving exercises on identifying and analyzing linearly independent sets.
- Analyzing real-world scenarios where linear independence is applicable.

Assessment:

- Understanding of linear independence.
- Problem-solving skills in applying linear independence.

Session 7: Basis and Dimension

Duration: 60 minutes

Objectives:

1. Introduce the concepts of basis and dimension.
2. Understand their significance in vector spaces.

Key Concepts:

- Definition of basis and dimension.
- Properties of basis and dimension.
- Significance of basis and dimension in vector spaces.

Teaching Strategies:

- Lecture on basis and dimension with examples.
- Explanation of properties and significance of basis and dimension.

Activities:

- Problem-solving exercises on identifying bases and dimensions.
- Analyzing real-world scenarios where bases and dimensions are applicable.

Assessment:

- Understanding of basis and dimension.
- Problem-solving skills in applying basis and dimension.

Session 8: Dimension of Subspaces

Duration: 60 minutes

Objectives:

1. Learn about the dimension of subspaces.
2. Understand its properties and applications.

Key Concepts:

- Definition of dimension of subspaces.
- Properties of dimension of subspaces.
- Applications of dimension of subspaces.

Teaching Strategies:

- Explanation of dimension of subspaces using examples.
- Derivation of properties and applications of dimension of subspaces.

Activities:

- Problem-solving exercises on identifying and analyzing dimensions of subspaces.
- Analyzing real-world scenarios where dimensions of subspaces are applicable.

Assessment:

- Understanding of dimension of subspaces.
- Problem-solving skills in applying dimension of subspaces.

Session 9-15: Real-World Applications and Case Studies

Duration: 60 minutes each

Objectives:

1. Apply linear algebra concepts to real-world scenarios.
2. Explore case studies and examples in various fields.

Key Concepts:

- Real-world applications of linear algebra concepts.
- Importance of linear algebra in engineering, computer science, physics, and other fields.

Teaching Strategies:

- Group discussions on applications of linear algebra.
- Presentation of case studies and examples in engineering, computer science, physics, and other fields.

Activities:

- Group presentations on real-world applications of linear algebra.
- Problem-solving exercises related to applications in various fields.

Assessment:

- Evaluation of group presentations.
- Problem-solving assessments related to real-world applications.

Conclusion:

This 15-hour lesson plan aims to provide undergraduate students with a comprehensive understanding of fundamental concepts in linear algebra. Through a structured approach covering topics such as vector spaces, subspaces, linear combinations, basis, and dimension, students will develop essential skills in vector space theory. Real-world applications incorporated throughout the sessions ensure that students recognize the practical relevance of linear algebra beyond the classroom. The lesson plan is designed to be engaging, interactive, and suitable for a 60-minute session, fostering a deeper understanding of linear algebra among students.

Title: Mastering Linear Algebra: From Basics to Advanced Concepts
Subtitle: Understanding Linear Transformations, Eigenvalues, and Isomorphisms
Duration: 25 hours (divided into 60-minute sessions)
Teacher's Name: DR. PAYEL GHOSH (PG)
Date: [Date of the Lesson]

Session 1: Introduction to Linear Algebra

Duration: 60 minutes

Objectives:

1. Understand the importance of linear algebra in mathematics and real-world applications.
2. Introduce basic concepts such as vectors and matrices.

Key Concepts:

- Definition of vectors and matrices.
- Basic operations on vectors and matrices.
- Importance of linear algebra in various fields.

Teaching Strategies:

- Interactive lecture to introduce the relevance of linear algebra.
- Demonstration of basic vector and matrix operations.
- Real-world examples of linear algebra applications.

Activities:

- Group discussion on real-world applications of linear algebra.
- Practice problems on basic vector and matrix operations.

Assessment:

- Participation in group discussions.
- Completion of practice problems.

Session 2: Linear Transformations

Duration: 60 minutes

Objectives:

1. Introduce the concept of linear transformations.
2. Understand the properties and characteristics of linear transformations.

Key Concepts:

- Definition of linear transformations.
- Properties of linear transformations: preservation of addition and scalar multiplication.
- Representation of linear transformations with matrices.

Teaching Strategies:

- Explanation of linear transformations with examples.
- Demonstration of how linear transformations are represented by matrices.
- Visual aids to illustrate properties of linear transformations.

Activities:

- Problem-solving exercises on identifying linear transformations.
- Analyzing real-world scenarios where linear transformations are applicable.

Assessment:

- Understanding of linear transformations.
- Problem-solving skills in identifying properties of linear transformations.

Session 3: Null Space and Range

Duration: 60 minutes

Objectives:

1. Introduce the concepts of null space and range.
2. Understand their significance in linear algebra.

Key Concepts:

- Definition of null space and range.
- Relationship between null space and range.
- Calculation of nullity and rank.

Teaching Strategies:

- Explanation of null space and range with examples.
- Derivation of formulas for nullity and rank.
- Real-world applications of null space and range.

Activities:

- Problem-solving exercises on calculating nullity and rank.
- Analyzing real-world scenarios where null space and range are applicable.

Assessment:

- Understanding of null space and range.
- Problem-solving skills in calculating nullity and rank.

Session 4: Matrix Representation of Linear Transformations

Duration: 60 minutes

Objectives:

1. Understand how linear transformations are represented by matrices.
2. Learn about the relationship between matrix representations and linear transformations.

Key Concepts:

- Matrix representation of linear transformations.
- Transformation matrix.
- Relationship between matrix multiplication and composition of linear transformations.

Teaching Strategies:

- Explanation of matrix representation with examples.
- Derivation of transformation matrices.
- Visual aids to illustrate the relationship between matrix multiplication and composition of linear transformations.

Activities:

- Problem-solving exercises on calculating transformation matrices.
- Analyzing real-world scenarios where matrix representation is applicable.

Assessment:

- Understanding of matrix representation.
- Problem-solving skills in calculating transformation matrices.

Session 5: Change of Coordinate Matrix

Duration: 60 minutes

Objectives:

1. Introduce the concept of change of coordinate matrix.
2. Understand its significance in linear algebra.

Key Concepts:

- Definition of change of coordinate matrix.
- Transformation between different coordinate systems.
- Calculation of change of coordinate matrices.

Teaching Strategies:

- Explanation of change of coordinate matrix with examples.
- Derivation of formulas for calculating change of coordinate matrices.
- Real-world applications of change of coordinate matrices.

Activities:

- Problem-solving exercises on calculating change of coordinate matrices.
- Analyzing real-world scenarios where change of coordinate matrices are applicable.

Assessment:

- Understanding of change of coordinate matrix.
- Problem-solving skills in calculating change of coordinate matrices.

Session 6: Algebra of Linear Transformations

Duration: 60 minutes

Objectives:

1. Explore the algebraic properties of linear transformations.
2. Understand how linear transformations form a vector space.

Key Concepts:

- Addition and scalar multiplication of linear transformations.
- Properties of linear transformations as a vector space.
- Subspace of linear transformations.

Teaching Strategies:

- Explanation of algebraic properties with examples.
- Derivation of properties of linear transformations as a vector space.
- Visual aids to illustrate subspace of linear transformations.

Activities:

- Problem-solving exercises on addition and scalar multiplication of linear transformations.
- Analyzing real-world scenarios where algebraic properties are applicable.

Assessment:

- Understanding of algebraic properties of linear transformations.
- Problem-solving skills in manipulating linear transformations.

Session 7: Isomorphisms

Duration: 60 minutes

Objectives:

1. Introduce the concept of isomorphisms.
2. Understand their significance in linear algebra.

Key Concepts:

- Definition of isomorphisms.
- Properties of isomorphisms.
- Isomorphism between vector spaces.

Teaching Strategies:

- Explanation of isomorphisms with examples.
- Derivation of properties of isomorphisms.
- Real-world applications of isomorphisms.

Activities:

- Problem-solving exercises on identifying and analyzing isomorphisms.
- Analyzing real-world scenarios where isomorphisms are applicable.

Assessment:

- Understanding of isomorphisms.
- Problem-solving skills in identifying properties of isomorphisms.

Session 8: Isomorphism Theorems

Duration: 60 minutes

Objectives:

1. Introduce the Isomorphism Theorems in linear algebra.
2. Understand their implications and applications.

Key Concepts:

- Statement and proof of Isomorphism Theorems.
- Application of Isomorphism Theorems in linear algebra.

Teaching Strategies:

- Explanation of Isomorphism Theorems with examples.
- Derivation and proof of the theorems.
- Real-world applications of Isomorphism Theorems.

Activities:

- Problem-solving exercises applying Isomorphism Theorems.
- Analyzing real-world scenarios where the theorems are applicable.

Assessment:

- Understanding of Isomorphism Theorems.
- Problem-solving skills in applying the theorems.

Session 9: Invertibility and Isomorphisms

Duration: 60 minutes

Objectives:

1. Explore the relationship between invertibility and isomorphisms.
2. Understand how invertible linear transformations relate to isomorphisms.

Key Concepts:

- Invertibility of linear transformations.
- Relationship between invertibility and isomorphisms.
- Isomorphisms between vector spaces.

Teaching Strategies:

- Explanation of the relationship between invertibility and isomorphisms.
- Derivation of conditions for invertibility.
- Real-world applications of invertibility and isomorphisms.

Activities:

- Problem-solving exercises on determining invertibility and isomorphisms.
- Analyzing real-world scenarios where invertibility and isomorphisms are applicable.

Assessment:

- Understanding of the relationship between invertibility and isomorphisms.
- Problem-solving skills in determining conditions for invertibility.

Session 10: Eigenvalues and Eigenvectors

Duration: 60 minutes

Objectives:

1. Introduce the concepts of eigenvalues and eigenvectors.
2. Understand their significance in linear algebra.

Key Concepts:

- Definition of eigenvalues and eigenvectors.

- Properties of eigenvalues and eigenvectors.
- Calculation of eigenvalues and eigenvectors.

Teaching Strategies:

- Explanation of eigenvalues and eigenvectors with examples.
- Derivation of formulas for calculating eigenvalues and eigenvectors.
- Real-world applications of eigenvalues and eigenvectors.

Activities:

- Problem-solving exercises on calculating eigenvalues and eigenvectors.
- Analyzing real-world scenarios where eigenvalues and eigenvectors are applicable.

Assessment:

- Understanding of eigenvalues and eigenvectors.
- Problem-solving skills in calculating eigenvalues and eigenvectors.

Session 11: Characteristic Equation of a Matrix

Duration: 60 minutes

Objectives:

1. Introduce the characteristic equation of a matrix.
2. Understand its significance in linear algebra.

Key Concepts:

- Definition of the characteristic equation.
- Relationship between eigenvalues and the characteristic equation.
- Calculation of the characteristic equation.

Teaching Strategies:

- Explanation of the characteristic equation with examples.
- Derivation of formulas for calculating the characteristic equation.
- Real-world applications of the characteristic equation.

Activities:

- Problem-solving exercises on calculating the characteristic equation.
- Analyzing real-world scenarios where the characteristic equation is applicable.

Assessment:

- Understanding of the characteristic equation.
- Problem-solving skills in calculating the characteristic equation.

Session 12: Cayley-Hamilton Theorem

Duration: 60 minutes

Objectives:

1. Introduce the Cayley-Hamilton Theorem.
2. Understand its implications and applications.

Key Concepts:

- Statement and proof of the Cayley-Hamilton Theorem.
- Application of the Cayley-Hamilton Theorem in finding the inverse of a matrix.

Teaching Strategies:

- Explanation of the Cayley-Hamilton Theorem with examples.
- Derivation and proof of the theorem.
- Real-world applications of the Cayley-Hamilton Theorem.

Activities:

- Problem-solving exercises applying the Cayley-Hamilton Theorem.
- Analyzing real-world scenarios where the theorem is applicable.

Assessment:

- Understanding of the Cayley-Hamilton Theorem.
- Problem-solving skills in applying the theorem.

Session 13-25: Real-World Applications and Case Studies

Duration: 60 minutes each

Objectives:

1. Apply linear algebra concepts to real-world scenarios.
2. Explore case studies and examples in computer graphics, machine learning, and physics.

Key Concepts:

- Real-world applications of linear algebra concepts.

- Importance of linear algebra in computer graphics, machine learning, and physics.

Teaching Strategies:

- Group discussions on applications of linear algebra.
- Presentation of case studies and examples in computer graphics and machine learning.

Activities:

- Group presentations on real-world applications of linear algebra.
- Problem-solving exercises related to applications in computer graphics and machine learning.

Assessment:

- Evaluation of group presentations.
- Problem-solving assessments related to real-world applications.

Session 25: Review, Assessments, and Conclusion

Duration: 60 minutes

Objectives:

1. Review and reinforce understanding of linear algebra concepts.
2. Complete assessments to evaluate understanding.
3. Reflect on personal learning experiences throughout the course.

Key Concepts:

- Comprehensive review of linear algebra topics.
- Problem-solving sessions to reinforce understanding.
- Assessment of understanding through quizzes and tests.
- Reflection on personal learning experiences and growth.

Teaching Strategies:

- Conduct a comprehensive review of all topics covered in the sessions.
- Practice problems and quizzes to reinforce understanding.
- Administer assessments to evaluate understanding.
- Facilitate a discussion on personal learning experiences and growth.

Activities:

- Collaborative problem-solving exercises.
- Review quizzes to reinforce understanding.
- Completion of assessments.

Assessment:

- Assessment of understanding through quizzes and tests.
- Performance in assessments.
- Participation in final reflection discussion.

Conclusion:

This 25-hour lesson plan aims to provide undergraduate students with a comprehensive understanding of linear algebra, covering basic concepts such as vectors and matrices to advanced topics like eigenvalues, eigenvectors, and isomorphisms. Through a structured approach, students will develop essential skills in linear algebra and recognize its significance in various fields such as computer graphics, machine learning, and physics. Real-world applications incorporated throughout the sessions ensure that students recognize the practical relevance of linear algebra beyond the classroom. The lesson plan is designed to be engaging, interactive, and suitable for a 60-minute session, fostering a deeper understanding of linear algebra among students.

Ordinary Differential Equation & Multivariate Calculus-I

Semester : 3 Credits : 5+1*=6

Core Course-7 Full Marks : 65+15**+20***=100

Paper Code(Theory): MTM-A-CC-3-7-TH

Paper Code (Tutorial):MTM-A-CC-3-7-TU

Unit-1 : Ordinary differential equation

Title: Mastering Ordinary Differential Equations
Subtitle: Exploring First-Order Differential Equations
Duration: 5 hours (divided into 60-minute sessions)
Teacher's Name: UTTAM ROY MANDAL (URM)
Date: [Date of the Lesson]

Session 1: Introduction to First-Order Differential Equations

Duration: 60 minutes

Objectives:

1. Understand the importance of first-order differential equations in mathematics and real-world applications.
2. Introduce basic concepts such as exact differential equations and integrating factors.

Key Concepts:

- Definition of first-order differential equations.
- Exact differential equations and integrating factors.
- Importance of first-order differential equations in various fields.

Teaching Strategies:

- Interactive lecture to introduce the relevance of first-order differential equations.
- Demonstration of exact differential equations with examples.
- Real-world examples of applications of first-order differential equations.

Activities:

- Group discussion on real-world applications of first-order differential equations.
- Practice problems on identifying exact differential equations and integrating factors.

Assessment:

- Participation in group discussions.
- Completion of practice problems.

Session 2: Special Integrating Factors and Transformations

Duration: 60 minutes

Objectives:

1. Introduce special integrating factors and transformations for solving differential equations.
2. Understand how to apply these techniques to solve specific types of equations.

Key Concepts:

- Special integrating factors and their properties.
- Transformations for simplifying differential equations.
- Application of special integrating factors and transformations in solving differential equations.

Teaching Strategies:

- Explanation of special integrating factors and transformations with examples.
- Derivation of formulas for calculating integrating factors.
- Real-world applications of special integrating factors and transformations.

Activities:

- Problem-solving exercises on applying special integrating factors and transformations.
- Analyzing real-world scenarios where these techniques are applicable.

Assessment:

- Understanding of special integrating factors and transformations.
- Problem-solving skills in applying these techniques.

Session 3: Linear Equations and Bernoulli Equations

Duration: 60 minutes

Objectives:

1. Introduce linear equations and Bernoulli equations.
2. Understand how to solve these specific types of differential equations.

Key Concepts:

- Definition of linear equations and Bernoulli equations.
- Solution techniques for linear equations and Bernoulli equations.
- Importance of linear and Bernoulli equations in various fields.

Teaching Strategies:

- Explanation of linear equations and Bernoulli equations with examples.
- Derivation of solution techniques for linear and Bernoulli equations.
- Real-world applications of linear and Bernoulli equations.

Activities:

- Problem-solving exercises on solving linear and Bernoulli equations.

- Analyzing real-world scenarios where these types of equations are applicable.

Assessment:

- Understanding of solution techniques for linear and Bernoulli equations.
- Problem-solving skills in applying these techniques.

Session 4: Existence and Uniqueness Theorem of Picard (Statement only)

Duration: 60 minutes

Objectives:

1. Introduce the existence and uniqueness theorem of Picard.
2. Understand its significance in the theory of ordinary differential equations.

Key Concepts:

- Statement of the existence and uniqueness theorem of Picard.
- Conditions for the existence and uniqueness of solutions to differential equations.
- Implications of the Picard theorem in solving differential equations.

Teaching Strategies:

- Explanation of the existence and uniqueness theorem of Picard.
- Discussion on the conditions for the existence and uniqueness of solutions.
- Real-world applications of the Picard theorem.

Activities:

- Group discussion on the implications of the Picard theorem.
- Analyzing real-world scenarios where the Picard theorem is applicable.

Assessment:

- Understanding of the statement of the Picard theorem.
- Participation in group discussions.

Session 5: Real-World Applications and Conclusion

Duration: 60 minutes

Objectives:

1. Apply first-order differential equation techniques to real-world scenarios.
2. Reflect on the importance of ordinary differential equations in various fields.

Key Concepts:

- Real-world applications of first-order differential equations.
- Importance of ordinary differential equations in engineering, physics, and biology.
- Reflection on personal learning experiences throughout the course.

Teaching Strategies:

- Group discussions on applications of first-order differential equations.
- Presentation of case studies and examples in engineering, physics, and biology.
- Reflection on personal learning experiences and growth.

Activities:

- Group presentations on real-world applications of first-order differential equations.
- Final reflection and discussion on the relevance of ordinary differential equations.

Assessment:

- Evaluation of group presentations.
- Reflection on personal learning experiences and growth.

Conclusion:

This 5-hour lesson plan aims to provide undergraduate students with a foundational understanding of first-order ordinary differential equations. Through a structured approach covering concepts such as exact differential equations, integrating factors, special integrating factors, linear equations, Bernoulli equations, and the existence and uniqueness theorem of Picard, students will develop essential skills in solving differential equations. Real-world applications incorporated throughout the sessions ensure that students recognize the practical relevance of ordinary differential equations beyond the classroom. The lesson plan is designed to be engaging, interactive, and suitable for a 60-minute session, fostering a deeper understanding of ordinary differential equations among students.

Title: Exploring Ordinary Differential Equations
Subtitle: Linear and Higher-Degree Equations with Applications
Duration: 5 hours (divided into 60-minute sessions)
Teacher's Name: UTTAM ROY MANDAL (URM)
Date: [Date of the Lesson]

Session 1: Introduction to Ordinary Differential Equations (ODEs)

Duration: 60 minutes

Objectives:

1. Understand the basic concepts of Ordinary Differential Equations (ODEs).
2. Introduce the classification of ODEs.

Key Concepts:

- Definition of Ordinary Differential Equations.
- Classification of ODEs based on order and linearity.

Teaching Strategies:

- Interactive lecture to introduce ODEs and their significance.
- Discussion on the order and linearity of ODEs.
- Visual aids to illustrate different types of ODEs.

Activities:

- Group discussion on real-world applications of ODEs.
- Practice problems on classifying ODEs.

Assessment:

- Participation in group discussions.
- Completion of practice problems.

Session 2: Linear First-Order ODEs

Duration: 60 minutes

Objectives:

1. Explore linear first-order Ordinary Differential Equations.
2. Understand the solution techniques for linear first-order ODEs.

Key Concepts:

- Definition of linear first-order ODEs.
- Separation of variables method.
- Integrating factor method.

Teaching Strategies:

- Explanation of linear first-order ODEs with examples.
- Step-by-step walkthrough of solution techniques.
- Visual representation of solution curves.

Activities:

- Problem-solving exercises on linear first-order ODEs.
- Analyzing real-world scenarios modeled by linear first-order ODEs.

Assessment:

- Understanding of solution techniques for linear first-order ODEs.
- Problem-solving skills in solving ODEs.

Session 3: Higher-Degree ODEs Solvable for x, y, and p

Duration: 60 minutes

Objectives:

1. Introduce higher-degree ODEs solvable for x, y, and p.
2. Understand the methods for solving these ODEs.

Key Concepts:

- Definition of higher-degree ODEs.
- Methods for solving higher-degree ODEs.

Teaching Strategies:

- Explanation of higher-degree ODEs solvable for x, y, and p.
- Demonstration of solution methods.
- Visual aids to illustrate solution techniques.

Activities:

- Problem-solving exercises on higher-degree ODEs.
- Analyzing real-world scenarios modeled by higher-degree ODEs.

Assessment:

- Understanding of solution methods for higher-degree ODEs.
- Problem-solving skills in solving ODEs.

Session 4: Clairaut’s Equations and Singular Solutions

Duration: 60 minutes

Objectives:

1. Introduce Clairaut’s equations in Ordinary Differential Equations.
2. Understand the concept of singular solutions.

Key Concepts:

- Definition of Clairaut's equations.
- Singular solutions in ODEs.

Teaching Strategies:

- Explanation of Clairaut's equations with examples.
- Discussion on singular solutions and their significance.
- Visual representation of singular solution curves.

Activities:

- Problem-solving exercises on Clairaut's equations.
- Analyzing real-world scenarios with singular solutions.

Assessment:

- Understanding of Clairaut's equations.
- Problem-solving skills in handling singular solutions.

Session 5: Real-World Applications and Conclusion

Duration: 60 minutes

Objectives:

1. Apply ODE concepts to real-world scenarios.
2. Reflect on the importance of ODEs in various fields.

Key Concepts:

- Real-world applications of Ordinary Differential Equations.
- Importance of ODEs in modeling dynamic systems.

Teaching Strategies:

- Group discussions on applications of ODEs in different fields.
- Presentation of case studies and examples in physics, biology, and engineering.

Activities:

- Group presentations on real-world applications of ODEs.
- Problem-solving exercises related to applications in physics and engineering.

Assessment:

- Evaluation of group presentations.
- Reflection on the importance of ODEs in modeling dynamic systems.

Conclusion:

This 5-hour lesson plan aims to provide undergraduate students with a foundational understanding of Ordinary Differential Equations, covering linear equations, higher-degree equations, Clairaut's equations, and singular solutions. Through a structured approach, students will develop essential skills in solving and understanding ODEs, recognizing their significance in various fields. Real-world applications incorporated throughout the sessions ensure that students recognize the practical relevance of ODEs beyond the classroom. The lesson plan is designed to be engaging, interactive, and suitable for a 60-minute session, fostering a deeper understanding of ODEs among students.

Title: Understanding Ordinary Differential Equations
Subtitle: Basic Theory of Linear Systems
Duration: 5 hours (divided into 60-minute sessions)
Teacher's Name: UTTAM ROY MANDAL (URM)]
Date: [Date of the Lesson]

Session 1: Introduction to Ordinary Differential Equations (ODEs)

Duration: 60 minutes

Objectives:

1. Introduce the concept of ordinary differential equations.
2. Understand the importance of ODEs in various fields.

Key Concepts:

- Definition of ordinary differential equations.
- Classification of ODEs based on order and linearity.
- Importance of ODEs in modeling real-world phenomena.

Teaching Strategies:

- Interactive lecture to introduce ODEs and their significance.
- Real-world examples of ODEs in physics, engineering, and biology.
- Visual aids to illustrate different types of ODEs.

Activities:

- Group discussion on real-world applications of ODEs.
- Practice problems on identifying and classifying ODEs.

Assessment:

- Participation in group discussions.
- Completion of practice problems.

Session 2: Basic Theory of Linear Systems

Duration: 60 minutes

Objectives:

1. Introduce the basic theory of linear systems of ordinary differential equations.
2. Understand the concept of normal form for linear systems.

Key Concepts:

- Definition of linear systems of ODEs.
- Normal form for linear systems.
- Properties and characteristics of linear systems.

Teaching Strategies:

- Explanation of linear systems with examples.
- Derivation of normal form for linear systems.
- Visual aids to illustrate the concept of normal form.

Activities:

- Problem-solving exercises on identifying and analyzing linear systems.
- Analyzing real-world scenarios where linear systems are applicable.

Assessment:

- Understanding of linear systems of ODEs.
- Problem-solving skills in identifying normal form.

Session 3: Homogeneous Linear Systems with Constant Coefficients

Duration: 60 minutes

Objectives:

1. Understand homogeneous linear systems of ODEs with constant coefficients.
2. Solve homogeneous linear systems with two equations in two unknown functions.

Key Concepts:

- Homogeneous linear systems with constant coefficients.
- Two equations in two unknown functions.
- Solution techniques for homogeneous linear systems.

Teaching Strategies:

- Explanation of homogeneous linear systems with examples.
- Derivation of solution techniques for two equations in two unknown functions.

- Real-world applications of homogeneous linear systems.

Activities:

- Problem-solving exercises on solving homogeneous linear systems.
- Analyzing real-world scenarios where homogeneous linear systems are applicable.

Assessment:

- Understanding of homogeneous linear systems with constant coefficients.
- Problem-solving skills in solving systems of ODEs.

Session 4: Application of Linear Systems in Real-World Problems

Duration: 60 minutes

Objectives:

1. Apply the concepts learned to solve real-world problems.
2. Understand the relevance of linear systems in various fields.

Key Concepts:

- Real-world applications of linear systems of ODEs.
- Importance of linear systems in modeling physical and engineering phenomena.
- Problem-solving techniques for real-world scenarios.

Teaching Strategies:

- Presentation of case studies and examples involving linear systems.
- Group discussion on the relevance of linear systems in different fields.
- Problem-solving exercises on real-world problems.

Activities:

- Group presentations on case studies involving linear systems.
- Problem-solving exercises on applying linear systems to real-world scenarios.

Assessment:

- Evaluation of group presentations.
- Problem-solving skills in applying linear systems to real-world problems.

Session 5: Review and Conclusion

Duration: 60 minutes

Objectives:

1. Review and reinforce understanding of concepts covered.

2. Reflect on the importance of ODEs and linear systems in mathematics and beyond.

Key Concepts:

- Comprehensive review of concepts covered in the previous sessions.
- Reflection on personal learning experiences and growth.

Teaching Strategies:

- Conduct a comprehensive review of all topics covered.
- Facilitate a discussion on personal learning experiences and insights gained.

Activities:

- Collaborative problem-solving exercises.
- Final reflection and discussion on the relevance of ODEs and linear systems.

Assessment:

- Participation in the review session.
- Reflection on personal learning experiences.

Conclusion:

This 5-hour lesson plan aims to provide undergraduate students with a basic understanding of ordinary differential equations and linear systems, focusing on homogeneous linear systems with constant coefficients. Through a structured approach, students will develop essential skills in solving linear systems and understanding their relevance in various fields such as physics, engineering, and biology. Real-world applications incorporated throughout the sessions ensure that students recognize the practical relevance of ODEs and linear systems beyond the classroom. The lesson plan is designed to be engaging, interactive, and suitable for a 60-minute session, fostering a deeper understanding of ODEs and linear systems among students.

Title: Mastering Ordinary Differential Equations
Subtitle: Exploring Second-Order Linear Differential Equations
Duration: 5 hours (divided into 60-minute sessions)
Teacher's Name: UTTAM ROY MANDAL (URM)
Date: [Date of the Lesson]

Session 1: Introduction to Second-Order Linear Differential Equations

Duration: 60 minutes

Objectives:

1. Understand the importance of second-order linear differential equations.
2. Introduce basic concepts and terminology.

Key Concepts:

- Definition of second-order linear differential equations.
- Homogeneous and non-homogeneous equations.
- General solution and particular solution.

Teaching Strategies:

- Interactive lecture to motivate the study of differential equations.
- Demonstration of examples illustrating second-order linear differential equations.
- Real-world applications of second-order linear differential equations.

Activities:

- Group discussion on real-world applications of differential equations.
- Practice problems on identifying homogeneous and non-homogeneous equations.

Assessment:

- Participation in group discussions.
- Completion of practice problems.

Session 2: Wronskian and its Properties

Duration: 60 minutes

Objectives:

1. Introduce the Wronskian and its significance.
2. Understand the properties and applications of the Wronskian.

Key Concepts:

- Definition of the Wronskian.
- Properties of the Wronskian.
- Applications of the Wronskian in determining linear independence.

Teaching Strategies:

- Explanation of the Wronskian with examples.
- Derivation and proof of properties of the Wronskian.
- Real-world applications of the Wronskian.

Activities:

- Problem-solving exercises on calculating and analyzing the Wronskian.
- Analyzing real-world scenarios where the Wronskian is applicable.

Assessment:

- Understanding of the Wronskian and its properties.
- Problem-solving skills in calculating and analyzing the Wronskian.

Session 3: Euler Equation

Duration: 60 minutes

Objectives:

1. Introduce the Euler equation and its characteristics.
2. Understand its significance in differential equations.

Key Concepts:

- Definition of the Euler equation.
- Characteristics of the Euler equation.
- Methods of solving the Euler equation.

Teaching Strategies:

- Explanation of the Euler equation with examples.
- Derivation of methods for solving the Euler equation.
- Real-world applications of the Euler equation.

Activities:

- Problem-solving exercises on solving the Euler equation.
- Analyzing real-world scenarios where the Euler equation is applicable.

Assessment:

- Understanding of the Euler equation and its characteristics.
- Problem-solving skills in solving the Euler equation.

Session 4: Methods of Undetermined Coefficients

Duration: 60 minutes

Objectives:

1. Introduce the method of undetermined coefficients.
2. Understand its application in solving non-homogeneous linear differential equations.

Key Concepts:

- Explanation of the method of undetermined coefficients.
- Application of the method to non-homogeneous equations.
- Determination of particular solutions using the method.

Teaching Strategies:

- Explanation of the method with examples.
- Step-by-step demonstration of applying the method to non-homogeneous equations.
- Real-world applications of the method of undetermined coefficients.

Activities:

- Problem-solving exercises on applying the method of undetermined coefficients.
- Analyzing real-world scenarios where the method is applicable.

Assessment:

- Understanding of the method of undetermined coefficients.
- Problem-solving skills in applying the method.

Session 5: Method of Variation of Parameters

Duration: 60 minutes

Objectives:

1. Introduce the method of variation of parameters.
2. Understand its application in solving non-homogeneous linear differential equations.

Key Concepts:

- Explanation of the method of variation of parameters.
- Application of the method to non-homogeneous equations.
- Determination of particular solutions using the method.

Teaching Strategies:

- Explanation of the method with examples.
- Step-by-step demonstration of applying the method to non-homogeneous equations.
- Real-world applications of the method of variation of parameters.

Activities:

- Problem-solving exercises on applying the method of variation of parameters.
- Analyzing real-world scenarios where the method is applicable.

Assessment:

- Understanding of the method of variation of parameters.
- Problem-solving skills in applying the method.

Conclusion:

This 5-hour lesson plan aims to provide undergraduate students with a comprehensive understanding of second-order linear differential equations and methods for solving them. Through a structured approach covering topics such as the Wronskian, Euler equation, method of undetermined coefficients, and method of variation of parameters, students will develop essential skills in differential equations. Real-world applications incorporated throughout the sessions ensure that students recognize the practical relevance of differential equations beyond the classroom. The lesson plan is designed to be engaging, interactive, and suitable for a 60-minute session, fostering a deeper understanding of ordinary differential equations among students.

Title: Understanding Ordinary Differential Equations
Subtitle: Exploring Linear Systems and Differential Operators
Duration: 5 hours (divided into 60-minute sessions)
Teacher's Name: UTTAM ROY MANDAL (URM)
Date: [Date of the Lesson]

Session 1: Introduction to Ordinary Differential Equations (ODEs)

Duration: 60 minutes

Objectives:

1. Introduce the concept of Ordinary Differential Equations (ODEs).
2. Understand the importance of ODEs in various fields.

Key Concepts:

- Definition of Ordinary Differential Equations.
- Types of ODEs: first-order, second-order, etc.
- Applications of ODEs in science and engineering.

Teaching Strategies:

- Interactive lecture to introduce ODEs and their significance.
- Real-world examples of ODEs in physics, engineering, and biology.
- Visual aids to illustrate different types of ODEs.

Activities:

- Group discussion on real-world applications of ODEs.
- Practice problems on identifying and classifying ODEs.

Assessment:

- Participation in group discussions.
- Completion of practice problems.

Session 2: System of Linear Differential Equations

Duration: 60 minutes

Objectives:

1. Introduce the concept of a system of linear differential equations.
2. Understand the properties and characteristics of linear systems.

Key Concepts:

- Definition of a system of linear differential equations.
- Types of linear systems: homogeneous and non-homogeneous.
- Properties of linear systems and their solutions.

Teaching Strategies:

- Explanation of linear systems with examples.
- Derivation of solutions to linear systems.
- Visual aids to illustrate properties of linear systems.

Activities:

- Problem-solving exercises on solving linear systems.
- Analyzing real-world scenarios where linear systems are applicable.

Assessment:

- Understanding of linear systems.
- Problem-solving skills in solving linear systems.

Session 3: Differential Operators

Duration: 60 minutes

Objectives:

1. Introduce the concept of differential operators.
2. Understand their significance in solving differential equations.

Key Concepts:

- Definition of a differential operator.
- Types of differential operators: differentiation, integration, etc.
- Application of differential operators in solving differential equations.

Teaching Strategies:

- Explanation of differential operators with examples.
- Derivation of formulas for different types of differential operators.
- Real-world applications of differential operators.

Activities:

- Problem-solving exercises on using differential operators to solve ODEs.
- Analyzing real-world scenarios where differential operators are applicable.

Assessment:

- Understanding of differential operators.
- Problem-solving skills in using differential operators to solve ODEs.

Session 4: Operator Method for Linear Systems with Constant Coefficients

Duration: 60 minutes

Objectives:

1. Introduce the operator method for solving linear systems with constant coefficients.
2. Understand its applications and advantages.

Key Concepts:

- Definition of the operator method.
- Procedure for solving linear systems using the operator method.
- Application of the operator method to specific examples.

Teaching Strategies:

- Explanation of the operator method with examples.
- Step-by-step demonstration of solving linear systems using the operator method.
- Real-world applications of the operator method.

Activities:

- Problem-solving exercises on using the operator method to solve linear systems.
- Analyzing real-world scenarios where the operator method is applicable.

Assessment:

- Understanding of the operator method.
- Problem-solving skills in using the operator method to solve linear systems.

Session 5: Real-World Applications and Conclusion

Duration: 60 minutes

Objectives:

1. Apply the concepts learned to real-world scenarios.
2. Reflect on the importance of ODEs in various fields.

Key Concepts:

- Real-world applications of ODEs and linear systems.
- Importance of ODEs in science, engineering, and other fields.
- Future directions and applications of ODEs.

Teaching Strategies:

- Group discussions on real-world applications of ODEs.
- Presentation of case studies and examples in science and engineering.
- Reflection on personal learning experiences.

Activities:

- Group presentations on real-world applications of ODEs.
- Discussion on the relevance of ODEs in various fields.
- Reflection on personal learning experiences and growth.

Assessment:

- Evaluation of group presentations.
- Participation in class discussions.
- Reflection on personal learning experiences.

Conclusion:

This 5-hour lesson plan provides an introduction to Ordinary Differential Equations (ODEs) and explores linear systems and differential operators. Through interactive lectures, problem-solving exercises, and real-world applications, students will gain a solid understanding of ODEs and their significance in various fields. By incorporating real-world applications, the lesson plan ensures that students recognize the practical relevance of ODEs beyond the classroom, fostering engagement and deeper understanding.

Title: Understanding Planar Linear Autonomous Systems
Subtitle: Equilibrium Points and Phase Portraits

Title: Understanding Planar Linear Autonomous Systems
Duration: 5 hours (divided into 60-minute sessions)
Teacher's Name: UTTAM ROY MANDAL (URM)
Date: [Date of the Lesson]

Session 1: Introduction to Planar Linear Autonomous Systems

Duration: 60 minutes

Objectives:

1. Introduce the concept of planar linear autonomous systems.
2. Understand the significance of equilibrium points.
3. Interpret phase planes and phase portraits.

Key Concepts:

- Definition of planar linear autonomous systems.
- Equilibrium points and their classification.
- Interpretation of phase planes and phase portraits.

Teaching Strategies:

- Interactive lecture to introduce planar linear autonomous systems.
- Visualization of equilibrium points on phase planes and phase portraits.
- Real-world examples of systems modeled by ordinary differential equations.

Activities:

- Group discussion on real-world applications of planar linear autonomous systems.
- Visualization exercises using phase planes and phase portraits.

Assessment:

- Participation in group discussions.
- Completion of visualization exercises.

Session 2: Equilibrium (Critical) Points

Duration: 60 minutes

Objectives:

1. Explore the concept of equilibrium points in more detail.
2. Understand how equilibrium points affect the behavior of planar linear autonomous systems.

Key Concepts:

- Definition and classification of equilibrium points.
- Stability analysis of equilibrium points.
- Behavior of solutions near equilibrium points.

Teaching Strategies:

- Explanation of equilibrium points with examples.
- Derivation of stability criteria for equilibrium points.
- Visual aids to illustrate the behavior of solutions near equilibrium points.

Activities:

- Problem-solving exercises on stability analysis of equilibrium points.
- Analyzing real-world scenarios where equilibrium points are applicable.

Assessment:

- Understanding of equilibrium points.
- Problem-solving skills in stability analysis.

Session 3: Interpretation of Phase Plane and Phase Portraits

Duration: 60 minutes

Objectives:

1. Understand how to interpret phase planes and phase portraits.
2. Analyze the behavior of solutions of planar linear autonomous systems using phase portraits.

Key Concepts:

- Definition and construction of phase planes and phase portraits.
- Interpretation of trajectories on phase planes.
- Analysis of stability based on phase portraits.

Teaching Strategies:

- Explanation of phase planes and phase portraits with examples.
- Demonstration of trajectory analysis on phase portraits.
- Real-world examples of phase portraits representing physical systems.

Activities:

- Group exercises on interpreting phase portraits.
- Analyzing real-world scenarios using phase portraits.

Assessment:

- Understanding of phase planes and phase portraits.

- Interpretation skills in analyzing phase portraits.

Session 4: Real-World Applications

Duration: 60 minutes

Objectives:

1. Explore real-world applications of planar linear autonomous systems.
2. Understand how ordinary differential equations model dynamic systems.

Key Concepts:

- Applications of planar linear autonomous systems in physics, biology, and engineering.
- Examples of dynamic systems modeled by ordinary differential equations.
- Importance of equilibrium points and phase portraits in analyzing system behavior.

Teaching Strategies:

- Presentation of case studies and examples in various fields.
- Discussion on the relevance of planar linear autonomous systems in real-world applications.
- Demonstration of how equilibrium points and phase portraits are used in system analysis.

Activities:

- Group discussions on real-world applications of planar linear autonomous systems.
- Analyzing case studies and examples related to dynamic systems.

Assessment:

- Participation in group discussions.
- Understanding of real-world applications.

Session 5: Conclusion and Reflection

Duration: 60 minutes

Objectives:

1. Reflect on the concepts learned throughout the session.
2. Summarize the importance of equilibrium points and phase portraits in planar linear autonomous systems.

Key Concepts:

- Recap of planar linear autonomous systems, equilibrium points, and phase portraits.
- Importance of understanding these concepts in mathematical modeling and analysis.
- Reflection on personal learning experiences and growth.

Teaching Strategies:

- Facilitate a discussion on key takeaways from the session.
- Encourage students to share their reflections on the session.
- Provide guidance on further resources for continued learning.

Activities:

- Group reflection on the concepts learned.
- Personal reflection on the relevance of the session to their studies and future careers.

Assessment:

- Participation in group and personal reflections.
- Understanding of key concepts demonstrated through reflections.

Conclusion:

This 5-hour lesson plan provides undergraduate students with a comprehensive understanding of planar linear autonomous systems, focusing on equilibrium points and phase portraits. Through a structured approach, students learn how to interpret phase planes and phase portraits to analyze the behavior of solutions of ordinary differential equations. Real-world applications incorporated throughout the sessions ensure that students recognize the practical relevance of these concepts beyond the classroom. The lesson plan is designed to be engaging, interactive, and suitable for a 60-minute session, fostering a deeper understanding of ordinary differential equations among students.

Title: Exploring Ordinary Differential Equations
Subtitle: Power Series Solutions and Regular Singular Points
Duration: 5 hours (divided into 60-minute sessions)
Teacher's Name: UTTAM ROY MANDAL (URM)
Date: [Date of the Lesson]

Session 1: Introduction to Ordinary Differential Equations

Duration: 60 minutes

Objectives:

1. Understand the importance of ordinary differential equations (ODEs).
2. Introduce basic concepts and terminology related to ODEs.

Key Concepts:

- Definition of ordinary differential equations.
- Classification of ODEs based on order and linearity.
- Importance and applications of ODEs in various fields.

Teaching Strategies:

- Interactive lecture to engage students in understanding the relevance of ODEs.
- Definition and explanation of basic terminology.
- Real-world examples to illustrate applications of ODEs.

Activities:

- Group discussion on real-world applications of ODEs.
- Practice problems on identifying and classifying ODEs.

Assessment:

- Participation in group discussions.
- Completion of practice problems.

Session 2: Power Series Solutions

Duration: 60 minutes

Objectives:

1. Introduce the concept of power series solutions for ODEs.
2. Understand the procedure for finding power series solutions.

Key Concepts:

- Definition of power series solutions.
- Procedure for finding power series solutions.
- Conditions for convergence of power series solutions.

Teaching Strategies:

- Explanation of power series solutions with examples.
- Step-by-step demonstration of finding power series solutions.
- Discussion on conditions for convergence.

Activities:

- Problem-solving exercises on finding power series solutions for ODEs.
- Analyzing real-world scenarios where power series solutions are applicable.

Assessment:

- Understanding of power series solutions.
- Problem-solving skills in finding power series solutions.

Session 3: Solution about an Ordinary Point

Duration: 60 minutes

Objectives:

1. Introduce the concept of ordinary points in ODEs.
2. Understand the procedure for finding solutions about ordinary points.

Key Concepts:

- Definition of ordinary points.
- Procedure for finding solutions about ordinary points.
- Representation of solutions using power series.

Teaching Strategies:

- Explanation of ordinary points with examples.
- Step-by-step demonstration of finding solutions about ordinary points.
- Illustration of solutions using power series.

Activities:

- Problem-solving exercises on finding solutions about ordinary points for ODEs.
- Analyzing real-world scenarios where solutions about ordinary points are applicable.

Assessment:

- Understanding of solutions about ordinary points.
- Problem-solving skills in finding solutions about ordinary points.

Session 4: Solution about a Regular Singular Point

Duration: 60 minutes

Objectives:

1. Introduce the concept of regular singular points in ODEs.
2. Understand the procedure for finding solutions about regular singular points.

Key Concepts:

- Definition of regular singular points.
- Procedure for finding solutions about regular singular points.
- Representation of solutions using Frobenius method.

Teaching Strategies:

- Explanation of regular singular points with examples.
- Step-by-step demonstration of finding solutions about regular singular points.
- Introduction to the Frobenius method for finding solutions.

Activities:

- Problem-solving exercises on finding solutions about regular singular points for ODEs.
- Analyzing real-world scenarios where solutions about regular singular points are applicable.

Assessment:

- Understanding of solutions about regular singular points.
- Problem-solving skills in finding solutions about regular singular points.

Session 5: Real-World Applications and Conclusion

Duration: 60 minutes

Objectives:

1. Apply concepts learned in ODEs to real-world scenarios.
2. Reflect on the importance of ODEs in various fields.

Key Concepts:

- Real-world applications of power series solutions and solutions about ordinary and regular singular points.
- Importance of ODEs in physics, engineering, and other fields.

Teaching Strategies:

- Group discussions on real-world applications of ODEs.
- Presentation of case studies and examples in physics and engineering.

Activities:

- Group presentations on real-world applications of ODEs.
- Problem-solving exercises related to applications in physics and engineering.

Assessment:

- Evaluation of group presentations.
- Problem-solving assessments related to real-world applications.

Conclusion:

This 5-hour lesson plan aims to provide undergraduate students with a foundational understanding of ordinary differential equations, focusing on power series solutions and solutions about ordinary and regular singular points. Through a structured approach, students will develop essential skills in solving ODEs and recognize their importance in various fields such as physics, engineering, and mathematics. Real-world applications incorporated throughout the sessions ensure that students recognize the practical relevance of ODEs beyond the classroom. The lesson plan is designed to be engaging, interactive, and suitable for a 60-minute session, fostering a deeper understanding of ODEs among students.

Unit-2 : Multivariate Calculus-I

Title: Exploring Multivariate Calculus
Subtitle: Understanding Neighbourhoods, Limits, and Continuity in Higher Dimensions
Duration: 5 hours (divided into 60-minute sessions)
Teacher's Name: SWADHIN BANERJEE (SB)
Date: [Date of the Lesson]

Session 1: Introduction to Multivariate Calculus

Duration: 60 minutes

Objectives:

1. Introduce the concept of multivariate calculus.
2. Understand the importance of studying functions in higher dimensions.

Key Concepts:

- Definition of multivariate calculus.
- Functions in R^n and R^m
- Real-world applications of multivariate calculus.

Teaching Strategies:

- Interactive lecture to engage students in the relevance of multivariate calculus.
- Definition and explanation of basic terminology.
- Real-world examples to illustrate applications.

Activities:

- Group discussion on real-world applications of multivariate calculus.
- Practice problems on identifying functions in higher dimensions.

Assessment:

- Participation in group discussions.
- Completion of practice problems.

Session 2: Neighbourhoods and Sets in R^n

Duration: 60 minutes

Objectives:

1. Introduce the concept of neighbourhoods in R^n.
2. Understand open and closed sets in R^n.

Key Concepts:

- Definition of neighbourhoods, interior points, and limit points.
- Definition of open and closed sets.
- Properties of neighbourhoods and sets in higher dimensions.

Teaching Strategies:

- Explanation of neighbourhoods and sets with examples.
- Illustration of properties using diagrams.
- Real-world applications of neighbourhoods and sets.

Activities:

- Problem-solving exercises on identifying neighbourhoods and sets in R^n.
- Analyzing real-world scenarios where sets are applicable.

Assessment:

- Understanding of neighbourhoods and sets.
- Problem-solving skills in identifying properties of sets.

Session 3: Functions in R^n

Duration: 60 minutes

Objectives:

1. Introduce functions from R^n to R^m.
2. Understand the concepts of limit and continuity for multivariable functions.

Key Concepts:

- Definition of functions in higher dimensions.
- Limit of a function of two or more variables.
- Continuity of multivariable functions.

Teaching Strategies:

- Explanation of functions in higher dimensions with examples.
- Derivation of limits and continuity for multivariable functions.
- Real-world applications of multivariable functions.

Activities:

- Problem-solving exercises on finding limits and testing continuity.
- Analyzing real-world scenarios where multivariable functions are applicable.

Assessment:

- Understanding of functions in R^n.
- Problem-solving skills in finding limits and continuity.

Session 4: Real-World Applications

Duration: 60 minutes

Objectives:

1. Apply concepts learned in multivariate calculus to real-world scenarios.
2. Explore case studies and examples in physics, engineering, and economics.

Key Concepts:

- Real-world applications of neighbourhoods, sets, and multivariable functions.
- Importance of multivariate calculus in various fields.

Teaching Strategies:

- Group discussions on real-world applications of multivariate calculus.
- Presentation of case studies and examples in physics, engineering, and economics.

Activities:

- Group presentations on real-world applications of multivariate calculus.
- Problem-solving exercises related to applications in physics, engineering, and economics.

Assessment:

- Evaluation of group presentations.
- Problem-solving assessments related to real-world applications.

Session 5: Review and Conclusion

Duration: 60 minutes

Objectives:

1. Review and reinforce understanding of concepts learned in multivariate calculus.
2. Reflect on the importance of multivariate calculus in various fields.

Key Concepts:

- Comprehensive review of neighbourhoods, sets, and multivariable functions.
- Importance and applications of multivariate calculus.

Teaching Strategies:

- Conduct a comprehensive review of all topics covered in the sessions.
- Practice problems and quizzes to reinforce understanding.
- Facilitate a discussion on the significance of multivariate calculus.

Activities:

- Collaborative problem-solving exercises.
- Review quizzes to reinforce understanding.
- Final reflection and discussion on the importance of multivariate calculus.

Assessment:

- Assessment of understanding through quizzes and tests.
- Participation in final reflection discussion.

Conclusion:

This 5-hour lesson plan aims to provide undergraduate students with a foundational understanding of multivariate calculus, focusing on concepts such as neighbourhoods, sets, and functions in higher dimensions. Through a structured approach, students will develop essential skills in understanding and analyzing functions in RnRn and their real-world applications. The lesson plan is designed to be engaging, interactive, and suitable for a 60-minute session, fostering a deeper understanding of multivariate calculus among students.

Title: Exploring Multivariate Calculus
Subtitle: Partial Derivatives, Total Derivative, and Chain Rule
Duration: 5 hours (divided into 60-minute sessions)
Teacher's Name: SWADHIN BANERJEE (SB)
Date: [Date of the Lesson]

Session 1: Introduction to Multivariate Calculus

Duration: 60 minutes

Objectives:

1. Understand the importance of multivariate calculus.
2. Introduce basic concepts and terminology related to multivariate calculus.

Key Concepts:

- Definition of multivariate calculus.
- Basic operations and functions in multivariate calculus.
- Importance and applications of multivariate calculus in various fields.

Teaching Strategies:

- Interactive lecture to engage students in understanding the relevance of multivariate calculus.
- Definition and explanation of basic terminology.
- Real-world examples to illustrate applications of multivariate calculus.

Activities:

- Group discussion on real-world applications of multivariate calculus.
- Practice problems on basic operations and functions.

Assessment:

- Participation in group discussions.
- Completion of practice problems.

Session 2: Partial Derivatives

Duration: 60 minutes

Objectives:

1. Introduce the concept of partial derivatives.
2. Understand the computation and interpretation of partial derivatives.

Key Concepts:

- Definition of partial derivatives.
- Computation of partial derivatives for functions of multiple variables.
- Interpretation of partial derivatives as rates of change.

Teaching Strategies:

- Explanation of partial derivatives with examples.
- Step-by-step demonstration of computing partial derivatives.
- Visualization of partial derivatives using graphs.

Activities:

- Problem-solving exercises on computing and interpreting partial derivatives.
- Analyzing real-world scenarios where partial derivatives are applicable.

Assessment:

- Understanding of partial derivatives.
- Problem-solving skills in computing and interpreting partial derivatives.

Session 3: Total Derivative and Differentiability

Duration: 60 minutes

Objectives:

1. Introduce the concept of the total derivative.
2. Understand the conditions for differentiability.

Key Concepts:

- Definition of the total derivative.
- Conditions for differentiability of functions of multiple variables.
- Sufficient condition for differentiability.

Teaching Strategies:

- Explanation of the total derivative with examples.
- Discussion on conditions for differentiability.
- Derivation and explanation of the sufficient condition for differentiability.

Activities:

- Problem-solving exercises on computing the total derivative.
- Analyzing real-world scenarios where differentiability is applicable.

Assessment:

- Understanding of the total derivative and differentiability.
- Problem-solving skills in applying conditions for differentiability.

Session 4: Chain Rule for One and Two Independent Parameters

Duration: 60 minutes

Objectives:

1. Introduce the chain rule for functions of multiple variables.
2. Understand the application of the chain rule in various contexts.

Key Concepts:

- Chain rule for functions of one independent parameter.
- Chain rule for functions of two independent parameters.
- Application of the chain rule in optimization and curve tracing.

Teaching Strategies:

- Explanation of the chain rule with examples.
- Derivation and demonstration of the chain rule for one and two independent parameters.
- Real-world applications of the chain rule.

Activities:

- Problem-solving exercises on applying the chain rule for optimization and curve tracing.
- Analyzing real-world scenarios where the chain rule is applicable.

Assessment:

- Understanding of the chain rule for one and two independent parameters.
- Problem-solving skills in applying the chain rule.

Session 5: Real-World Applications and Conclusion

Duration: 60 minutes

Objectives:

1. Apply concepts learned in multivariate calculus to real-world scenarios.
2. Reflect on the importance of multivariate calculus in various fields.

Key Concepts:

- Real-world applications of partial derivatives, total derivatives, and the chain rule.
- Importance of multivariate calculus in physics, engineering, and economics.

Teaching Strategies:

- Group discussions on real-world applications of multivariate calculus.
- Presentation of case studies and examples in physics and engineering.

Activities:

- Group presentations on real-world applications of multivariate calculus.
- Problem-solving exercises related to applications in physics and engineering.

Assessment:

- Evaluation of group presentations.
- Problem-solving assessments related to real-world applications.

Conclusion:

This 5-hour lesson plan aims to provide undergraduate students with a foundational understanding of multivariate calculus, focusing on partial derivatives, total derivatives, and the chain rule. Through a structured approach, students will develop essential skills in analyzing functions of multiple variables and recognizing their importance in various fields such as physics, engineering, and economics. Real-world applications incorporated throughout the sessions ensure that students recognize the practical relevance of multivariate calculus beyond the classroom. The lesson plan is designed to be engaging, interactive, and suitable for a 60-minute session, fostering a deeper understanding of multivariate calculus among students.

Title: Mastering Multivariate Calculus
Subtitle: Exploring Directional Derivatives, Gradient, and Optimization
Duration: 20 hours (divided into 60-minute sessions)
Teacher's Name: SWADHIN BANERJEE (SB)
Date: [Date of the Lesson]

Session 1: Introduction to Multivariate Calculus

Duration: 60 minutes

Objectives:

1. Understand the importance of multivariate calculus in mathematics and real-world applications.
2. Introduce basic concepts and terminology related to multivariate calculus.

Key Concepts:

- Definition of multivariate calculus.
- Difference between single-variable and multivariable functions.
- Importance and applications of multivariate calculus in various fields.

Teaching Strategies:

- Interactive lecture to engage students in understanding the relevance of multivariate calculus.
- Definition and explanation of basic terminology.
- Real-world examples to illustrate applications of multivariate calculus.

Activities:

- Group discussion on real-world applications of multivariate calculus.
- Practice problems on identifying multivariable functions.

Assessment:

- Participation in group discussions.
- Completion of practice problems.

Session 2: Directional Derivatives

Duration: 60 minutes

Objectives:

1. Introduce the concept of directional derivatives.
2. Understand how to compute directional derivatives.

Key Concepts:

- Definition of directional derivatives.
- Computation of directional derivatives using gradients.
- Properties and interpretation of directional derivatives.

Teaching Strategies:

- Explanation of directional derivatives with examples.
- Step-by-step demonstration of computing directional derivatives.
- Visualization of directional derivatives using gradients.

Activities:

- Problem-solving exercises on computing directional derivatives.
- Analyzing real-world scenarios where directional derivatives are applicable.

Assessment:

- Understanding of directional derivatives.
- Problem-solving skills in computing directional derivatives.

Session 3: The Gradient

Duration: 60 minutes

Objectives:

1. Introduce the gradient of a function.
2. Understand its properties and applications.

Key Concepts:

- Definition of the gradient.
- Interpretation of the gradient as a vector.
- Properties of the gradient.

Teaching Strategies:

- Explanation of the gradient with examples.
- Illustration of properties of the gradient.
- Real-world applications of the gradient.

Activities:

- Problem-solving exercises on computing gradients.
- Analyzing real-world scenarios where the gradient is applicable.

Assessment:

- Understanding of the gradient.
- Problem-solving skills in computing gradients.

Session 4: Maximal and Normal Property of the Gradient

Duration: 60 minutes

Objectives:

1. Understand the maximal and normal property of the gradient.
2. Learn how to interpret and apply these properties.

Key Concepts:

- Maximal property of the gradient.
- Normal property of the gradient.
- Relationship between gradients and level curves.

Teaching Strategies:

- Explanation of maximal and normal property with examples.
- Illustration of the relationship between gradients and level curves.
- Real-world applications of maximal and normal property.

Activities:

- Problem-solving exercises on interpreting level curves and gradients.
- Analyzing real-world scenarios where maximal and normal property are applicable.

Assessment:

- Understanding of maximal and normal property.
- Problem-solving skills in interpreting level curves and gradients.

Session 5: Tangent Planes

Duration: 60 minutes

Objectives:

1. Introduce the concept of tangent planes to surfaces.
2. Understand how to find tangent planes.

Key Concepts:

- Definition of tangent planes.
- Computation of tangent planes using gradients.
- Properties and interpretation of tangent planes.

Teaching Strategies:

- Explanation of tangent planes with examples.
- Step-by-step demonstration of finding tangent planes.
- Visualization of tangent planes to surfaces.

Activities:

- Problem-solving exercises on finding tangent planes.
- Analyzing real-world scenarios where tangent planes are applicable.

Assessment:

- Understanding of tangent planes.
- Problem-solving skills in finding tangent planes.

Session 6: Extrema of Functions of Two Variables

Duration: 60 minutes

Objectives:

1. Introduce the concept of extrema for functions of two variables.
2. Understand how to find extrema using partial derivatives.

Key Concepts:

- Definition of extrema for functions of two variables.
- Classification of critical points as maxima, minima, or saddle points.
- Conditions for identifying extrema using second partial derivatives.

Teaching Strategies:

- Explanation of extrema with examples.
- Step-by-step demonstration of finding extrema using partial derivatives.
- Real-world applications of finding extrema.

Activities:

- Problem-solving exercises on finding extrema.
- Analyzing real-world scenarios where extrema are applicable.

Assessment:

- Understanding of extrema.

- Problem-solving skills in finding extrema.

Session 7: Method of Lagrange Multipliers

Duration: 60 minutes

Objectives:

1. Introduce the method of Lagrange multipliers for constrained optimization.
2. Understand how to use Lagrange multipliers to find extrema subject to constraints.

Key Concepts:

- Statement and interpretation of the method of Lagrange multipliers.
- Procedure for finding extrema subject to constraints using Lagrange multipliers.
- Real-world applications of Lagrange multipliers.

Teaching Strategies:

- Explanation of Lagrange multipliers with examples.
- Step-by-step demonstration of using Lagrange multipliers.
- Visualization of constrained optimization problems.

Activities:

- Problem-solving exercises on using Lagrange multipliers to find extrema.
- Analyzing real-world scenarios where Lagrange multipliers are applicable.

Assessment:

- Understanding of Lagrange multipliers.
- Problem-solving skills in using Lagrange multipliers.

Session 8-20: Real-World Applications and Case Studies

Duration: 60 minutes each

Objectives:

1. Apply concepts learned in multivariate calculus to real-world scenarios.
2. Explore case studies and examples in physics, economics, and engineering.

Key Concepts:

- Real-world applications of directional derivatives, gradients, tangent planes, and extrema.
- Importance of multivariate calculus in physics, economics, and engineering.

Teaching Strategies:

- Group discussions on real-world applications of multivariate calculus.
- Presentation of case studies and examples in physics, economics, and engineering.

Activities:

- Group presentations on real-world applications of multivariate calculus.
- Problem-solving exercises related to applications in physics, economics, and engineering.

Assessment:

- Evaluation of group presentations.
- Problem-solving assessments related to real-world applications.

Conclusion:

This 20-hour lesson plan aims to provide undergraduate students with a comprehensive understanding of multivariate calculus, covering concepts such as directional derivatives, gradients, tangent planes, and extrema. Through a structured approach, students will develop essential skills in solving optimization problems and recognize their importance in various fields such as physics, economics, and engineering. Real-world applications incorporated throughout the sessions ensure that students recognize the practical relevance of multivariate calculus beyond the classroom. The lesson plan is designed to be engaging, interactive,

C Programming Language

Semester : 3 Credits : 2

Skill Enhancement Course- SEC A Full Marks : 100

(=80+20*)

Paper Code (Theory) : MTM-A-SEC-A-TH

Title	Subtitle	Duration	Teacher's Name	Date
Introduction to C Programming	Theoretical Foundations and History of Computers	3 Hours	[URM]	[Date]
Objectives:	- Understand the theoretical concepts of computers			
	- Explore the history and evolution of computers			
Key Concepts:	- Theoretical computers			
	- Overview of computer architecture			
	- Compiler, assembler, machine language, high-level language			
	- Introduction to C programming and its importance			
Teaching Strategies:	Lecture, multimedia presentation			
Activities:	Discussion on the evolution of computers, Q&A session			
Assessment:	Short quiz on theoretical concepts			

Title	Subtitle	Duration	Teacher's Name	Date
Constants, Variables, and Data Types	Understanding Character Set and Declarations	3 Hours	[URM]	[Date]
Objectives:	- Define constants, variables, and data types in C			
Key Concepts:	- Character set			
	- Constants, variables, and data types			
	- Expression, assignment statements, and declaration			
Teaching Strategies:	Lecture, code examples			
Activities:	Hands-on practice with variable declarations and assignments			
Assessment:	In-class exercises and quizzes			

Title	Subtitle	Duration	Teacher's Name	Date
Operation and Expressions	Exploring Arithmetic, Relational, and Logical Operators	3 Hours	[URM]	[Date]
Objectives:	- Understand arithmetic, relational, and logical operators in C			
Key Concepts:	- Arithmetic operators			

Title	Subtitle	Duration	Teacher's Name	Date
	- Relational operators			
	- Logical operators			
Teaching Strategies:	Lecture, interactive coding demonstrations			
Activities:	Code writing exercises for each type of operator			
Assessment:	In-class coding assessment			

Title	Subtitle	Duration	Teacher's Name	Date
Decision Making and Branching	Implementing Decision-Making Statements in C	4 Hours	[URM]	[Date]
Objectives:	- Learn to use if, if-else, nested if, and switch statements in C			
Key Concepts:	- If statement			
	- If-else statement			
	- Nested if statement			
	- Switch statement			
Teaching Strategies:	Lecture, live coding sessions			
Activities:	Code implementation of decision-making scenarios			
Assessment:	Individual coding assignment			

Title	Subtitle	Duration	Teacher's Name	Date
Control Statements	Mastering While, Do-While, and For Loops in C	3 Hours	[URM]	[Date]
Objectives:	- Understand the usage of while, do-while, and for loops in C			
Key Concepts:	- While statement			
	- Do-while statement			
	- For statement			
Teaching Strategies:	Lecture, step-by-step coding walkthroughs			
Activities:	Hands-on coding practice with loops			
Assessment:	Group coding project using loops			

Title	Subtitle	Duration	Teacher's Name	Date
Arrays	Exploring One-Dimensional, Two-Dimensional, and Multidimensional Arrays	4 Hours	[URM]	[Date]
Objectives:	- Learn to declare and initialize one-dimensional and multi-dimensional arrays			

Title	Subtitle	Duration	Teacher's Name	Date
Key Concepts:	- One-dimensional arrays			
	- Two-dimensional arrays			
	- Multidimensional arrays			
Teaching Strategies:	Lecture, code demonstrations			
Activities:	Hands-on coding exercises with arrays			
Assessment:	In-class assessment on array manipulation			

Title	Subtitle	Duration	Teacher's Name	Date
User-defined Functions	Understanding Function Definitions, Scope, and Recurrence	4 Hours	[URM]	[Date]
Objectives:	- Define user-defined functions in C			
Key Concepts:	- Definition of functions			
	- Scope of variables			
	- Return values and their types			
	- Function declaration			
Teaching Strategies:	Lecture, live coding examples			
Activities:	Practice writing and calling functions			
Assessment:	Individual coding assignment on function implementation			

Title	Subtitle	Duration	Teacher's Name	Date
Introduction to Library Functions	Exploring Standard Library Functions in C	3 Hours	[Instructor]	[Date]
Objectives:	- Familiarize with standard library functions in C			
Key Concepts:	- Standard library functions			
Teaching Strategies:	Lecture, live coding demonstrations			
Activities:	Hands-on practice with library functions			
Assessment:	In-class assessment on library function usage			

Title	Subtitle	Duration	Teacher's Name	Date
Hands-On Examples	Applying C Programming Concepts in Real-world Scenarios	3 Hours	[URM]	[Date]
Objectives:	- Apply C programming concepts in practical scenarios			

Title	Subtitle	Duration	Teacher's Name	Date
Teaching Strategies:	Demonstration, hands-on coding sessions			
Activities:	Solving real-world problems using C programming			
Assessment:	Assessment based on real-world problem-solving skills			

By organizing the lesson plan in this manner, with clear objectives, key concepts, teaching strategies, activities, and assessments for each session, students can progress through the course in a structured and engaging manner. Real-world applications of C programming will help students see the relevance of the material beyond the classroom, enhancing their understanding and motivation.

Probability & Statistics

Semester : 5 Credits : 5+1*=6

Core Course-11 Full Marks :

65+15**+20***=100

Paper Code(Theory): MTM-A-CC-5-11-TH

Paper Code (Tutorial):MTM-A-CC-5-11-TU

Unit-1:

Title: Introduction to Probability & Statistics
Subtitle: Understanding Random Experiments and Probability Axioms
Duration: 5 hours (divided into 60-minute sessions)
Teacher's Name: DEBABRATA JANA (DJ)
Date: [Date of the Lesson]

Session 1: Introduction to Probability

Duration: 60 minutes

Objectives:

1. Understand the concept of probability.
2. Introduce basic terminology and concepts in probability theory.

Key Concepts:

- Definition of random experiment.
- Sigma-field and sample space.
- Probability as a set function.
- Probability axioms and probability space.

Teaching Strategies:

- Interactive lecture to introduce the concept of probability.
- Definition and explanation of basic terminology.
- Real-world examples to illustrate applications of probability.

Activities:

- Group discussion on real-world applications of probability.
- Practice problems on identifying sample spaces and calculating probabilities.

Assessment:

- Participation in group discussions.
- Completion of practice problems.

Session 2: Finite Sample Spaces

Duration: 60 minutes

Objectives:

1. Introduce finite sample spaces.
2. Understand how to calculate probabilities for finite sample spaces.

Key Concepts:

- Definition of finite sample spaces.
- Calculation of probabilities using classical probability.

Teaching Strategies:

- Explanation of finite sample spaces with examples.
- Step-by-step demonstration of calculating probabilities for finite sample spaces.
- Discussion on classical probability and its limitations.

Activities:

- Problem-solving exercises on calculating probabilities for finite sample spaces.
- Analyzing real-world scenarios with finite sample spaces.

Assessment:

- Understanding of finite sample spaces.

- Problem-solving skills in calculating probabilities.

Session 3: Conditional Probability

Duration: 60 minutes

Objectives:

1. Introduce the concept of conditional probability.
2. Understand its calculation and interpretation.

Key Concepts:

- Definition of conditional probability.
- Calculation of conditional probability using the probability formula.
- Interpretation of conditional probability in terms of events occurring together.

Teaching Strategies:

- Explanation of conditional probability with examples.
- Step-by-step demonstration of calculating conditional probabilities.
- Visualization of conditional probabilities using Venn diagrams.

Activities:

- Problem-solving exercises on calculating conditional probabilities.
- Analyzing real-world scenarios where conditional probabilities are applicable.

Assessment:

- Understanding of conditional probability.
- Problem-solving skills in calculating and interpreting conditional probabilities.

Session 4: Bayes Theorem

Duration: 60 minutes

Objectives:

1. Introduce Bayes' Theorem.
2. Understand its application in probability problems.

Key Concepts:

- Statement and proof of Bayes' Theorem.
- Application of Bayes' Theorem in probability problems.

Teaching Strategies:

- Explanation of Bayes' Theorem with examples.
- Derivation and proof of the theorem.
- Real-world applications of Bayes' Theorem in medical diagnosis, engineering, and finance.

Activities:

- Problem-solving exercises applying Bayes' Theorem to probability problems.
- Analyzing real-world scenarios where Bayes' Theorem is applicable.

Assessment:

- Understanding of Bayes' Theorem.
- Problem-solving skills in applying the theorem to probability problems.

Session 5: Independence

Duration: 60 minutes

Objectives:

1. Introduce the concept of independence between events.
2. Understand its calculation and implications.

Key Concepts:

- Definition of independence between events.
- Calculation of independence using conditional probability.
- Implications of independence in probability problems.

Teaching Strategies:

- Explanation of independence with examples.
- Step-by-step demonstration of calculating independence.
- Discussion on the implications of independence in probability problems.

Activities:

- Problem-solving exercises on identifying independence between events.
- Analyzing real-world scenarios where independence is applicable.

Assessment:

- Understanding of independence.
- Problem-solving skills in calculating and interpreting independence.

Real-World Applications

Throughout the sessions, real-world applications of probability and statistics will be incorporated, including:

- Medical diagnosis using conditional probability and Bayes' Theorem.
- Engineering applications such as reliability analysis and quality control.

- Financial applications such as risk assessment and portfolio optimization.

Conclusion:

This 5-hour lesson plan provides undergraduate students with a foundational understanding of probability and statistics, covering key concepts such as random experiments, probability axioms, conditional probability, Bayes' Theorem, and independence. Through a structured approach, students will develop essential skills in calculating probabilities and understanding their implications in various real-world scenarios. The incorporation of real-world applications ensures that students recognize the practical relevance of probability and statistics beyond the classroom. The lesson plan is designed to be engaging, interactive, and suitable for a 60-minute session, fostering a deeper understanding of probability and statistics among students.

Lesson Plan: Probability & Statistics in Mathematics

Title:	**Probability & Statistics Masterclass**
Subtitle:	Real Random Variables, Distributions, and Applications
Duration:	15 hours (divided into 15 sessions of 60 minutes each)
Teacher's Name:	DEBABRATA JANA (DJ)
Date:	[Date of the Session]

Session 1: Introduction to Probability (Duration: 60 minutes)

Objectives:

- Define probability and its significance.
- Understand basic terminology (sample space, events, outcomes).
- Introduce the concept of random variables.

Key Concepts:

- Probability basics
- Random variables

Teaching Strategies:

- Lecture with interactive discussions.
- Use real-world examples to explain probability concepts.
- Engage students in small-group discussions.

Activities:

1. Coin toss experiment to introduce probability.
2. Group discussion on everyday examples of random variables.

Assessment:

- Short quiz on basic probability concepts.

Session 2: Real Random Variables (Duration: 60 minutes)

Objectives:

- Differentiate between discrete and continuous random variables.
- Understand cumulative distribution functions.

Key Concepts:

- Discrete vs. continuous random variables
- Cumulative distribution function (CDF)

Teaching Strategies:

- Visualization of probability distributions.
- Hands-on examples with coin tosses and dice rolls.
- Interactive CDF calculations.

Activities:

1. Roll a fair six-sided die and calculate the CDF.
2. Compare and contrast discrete and continuous variables.

Assessment:

- Group activity: Create a CDF for a given set of discrete data.

Session 3: Probability Mass/Density Functions (Duration: 60 minutes)

Objectives:

- Define probability mass function (PMF) and probability density function (PDF).
- Understand the role of PMF and PDF in probability distributions.

Key Concepts:

- PMF and PDF
- Probability distribution functions

Teaching Strategies:

- Derive and interpret PMF and PDF.
- Solve practical problems using PMF and PDF.

Activities:

1. Calculate PMF for a given discrete distribution.

2. Graphical representation of PDF for continuous distributions.

Assessment:

- Individual assignment: Solve problems involving PMF and PDF.

Session 4: Mathematical Expectation (Duration: 60 minutes)

Objectives:

- Define mathematical expectation (expected value).
- Understand the linearity of expectation.

Key Concepts:

- Mathematical expectation
- Linearity of expectation

Teaching Strategies:

- Practical examples illustrating mathematical expectation.
- Group discussions on real-world applications.

Activities:

1. Calculate the expected value of a random experiment.
2. Discuss real-world scenarios where mathematical expectation is relevant.

Assessment:

- In-class problem-solving session on expected values.

Session 5: Moments and Moment Generating Function (Duration: 60 minutes)

Objectives:

- Define moments and their significance.
- Introduce the concept of moment generating functions (MGF).

Key Concepts:

- Moments
- Moment generating functions (MGF)

Teaching Strategies:

- Conceptual explanation of moments.
- Derive and interpret MGF.

Activities:

1. Calculate moments for a given probability distribution.
2. Explore the use of MGF in solving probability problems.

Assessment:

- Group project: Analyze a real-world scenario using moments and MGF.

Session 6: Characteristic Function (Duration: 60 minutes)

Objectives:

- Define characteristic functions and their properties.
- Understand the relationship between characteristic functions and probability distributions.

Key Concepts:

- Characteristic functions
- Properties of characteristic functions

Teaching Strategies:

- Visual representation of characteristic functions.
- Application of characteristic functions in statistics.

Activities:

1. Calculate characteristic functions for common distributions.
2. Analyze the properties of characteristic functions.

Assessment:

- Individual quiz on characteristic functions and their properties.

Session 7-12: Discrete Distributions (Duration: 60 minutes each)

Objectives:

- Explore various discrete probability distributions.
- Understand their properties and applications.

Key Concepts:

- Uniform, binomial, Poisson, geometric, negative binomial distributions.

Teaching Strategies:

- In-depth exploration of each distribution.
- Problem-solving sessions with real-world applications.

Activities:

1. Simulate scenarios using different discrete distributions.
2. Group projects: Analyze real-world data using discrete distributions.

Assessment:

- Weekly quizzes on discrete distributions.

Session 13-15: Continuous Distributions (Duration: 60 minutes each)

Objectives:

- Explore various continuous probability distributions.
- Understand their properties and applications.

Key Concepts:

- Uniform, normal, exponential distributions.

Teaching Strategies:

- In-depth exploration of each distribution.
- Practical examples and problem-solving sessions.

Activities:

1. Analyze real-world data using continuous distributions.
2. Group projects: Develop applications using continuous distributions.

Assessment:

- Weekly quizzes on continuous distributions.

Final Session: Real-World Applications (Duration: 60 minutes)

Objectives:

- Apply probability and statistics concepts to real-world scenarios.
- Demonstrate the relevance of the course beyond the classroom.

Key Concepts:

- Practical applications of probability and statistics.

Teaching Strategies:

- Guest speaker from a relevant industry.
- Group presentations on real-world applications.

Activities:

1. Case studies on real-world problems.
2. Group projects: Develop solutions using probability and statistics.

Assessment:

- Final project presentation and reflection on the course.

This comprehensive 15-hour lesson plan ensures a structured and engaging learning experience, gradually building students' understanding of probability and statistics concepts. The incorporation of real-world applications enhances the practical relevance of the material, fostering a deeper understanding among undergraduate students.

Unit-2

Title	Comprehensive Lesson Plan for Probability & Statistics in Mathematics
Subtitle	Joint Distributions, Regression, and Bivariate Normal Distribution
Duration	15 hours
Teacher's Name	DEBABRATA JANA (DJ)
Date	[Date of the session]

Session 1: Introduction to Joint Cumulative Distribution Function (CDF)

- **Duration:** 60 minutes
- **Objectives:**
  - Understand the concept of joint cumulative distribution function.
  - Learn the properties of joint CDF.
- **Key Concepts:**
  - Joint cumulative distribution function (CDF)
  - Properties of joint CDF
- **Teaching Strategies:**
  - Lecture with examples
  - Interactive discussion
- **Activities:**
  - Work through examples of joint CDFs
- **Assessment:**
  - Quiz on properties of joint CDF

Session 2: Joint Probability Density Functions (PDFs)

- **Duration:** 60 minutes
- **Objectives:**
  - Introduce joint probability density functions.
  - Understand the relationship between joint PDFs and joint CDFs.
- **Key Concepts:**
  - Joint probability density functions

    - Relationship between joint PDFs and joint CDFs
- **Teaching Strategies:**
    - Lecture with graphical representations
    - Group discussion
- **Activities:**
    - Work through problems involving joint PDFs
- **Assessment:**
    - Problem-solving exercise

Session 3: Marginal and Conditional Distributions

- **Duration:** 60 minutes
- **Objectives:**
    - Define marginal and conditional distributions.
    - Understand their significance in joint distributions.
- **Key Concepts:**
    - Marginal distributions
    - Conditional distributions
- **Teaching Strategies:**
    - Lecture with examples
    - Peer teaching
- **Activities:**
    - Derive marginal and conditional distributions from joint distributions
- **Assessment:**
    - Analytical exercise on marginal and conditional distributions

Session 4: Expectation and Moments of Two Random Variables

- **Duration:** 60 minutes
- **Objectives:**
    - Calculate expectations of functions of two random variables.
    - Understand moments of two random variables.
- **Key Concepts:**
    - Expectation of functions of two random variables
    - Moments
- **Teaching Strategies:**
    - Lecture with derivations
    - Problem-solving sessions
- **Activities:**
    - Calculate expectations and moments for various distributions
- **Assessment:**
    - Problem-solving assignment

Session 5: Covariance and Correlation Coefficient

- **Duration:** 60 minutes
- **Objectives:**
    - Define covariance and correlation coefficient.
    - Understand their roles in analyzing relationships between random variables.
- **Key Concepts:**
    - Covariance

    - Correlation coefficient
- **Teaching Strategies:**
    - Lecture with real-world examples
    - Group discussions
- **Activities:**
    - Calculate covariance and correlation coefficient for datasets
- **Assessment:**
    - Data analysis project

Session 6: Independent Random Variables

- **Duration:** 60 minutes
- **Objectives:**
    - Define independent random variables.
    - Understand the properties of independent random variables.
- **Key Concepts:**
    - Independent random variables
    - Properties of independence
- **Teaching Strategies:**
    - Lecture with proofs
    - Interactive exercises
- **Activities:**
    - Prove independence of random variables
- **Assessment:**
    - Logical reasoning questions

Session 7: Joint Moment Generating Function (MGF) and Calculation of Covariance

- **Duration:** 60 minutes
- **Objectives:**
    - Introduce joint moment generating functions.
    - Learn how to calculate covariance from MGF.
- **Key Concepts:**
    - Joint moment generating function (MGF)
    - Calculation of covariance from MGF
- **Teaching Strategies:**
    - Lecture with step-by-step calculations
    - Hands-on exercises
- **Activities:**
    - Compute MGF and covariance for given distributions
- **Assessment:**
    - Problem-solving assessment

Session 8: Characteristic Function and Conditional Expectations

- **Duration:** 60 minutes
- **Objectives:**
    - Understand characteristic functions.
    - Define conditional expectations and their applications.
- **Key Concepts:**
    - Characteristic function

    - Conditional expectations
- **Teaching Strategies:**
    - Lecture with illustrations
    - Peer teaching
- **Activities:**
    - Derive characteristic functions and compute conditional expectations
- **Assessment:**
    - Conceptual questions

Session 9: Linear Regression for Two Variables

- **Duration:** 60 minutes
- **Objectives:**
    - Introduce linear regression analysis.
    - Understand the concepts of slope, intercept, and residuals.
- **Key Concepts:**
    - Linear regression
    - Slope, intercept, and residuals
- **Teaching Strategies:**
    - Lecture with examples
    - Regression analysis using software tools
- **Activities:**
    - Perform linear regression analysis on datasets
- **Assessment:**
    - Regression analysis project

Session 10: Regression Curves

- **Duration:** 60 minutes
- **Objectives:**
    - Explore different types of regression curves.
    - Understand their applications in modeling data.
- **Key Concepts:**
    - Types of regression curves
    - Modeling data with regression curves
- **Teaching Strategies:**
    - Lecture with case studies
    - Interactive discussions
- **Activities:**
    - Fit regression curves to real-world datasets
- **Assessment:**
    - Model fitting exercise

Session 11: Bivariate Normal Distribution

- **Duration:** 60 minutes
- **Objectives:**
    - Introduce the bivariate normal distribution.
    - Understand its properties and applications.
- **Key Concepts:**
    - Bivariate normal distribution

    - Properties and applications
- **Teaching Strategies:**
    - Lecture with visual aids
    - Problem-solving sessions
- **Activities:**
    - Analyze data using bivariate normal distribution
- **Assessment:**
    - Data analysis project

Session 12: Real-world Applications

- **Duration:** 60 minutes
- **Objectives:**
    - Apply the concepts learned to real-world scenarios.
    - Understand the relevance of probability and statistics in various fields.
- **Key Concepts:**
    - Application of probability and statistics
- **Teaching Strategies:**
    - Case studies
    - Guest lectures (if possible)
- **Activities:**
    - Analyze real-world datasets
- **Assessment:**
    - Presentation of findings from real-world applications

Session 13: Review and Practice

- **Duration:** 60 minutes
- **Objectives:**
    - Review key concepts covered in the course.
    - Provide students with opportunities for additional practice.
- **Key Concepts:**
    - Comprehensive review of course material
- **Teaching Strategies:**
    - Review session with Q&A
    - Practice problems
- **Activities:**
    - Solve practice problems
- **Assessment:**
    - Comprehensive exam review

Session 14: Exam Preparation

- **Duration:** 60 minutes
- **Objectives:**
    - Prepare students for the final exam.
    - Address any remaining doubts or questions.
- **Key Concepts:**
    - Final exam preparation
- **Teaching Strategies:**
    - Exam-style questions

- One-on-one consultations
- **Activities:**
  - Practice exam questions
- **Assessment:**
  - Mock exam

Session 15: Final Exam

- **Duration:** 60 minutes
- **Objectives:**
  - Assess students' understanding of the course material.
- **Key Concepts:**
  - All concepts covered in the course
- **Teaching Strategies:**
  - Final exam
- **Assessment:**
  - Final exam

This comprehensive lesson plan covers a wide range of topics in probability and statistics, providing students with a thorough understanding of the subject matter. The incorporation of real-world applications helps demonstrate the relevance of the mathematical concepts beyond the classroom, enhancing students' engagement and understanding.

Unit-3

Title	Comprehensive Lesson Plan for Probability & Statistics in Mathematics
Subtitle	Markov's and Chebyshev's Inequalities, Convergence, and Central Limit Theorem
Duration	5 hours (60 minutes per session)
Teacher's Name	DEBABRATA JANA (DJ)
Date	[Date of the session]

Session 1: Markov's and Chebyshev's Inequalities

- **Duration:** 60 minutes
- **Objectives:**
  - Understand Markov's and Chebyshev's inequalities.
  - Learn how to apply these inequalities to probability distributions.
- **Key Concepts:**
  - Markov's inequality
  - Chebyshev's inequality
- **Teaching Strategies:**
  - Lecture with examples
  - Interactive discussion
- **Activities:**
  - Work through examples applying Markov's and Chebyshev's inequalities

- **Assessment:**
    - Quiz on the applications of Markov's and Chebyshev's inequalities

Session 2: Convergence in Probability

- **Duration:** 60 minutes
- **Objectives:**
    - Define convergence in probability.
    - Understand the implications and interpretations of convergence in probability.
- **Key Concepts:**
    - Convergence in probability
    - Interpretations and implications
- **Teaching Strategies:**
    - Lecture with illustrations
    - Group discussions
- **Activities:**
    - Analyze scenarios involving convergence in probability
- **Assessment:**
    - Conceptual questions on convergence in probability

Session 3: Weak Law of Large Numbers

- **Duration:** 60 minutes
- **Objectives:**
    - Introduce the weak law of large numbers.
    - Understand its statement and interpretation.
- **Key Concepts:**
    - Weak law of large numbers
    - Statement and interpretation
- **Teaching Strategies:**
    - Lecture with real-world examples
    - Peer teaching
- **Activities:**
    - Discuss applications of the weak law of large numbers
- **Assessment:**
    - Problem-solving exercise on weak law of large numbers

Session 4: Strong Law of Large Numbers

- **Duration:** 60 minutes
- **Objectives:**
    - Introduce the strong law of large numbers.
    - Understand its statement and interpretation.
- **Key Concepts:**
    - Strong law of large numbers
    - Statement and interpretation
- **Teaching Strategies:**
    - Lecture with proofs
    - Interactive exercises
- **Activities:**
    - Discuss applications of the strong law of large numbers

- **Assessment:**
    - Analytical exercise on strong law of large numbers

Session 5: Central Limit Theorem

- **Duration:** 60 minutes
- **Objectives:**
    - Introduce the central limit theorem.
    - Understand its application to independent and identically distributed random variables.
- **Key Concepts:**
    - Central limit theorem
    - Application to iid random variables
- **Teaching Strategies:**
    - Lecture with visual aids
    - Problem-solving sessions
- **Activities:**
    - Work through examples applying the central limit theorem
- **Assessment:**
    - Data analysis project using the central limit theorem

Real-World Applications:

- **Duration:** Ongoing throughout the sessions
- **Objectives:**
    - Connect mathematical concepts to real-world scenarios.
    - Demonstrate the practical relevance of probability and statistics.
- **Key Concepts:**
    - Application of probability and statistics in various fields
- **Teaching Strategies:**
    - Incorporate case studies
    - Discuss real-world examples during lectures
- **Activities:**
    - Analyze real-world datasets
- **Assessment:**
    - Presentation of findings from real-world applications

This lesson plan covers fundamental concepts in probability and statistics, providing a comprehensive understanding of Markov's and Chebyshev's inequalities, convergence, and the central limit theorem. Real-world applications are integrated throughout the sessions to demonstrate the practical relevance of these mathematical concepts.

Unit-4:

Title	Probability & Statistics in Mathematics
Subtitle	Sampling and Sampling Distributions
Duration	5 hours (divided into 60-minute sessions)
Teacher's Name	[DEBABRATA JANA (DJ)
Date	[Date of the Lesson Plan]

Session 1: Introduction to Sampling

- **Duration:** 60 minutes
- **Objectives:**
  - Define populations and samples.
  - Understand the concept of a random sample.
- **Key Concepts:**
  - Populations and Samples
  - Random Sample
- **Teaching Strategies:**
  - Lecture and discussion
- **Activities:**
  - Discuss real-world scenarios where sampling is used.
  - Work through examples of simple random sampling.

Session 2: Distribution of Samples

- **Duration:** 60 minutes
- **Objectives:**
  - Explore the distribution of a sample.
  - Understand simple random sampling with and without replacement.
- **Key Concepts:**
  - Distribution of the Sample
  - Simple Random Sampling
- **Teaching Strategies:**
  - Demonstration and hands-on activities
- **Activities:**
  - Conduct a hands-on activity demonstrating simple random sampling with and without replacement.
  - Discuss and analyze sample characteristics.

Session 3: Sampling Distributions

- **Duration:** 60 minutes

- **Objectives:**
    - Understand the concept of sampling distributions.
    - Explore the distribution of the sample mean.
- **Key Concepts:**
    - Sampling Distributions
- **Teaching Strategies:**
    - Interactive simulations and group discussions
- **Activities:**
    - Use simulations to demonstrate sampling distributions.
    - Discuss real-world applications of sampling distributions.

Session 4: Sampling from Normal Distributions

- **Duration:** 60 minutes
- **Objectives:**
    - Understand sampling from normal distributions.
    - Explore the Central Limit Theorem.
- **Key Concepts:**
    - Central Limit Theorem
- **Teaching Strategies:**
    - Interactive discussions and practical examples
- **Activities:**
    - Work through examples of sampling from normal distributions.
    - Discuss real-world applications of the Central Limit Theorem.

Session 5: Real-World Applications and Assessment

- **Duration:** 60 minutes
- **Objectives:**
    - Apply the concepts learned to real-world scenarios.
    - Assess understanding through problem-solving exercises.
- **Key Concepts:**
    - Application of Sampling and Sampling Distributions
- **Teaching Strategies:**
    - Group projects and case studies
- **Activities:**
    - Students work on group projects applying sampling and sampling distribution concepts to real-world problems.
    - Problem-solving exercises to assess understanding.

Note: This lesson plan provides a comprehensive overview of sampling and sampling distributions, incorporating real-world applications to enhance understanding and engagement.

Title	Probability & Statistics in Mathematics
Subtitle	Sampling Distributions
Duration	5 hours (divided into 60-minute sessions)
Teacher's Name	DEBABRATA JANA (DJ)
Date	[Date of the Lesson Plan]

Session 1: Introduction to Sampling Distributions

- **Duration:** 60 minutes
- **Objectives:**
  - Understand the concept of sampling distributions.
  - Learn about sample moments and sample variance.
- **Key Concepts:**
  - Sampling Distributions
  - Sample Moments
  - Sample Variance
- **Teaching Strategies:**
  - Lecture and interactive discussions
- **Activities:**
  - Discuss real-world examples where sampling distributions are used.
  - Work through examples of calculating sample moments and sample variance.

Session 2: Sampling from Normal Distributions

- **Duration:** 60 minutes
- **Objectives:**
  - Explore sampling from normal distributions.
  - Understand the properties of normal distributions.
- **Key Concepts:**
  - Sampling from Normal Distributions
- **Teaching Strategies:**
  - Problem-solving exercises and group discussions
- **Activities:**
  - Work through examples of sampling from normal distributions.
  - Discuss real-world applications of normal distributions in various fields such as finance, biology, and engineering.

Session 3: Chi-square, t, and F-distributions

- **Duration:** 60 minutes
- **Objectives:**
  - Introduce Chi-square, t, and F-distributions.
  - Understand their properties and applications.
- **Key Concepts:**

    - Chi-square Distribution
    - t Distribution
    - F Distribution
- **Teaching Strategies:**
    - Interactive simulations and group discussions
- **Activities:**
    - Use simulations to demonstrate Chi-square, t, and F-distributions.
    - Discuss real-world scenarios where these distributions are applied, such as hypothesis testing and analysis of variance.

Session 4: Sampling Distribution of X and s^2

- **Duration:** 60 minutes
- **Objectives:**
    - Explore the sampling distribution of X and s^2.
    - Understand their importance in statistical inference.
- **Key Concepts:**
    - Sampling Distribution of X
    - Sampling Distribution of s^2
- **Teaching Strategies:**
    - Problem-solving exercises and case studies
- **Activities:**
    - Work through examples of calculating sampling distributions of X and s^2.
    - Discuss real-world applications of these distributions in quality control and process improvement.

Session 5: sqrt(n)/s (X − μ) and Real-world Applications

- **Duration:** 60 minutes
- **Objectives:**
    - Learn about the standard error of the mean and its significance.
    - Explore real-world applications of sampling distributions.
- **Key Concepts:**
    - Standard Error of the Mean
- **Teaching Strategies:**
    - Interactive discussions and practical examples
- **Activities:**
    - Calculate sqrt(n)/s (X − μ) for given data sets.
    - Discuss real-world applications such as opinion polls, market research, and medical trials where understanding sampling distributions is crucial for making accurate predictions and decisions.

Note: This lesson plan aims to provide a comprehensive understanding of sampling distributions and their applications, integrating theoretical concepts with real-world relevance to engage undergraduate students.

Title	Probability & Statistics in Mathematics
Subtitle	Estimation of Parameters, Maximum Likelihood Method
Duration	7 hours (divided into 60-minute sessions)
Teacher's Name	DEBABRATA JANA (DJ)
Date	[Date of the Lesson Plan]

Session 1: Introduction to Estimation of Parameters

- **Duration:** 60 minutes
- **Objectives:**
  - Understand the concept of parameter estimation.
  - Introduce point estimation.
- **Key Concepts:**
  - Parameter Estimation
  - Point Estimation
- **Teaching Strategies:**
  - Lecture and interactive discussions
- **Activities:**
  - Discuss real-world scenarios where parameter estimation is used.
  - Work through examples of point estimation.

Session 2: Interval Estimation - Confidence Intervals

- **Duration:** 60 minutes
- **Objectives:**
  - Introduce interval estimation.
  - Understand the concept of confidence intervals.
- **Key Concepts:**
  - Confidence Intervals
  - Mean-squared Error
- **Teaching Strategies:**
  - Problem-solving exercises and group discussions
- **Activities:**
  - Work through examples of constructing confidence intervals for mean and variance of normal population.
  - Discuss the concept of mean-squared error.

Session 3: Properties of Good Estimators

- **Duration:** 60 minutes
- **Objectives:**
  - Understand the properties of good estimators.
  - Introduce Minimum-Variance Unbiased Estimator (MVUE).
- **Key Concepts:**
  - Unbiasedness, Consistency, Sufficiency
  - MVUE
- **Teaching Strategies:**
  - Case studies and interactive discussions
- **Activities:**
  - Analyze examples to identify properties of good estimators.
  - Solve problems related to MVUE.

Session 4: Maximum Likelihood Method - Introduction and Likelihood Function

- **Duration:** 60 minutes
- **Objectives:**
  - Introduce the Maximum Likelihood Method.
  - Understand the concept of the likelihood function.
- **Key Concepts:**
  - Maximum Likelihood Method

    - Likelihood Function
- **Teaching Strategies:**
    - Lecture and interactive discussions
- **Activities:**
    - Work through examples to calculate likelihood functions.
    - Discuss the applications of the Maximum Likelihood Method.

Session 5: ML Estimators for Discrete Models

- **Duration:** 60 minutes
- **Objectives:**
    - Understand ML estimators for discrete models.
    - Apply the Maximum Likelihood Method to solve problems.
- **Key Concepts:**
    - ML Estimators for Discrete Models
- **Teaching Strategies:**
    - Problem-solving exercises and group discussions
- **Activities:**
    - Solve problems involving ML estimators for discrete models.
    - Discuss real-world applications.

Session 6: ML Estimators for Continuous Models

- **Duration:** 60 minutes
- **Objectives:**
    - Understand ML estimators for continuous models.
    - Apply the Maximum Likelihood Method to solve problems.
- **Key Concepts:**
    - ML Estimators for Continuous Models
- **Teaching Strategies:**
    - Problem-solving exercises and group discussions
- **Activities:**
    - Solve problems involving ML estimators for continuous models.
    - Discuss real-world applications.

Session 7: Review and Application

- **Duration:** 60 minutes
- **Objectives:**
    - Review key concepts from previous sessions.
    - Apply the learned concepts to real-world scenarios and case studies.
- **Key Concepts:**
    - Comprehensive Review
    - Real-world Applications
- **Teaching Strategies:**
    - Group projects, case studies, and problem-solving sessions
- **Activities:**
    - Students work on group projects applying probability and statistics concepts.
    - Present real-world applications and case studies related to the course material.

Note: The lesson plan structure ensures a gradual progression from basic concepts to more advanced topics, allowing for a comprehensive understanding of estimation methods. Real-world applications are incorporated throughout to demonstrate the relevance of the mathematical concepts.

Unit-5:

Title	Probability & Statistics in Mathematics
Subtitle	Statistical Hypothesis Testing
Duration	15 hours (divided into 60-minute sessions)
Teacher's Name	DEBABRATA JANA (DJ)
Date	[Date of the Lesson Plan]

Session 1: Introduction to Statistical Hypothesis Testing

- Duration: 60 minutes
  - Objectives:
    - Define statistical hypotheses.
    - Understand null and alternative hypotheses.
  - Key Concepts:
    - Simple and Composite Hypotheses
    - Null and Alternative Hypotheses
  - Teaching Strategies:
    - Lecture and interactive discussion
  - Activities:
    - Discuss real-world examples of hypothesis testing.
    - Identify null and alternative hypotheses in various scenarios.

Session 2: Types of Hypotheses and Errors

- Duration: 60 minutes
  - Objectives:
    - Understand one-sided and two-sided hypotheses.
    - Introduce type I and type II errors.
  - Key Concepts:
    - One-sided and Two-sided Hypotheses
    - Type I and Type II Errors
  - Teaching Strategies:
    - Problem-solving exercises and group discussions
  - Activities:
    - Distinguish between one-sided and two-sided hypotheses.
    - Discuss scenarios where type I and type II errors occur.

Session 3: Critical Region and Test Statistic

- Duration: 60 minutes

- Objectives:
    - Define critical region and test statistic.
- Key Concepts:
    - Critical Region
    - Test Statistic
- Teaching Strategies:
    - Interactive simulations and group discussions
- Activities:
    - Illustrate critical regions and test statistics using simulations.
    - Work through examples to determine critical regions and test statistics.

Session 4: Level of Significance and Power Function

- Duration: 60 minutes
    - Objectives:
        - Understand the concept of level of significance.
        - Introduce the power function of a test.
    - Key Concepts:
        - Level of Significance
        - Power Function
    - Teaching Strategies:
        - Lecture and problem-solving exercises
    - Activities:
        - Discuss the significance of the level of significance in hypothesis testing.
        - Calculate the power function for various tests.

Session 5: Most Powerful Test

- Duration: 60 minutes
    - Objectives:
        - Understand the concept of the most powerful test.
    - Key Concepts:
        - Most Powerful Test
    - Teaching Strategies:
        - Lecture and interactive discussions
    - Activities:
        - Discuss the concept of the most powerful test and its applications.
        - Work through examples to find the most powerful test for given scenarios.

Session 6: The p-value

- Duration: 60 minutes
    - Objectives:
        - Define the p-value and its significance.
    - Key Concepts:
        - p-value
    - Teaching Strategies:
        - Interactive discussions and practical examples
    - Activities:
        - Calculate p-values for given hypotheses.
        - Discuss the interpretation of p-values in hypothesis testing.

Session 7: Calculating p-values

- Duration: 60 minutes
    - Objectives:
        - Learn methods for calculating p-values.
    - Key Concepts:
        - Calculating p-values
    - Teaching Strategies:
        - Problem-solving exercises and group discussions
    - Activities:
        - Work through examples to calculate p-values using various techniques.
        - Discuss the advantages and limitations of different methods.

Session 8: Simple Hypothesis versus Simple Alternative

- Duration: 60 minutes
    - Objectives:
        - Understand the concept of simple hypothesis versus simple alternative.
    - Key Concepts:
        - Simple Hypothesis versus Simple Alternative
    - Teaching Strategies:
        - Lecture and interactive discussions
    - Activities:
        - Present the concept of simple hypothesis versus simple alternative.
        - Discuss real-world examples illustrating this concept.

Session 9: Neyman-Pearson Lemma (Statement only)

- Duration: 60 minutes
    - Objectives:
        - Introduce the Neyman-Pearson Lemma.
    - Key Concepts:
        - Neyman-Pearson Lemma (Statement)
    - Teaching Strategies:
        - Lecture and interactive discussions
    - Activities:
        - Present the statement of the Neyman-Pearson Lemma.
        - Discuss its implications in hypothesis testing.

Session 10: Introduction to Bivariate Frequency Distribution

- Duration: 60 minutes
    - Objectives:
        - Define bivariate data and frequency distribution.
    - Key Concepts:
        - Bivariate Data
        - Frequency Distribution
    - Teaching Strategies:
        - Demonstration and hands-on activities
    - Activities:
        - Create frequency distributions for bivariate data sets.
        - Discuss real-world applications of bivariate frequency distributions.

Session 11: Scatter Diagram

- Duration: 60 minutes
    - Objectives:
        - Understand scatter diagrams as a visual representation of bivariate data.
    - Key Concepts:
        - Scatter Diagram
    - Teaching Strategies:
        - Interactive simulations and group discussions
    - Activities:
        - Create scatter diagrams from given bivariate data sets.
        - Discuss the interpretation of scatter diagrams.

Session 12: Correlation

- Duration: 60 minutes
    - Objectives:
        - Understand correlation as a measure of association between variables.
    - Key Concepts:
        - Correlation
    - Teaching Strategies:
        - Problem-solving exercises and group discussions
    - Activities:
        - Calculate correlation coefficients for given data sets.
        - Discuss the interpretation of correlation coefficients.

Session 13: Linear Regression

- Duration: 60 minutes
    - Objectives:
        - Introduce linear regression as a method for modeling the relationship between variables.
    - Key Concepts:
        - Linear Regression
    - Teaching Strategies:
        - Lecture and interactive discussions
    - Activities:
        - Perform linear regression analysis on bivariate data sets.
        - Interpret the results of linear regression analysis.

Session 14: Principle of Least Squares and Fitting of Polynomials

- Duration: 60 minutes
    - Objectives:
        - Learn about the principle of least squares in curve fitting.
    - Key Concepts:
        - Principle of Least Squares
        - Fitting of Polynomials
    - Teaching Strategies:
        - Interactive simulations and group discussions
    - Activities:
        - Fit polynomials to bivariate data sets using the principle of least squares.
        - Discuss the advantages and limitations of polynomial curve fitting.

Session 15: Fitting of Exponential Curves and Real-world Applications

- Duration: 60 minutes
    - Objectives:
        - Introduce fitting of exponential curves to bivariate data.
        - Explore real-world applications of bivariate frequency distribution, correlation, and regression.
    - Key Concepts:
        - Fitting of Exponential Curves
        - Real-world Applications
    - Teaching Strategies:
        - Case studies and interactive discussions
    - Activities:
        - Fit exponential curves to bivariate data sets.
        - Discuss real-world applications of bivariate frequency distribution, correlation, and regression in various fields such as economics, biology, and engineering.

Group Theory-II & Linear Algebra-II

Semester : 5 Credits : 5+1*=6

Core Course-12 Full Marks : 65+15**+20***=100

Paper Code(Theory): MTM-A-CC-5-12-TH

Paper Code (Tutorial):MTM-A-CC-5-12-TU

Unit-1 : Group theory

Title	Group Theory in Mathematics
Subtitle	External Direct Product and Finite Abelian Groups
Duration	20 hours (divided into 60-minute sessions)
Teacher's Name	Swadhin Banerjee (SB)
Date	[Date of the Lesson Plan]

Session 1: Introduction to Group Theory

- **Duration:** 60 minutes
- **Objectives:**
    - Define a group and its basic properties.
    - Introduce the concept of group operations.
- **Key Concepts:**
    - Group Definition

- Group Operations
- **Teaching Strategies:**
    - Lecture and interactive discussions
- **Activities:**
    - Discuss examples of groups in various contexts.
    - Work through basic group operations.

Session 2: External Direct Product - Introduction

- **Duration:** 60 minutes
- **Objectives:**
    - Define external direct product of groups.
    - Understand the properties of external direct products.
- **Key Concepts:**
    - External Direct Product
- **Teaching Strategies:**
    - Lecture and problem-solving exercises
- **Activities:**
    - Work through examples of external direct products.
    - Discuss properties of external direct products.

Session 3-5: External Direct Product and Its Properties

- **Duration:** 60 minutes each (3 sessions)
- **Objectives:**
    - Explore the properties of external direct products in detail.
- **Key Concepts:**
    - Properties of External Direct Products
- **Teaching Strategies:**
    - Interactive discussions, proofs, and problem-solving
- **Activities:**
    - Prove the properties of external direct products.
    - Work on exercises to reinforce understanding.

Session 6: Group of Units Modulo n as External Direct Product

- **Duration:** 60 minutes
- **Objectives:**
    - Understand the group of units modulo n.
    - Represent the group of units modulo n as an external direct product.
- **Key Concepts:**
    - Group of Units Modulo n
- **Teaching Strategies:**
    - Lecture and group discussions
- **Activities:**
    - Explore examples of the group of units modulo n.
    - Discuss how it can be represented as an external direct product.

Session 7-10: Internal Direct Product

- **Duration:** 60 minutes each (4 sessions)
- **Objectives:**
  - Define internal direct product.
  - Explore properties of internal direct products.
- **Key Concepts:**
  - Internal Direct Product
- **Teaching Strategies:**
  - Examples, proofs, and problem-solving
- **Activities:**
  - Prove properties of internal direct products.
  - Work through examples demonstrating internal direct products.

Session 11: Converse of Lagrange's Theorem for Finite Abelian Group

- **Duration:** 60 minutes
- **Objectives:**
  - State and understand the converse of Lagrange's theorem.
  - Apply the converse to finite abelian groups.
- **Key Concepts:**
  - Converse of Lagrange's Theorem
- **Teaching Strategies:**
  - Lecture, examples, and group discussions
- **Activities:**
  - Work through examples applying the converse of Lagrange's theorem.
  - Discuss its implications in the context of finite abelian groups.

Session 12: Cauchy's Theorem for Finite Abelian Group

- **Duration:** 60 minutes
- **Objectives:**
  - State and understand Cauchy's theorem for finite abelian groups.
  - Apply the theorem to solve problems.
- **Key Concepts:**
  - Cauchy's Theorem for Finite Abelian Groups
- **Teaching Strategies:**
  - Problem-solving exercises and group discussions
- **Activities:**
  - Solve problems applying Cauchy's theorem.
  - Discuss the significance of the theorem in the study of finite abelian groups.

Session 13-16: Fundamental Theorem of Finite Abelian Groups

- **Duration:** 60 minutes each (4 sessions)
- **Objectives:**
  - State and prove the Fundamental Theorem of Finite Abelian Groups.
- **Key Concepts:**
  - Fundamental Theorem of Finite Abelian Groups
- **Teaching Strategies:**
  - Proofs, examples, and group discussions
- **Activities:**

    - Work through the proof of the Fundamental Theorem.
    - Apply the theorem to classify finite abelian groups.

Session 17-20: Real-world Applications and Review

- **Duration:** 60 minutes each (4 sessions)
- **Objectives:**
    - Explore real-world applications of group theory.
    - Review key concepts and theorems covered in the course.
- **Key Concepts:**
    - Applications of Group Theory
- **Teaching Strategies:**
    - Case studies, discussions, and review sessions
- **Activities:**
    - Discuss applications of group theory in cryptography, physics, and computer science.
    - Review key theorems and concepts through problem-solving and discussions.

Unit-2 : Linear algebra

Title	Linear Algebra: Fundamentals and Applications
Subtitle	Inner Product Spaces and Orthogonalization Processes
Duration	10 hours (divided into 60-minute sessions)
Teacher's Name	Swadhin Banerjee (SB)
Date	[Date of the Lesson Plan]

Session 1: Introduction to Inner Product Spaces

- **Duration:** 60 minutes
- **Objectives:**
    - Define inner product spaces and norms.
    - Understand the properties of inner products.
- **Key Concepts:**
    - Inner Product Spaces
    - Norms
- **Teaching Strategies:**
    - Lecture and interactive discussion
- **Activities:**
    - Discuss real-world examples of inner product spaces.
    - Work through examples illustrating inner product properties.

Session 2: Gram-Schmidt Orthonormalization Process

- **Duration:** 60 minutes
- **Objectives:**
    - Introduce the Gram-Schmidt process for orthonormalization.

    - Understand the steps involved in the process.
- **Key Concepts:**
    - Gram-Schmidt Process
    - Orthonormalization
- **Teaching Strategies:**
    - Demonstration and problem-solving exercises
- **Activities:**
    - Walk through the steps of the Gram-Schmidt process with examples.
    - Apply the process to vectors in different spaces.

Session 3: Orthogonal Complements

- **Duration:** 60 minutes
- **Objectives:**
    - Define orthogonal complements of subspaces.
    - Understand the properties of orthogonal complements.
- **Key Concepts:**
    - Orthogonal Complements
- **Teaching Strategies:**
    - Interactive discussions and problem-solving
- **Activities:**
    - Work through examples to find orthogonal complements of subspaces.
    - Discuss applications of orthogonal complements in geometry and optimization.

Session 4: Bessel's Inequality

- **Duration:** 60 minutes
- **Objectives:**
    - Introduce Bessel's inequality and its significance.
    - Understand the relationship between norms and inner products.
- **Key Concepts:**
    - Bessel's Inequality
- **Teaching Strategies:**
    - Lecture and interactive discussions
- **Activities:**
    - Prove Bessel's inequality and discuss its implications.
    - Work through examples illustrating the inequality in various contexts.

Session 5: The Adjoint of a Linear Operator

- **Duration:** 60 minutes
- **Objectives:**
    - Define the adjoint of a linear operator.
    - Understand its properties and significance.
- **Key Concepts:**
    - Adjoint of a Linear Operator
- **Teaching Strategies:**
    - Problem-solving exercises and group discussions

- **Activities:**
    - Discuss the concept of the adjoint operator and its relation to inner products.
    - Work through examples finding adjoints of linear operators.

Session 6: Basic Properties of the Adjoint

- **Duration:** 60 minutes
- **Objectives:**
    - Explore basic properties of the adjoint operator.
    - Understand its role in inner product spaces.
- **Key Concepts:**
    - Properties of the Adjoint
- **Teaching Strategies:**
    - Lecture and interactive discussions
- **Activities:**
    - Discuss properties such as linearity, self-adjointness, and invertibility of the adjoint.
    - Work through examples illustrating these properties.

Session 7: Applications of Inner Product Spaces

- **Duration:** 60 minutes
- **Objectives:**
    - Explore real-world applications of inner product spaces and norms.
    - Understand how these concepts are used in various fields.
- **Key Concepts:**
    - Real-world Applications
- **Teaching Strategies:**
    - Case studies and interactive discussions
- **Activities:**
    - Present case studies from physics, engineering, and computer science where inner product spaces are utilized.
    - Discuss the importance of norms in optimization problems.

Session 8: Practical Examples of Orthogonalization

- **Duration:** 60 minutes
- **Objectives:**
    - Apply the Gram-Schmidt process to real-world examples.
    - Understand the practical significance of orthogonalization.
- **Key Concepts:**
    - Orthogonalization
- **Teaching Strategies:**
    - Problem-solving exercises and group discussions
- **Activities:**
    - Work through practical examples of orthogonalization in vector spaces.
    - Discuss the importance of orthogonal bases in signal processing and image compression.

Session 9: Advanced Applications of the Adjoint

- **Duration:** 60 minutes
- **Objectives:**
    - Explore advanced applications of the adjoint operator.

    - Understand its role in functional analysis and quantum mechanics.
- **Key Concepts:**
    - Advanced Applications
- **Teaching Strategies:**
    - Lecture and interactive discussions
- **Activities:**
    - Discuss applications of the adjoint in solving differential equations and integral transforms.
    - Explore its role in quantum mechanics, particularly in the context of Hermitian operators.

Session 10: Review and Synthesis

- **Duration:** 60 minutes
- **Objectives:**
    - Review key concepts covered throughout the course.
    - Synthesize learning through problem-solving and discussion.
- **Teaching Strategies:**
    - Group discussions and problem-solving exercises
- **Activities:**
    - Review important theorems and concepts from each session.
    - Work through challenging problems that require the application of multiple concepts learned in the course.

Note: This lesson plan offers a comprehensive exploration of inner product spaces and their applications, providing both theoretical understanding and practical skills for undergraduate students.

Title	Linear Algebra: Advanced Topics
Subtitle	Bilinear and Quadratic Forms, Diagonalization of Symmetric Matrices
Duration	10 hours (10 sessions x 60 minutes)
Teacher's Name	Swadhin Banerjee (SB)
Date	[Date of the Lesson Plan]

Session 1: Introduction to Bilinear and Quadratic Forms

- **Duration:** 60 minutes
- **Objectives:**
    - Define bilinear and quadratic forms.
    - Understand their properties and applications.
- **Key Concepts:**
    - Bilinear Forms
    - Quadratic Forms
- **Teaching Strategies:**
    - Lecture and interactive discussion
- **Activities:**
    - Discuss real-world applications of bilinear and quadratic forms.
    - Work through examples illustrating their properties.

Session 2: Diagonalization of Symmetric Matrices

- **Duration:** 60 minutes
- **Objectives:**

    - Learn the concept of diagonalization.
    - Focus on diagonalization of symmetric matrices.
- **Key Concepts:**
    - Diagonalization
    - Symmetric Matrices
- **Teaching Strategies:**
    - Problem-solving exercises and group discussions
- **Activities:**
    - Work through examples of diagonalizing symmetric matrices.
    - Discuss applications of diagonalization in eigenvalue problems and optimization.

Session 3: Second Derivative Test for Critical Points

- **Duration:** 60 minutes
- **Objectives:**
    - Understand the second derivative test for critical points of functions of several variables.
- **Key Concepts:**
    - Second Derivative Test
    - Critical Points
- **Teaching Strategies:**
    - Lecture and interactive discussions
- **Activities:**
    - Work through examples applying the second derivative test to find critical points.
    - Discuss the geometric interpretation of the second derivative test.

Session 4: Hessian Matrix

- **Duration:** 60 minutes
- **Objectives:**
    - Introduce the Hessian matrix and its role in optimization.
- **Key Concepts:**
    - Hessian Matrix
- **Teaching Strategies:**
    - Problem-solving exercises and group discussions
- **Activities:**
    - Calculate Hessian matrices for functions of several variables.
    - Discuss the properties of the Hessian matrix and its significance in optimization problems.

Session 5: Sylvester's Law of Inertia

- **Duration:** 60 minutes
- **Objectives:**
    - Learn Sylvester's Law of Inertia and its applications.
- **Key Concepts:**
    - Sylvester's Law of Inertia
- **Teaching Strategies:**
    - Lecture and interactive discussions
- **Activities:**

    - Work through examples illustrating Sylvester's Law of Inertia.
    - Discuss applications in quadratic forms and optimization problems.

Session 6: Index and Signature

- **Duration:** 60 minutes
- **Objectives:**
    - Define the index and signature of a quadratic form.
- **Key Concepts:**
    - Index
    - Signature
- **Teaching Strategies:**
    - Problem-solving exercises and group discussions
- **Activities:**
    - Calculate the index and signature of given quadratic forms.
    - Discuss the geometric interpretation of index and signature.

Session 7: Review and Application of Bilinear and Quadratic Forms

- **Duration:** 60 minutes
- **Objectives:**
    - Review concepts related to bilinear and quadratic forms.
    - Apply these concepts to solve problems and real-world applications.
- **Teaching Strategies:**
    - Group projects, case studies, and problem-solving sessions
- **Activities:**
    - Work on group projects applying bilinear and quadratic forms to various mathematical problems.
    - Discuss real-world applications such as optimization and physics.

Session 8: Review and Application of Diagonalization of Symmetric Matrices

- **Duration:** 60 minutes
- **Objectives:**
    - Review the diagonalization of symmetric matrices.
    - Apply diagonalization techniques to solve problems.
- **Teaching Strategies:**
    - Interactive discussions and practical examples
- **Activities:**
    - Work through examples applying diagonalization to eigenvalue problems.
    - Discuss applications in physics, engineering, and computer science.

Session 9: Review and Application of Optimization Techniques

- **Duration:** 60 minutes
- **Objectives:**
    - Review optimization techniques using second derivative tests, Hessian matrices, and Sylvester's Law of Inertia.
    - Apply these techniques to solve optimization problems.
- **Teaching Strategies:**
    - Problem-solving exercises and group discussions
- **Activities:**
    - Work through optimization problems using second derivative tests and Hessian matrices.

- Discuss real-world applications in economics, engineering, and operations research.

Session 10: Real-world Applications and Wrap-up

- **Duration:** 60 minutes
- **Objectives:**
  - Explore real-world applications of linear algebra concepts covered in the course.
  - Wrap up the course with a summary and discussion.
- **Teaching Strategies:**
  - Case studies, interactive discussions, and student presentations
- **Activities:**
  - Present case studies or research projects where linear algebra concepts are applied.
  - Discuss the importance of linear algebra in various fields and its relevance beyond the classroom.

Title	Linear Algebra in Mathematics
Subtitle	Dual Spaces, Eigenspaces, and Canonical Forms
Duration	20 hours (divided into 60-minute sessions)
Teacher's Name	Swadhin Banerjee (SB)
Date	[Date of the Lesson Plan]

Session 1: Introduction to Dual Spaces

- **Duration:** 60 minutes
- **Objectives:**
  - Define dual spaces and their properties.
  - Understand the concept of a dual basis.
- **Key Concepts:**
  - Dual Spaces
  - Dual Basis
- **Teaching Strategies:**
  - Lecture and interactive discussion
- **Activities:**
  - Introduce real-world examples where dual spaces are applicable.
  - Work through exercises on finding dual bases.

Session 2: Double Dual and Annihilators

- **Duration:** 60 minutes
- **Objectives:**
  - Define the double dual space.
  - Understand annihilators and their properties.
- **Key Concepts:**
  - Double Dual Space
  - Annihilators
- **Teaching Strategies:**
  - Problem-solving exercises and group discussions
- **Activities:**
  - Work through examples to find the double dual of a given space.

- Discuss applications of annihilators in linear algebra.

Session 3: Transpose of a Linear Transformation

- **Duration:** 60 minutes
- **Objectives:**
  - Define the transpose of a linear transformation.
  - Understand its properties and applications.
- **Key Concepts:**
  - Transpose of a Linear Transformation
- **Teaching Strategies:**
  - Interactive simulations and group discussions
- **Activities:**
  - Work through examples to find the transpose of linear transformations.
  - Discuss real-world applications of transposes in various fields.

Session 4: Matrix in the Dual Basis

- **Duration:** 60 minutes
- **Objectives:**
  - Understand the concept of a matrix in the dual basis.
  - Explore its relationship with the original matrix.
- **Key Concepts:**
  - Matrix in the Dual Basis
- **Teaching Strategies:**
  - Lecture and problem-solving exercises
- **Activities:**
  - Work through examples to find the matrix representation in the dual basis.
  - Discuss the implications of changing bases on matrix representations.

Session 5: Introduction to Eigenspaces

- **Duration:** 60 minutes
- **Objectives:**
  - Define eigenspaces of a linear operator.
  - Understand their properties and significance.
- **Key Concepts:**
  - Eigenspaces
- **Teaching Strategies:**
  - Interactive discussions and practical examples
- **Activities:**
  - Work through examples to find eigenspaces for given linear operators.
  - Discuss the importance of eigenspaces in various applications.

Session 6: Diagonalizability

- **Duration:** 60 minutes
- **Objectives:**
  - Introduce the concept of diagonalizability.
  - Understand its conditions and implications.
- **Key Concepts:**
  - Diagonalizability

- **Teaching Strategies:**
  - Problem-solving exercises and group discussions
- **Activities:**
  - Work through examples to determine if a linear operator is diagonalizable.
  - Discuss the advantages of diagonalization in solving systems of linear equations.

Session 7: Invariant Subspaces

- **Duration:** 60 minutes
- **Objectives:**
  - Define invariant subspaces under a linear operator.
  - Explore their properties and applications.
- **Key Concepts:**
  - Invariant Subspaces
- **Teaching Strategies:**
  - Lecture and interactive discussions
- **Activities:**
  - Work through examples to identify invariant subspaces.
  - Discuss how invariant subspaces simplify the analysis of linear operators.

Session 8: Cayley-Hamilton Theorem

- **Duration:** 60 minutes
- **Objectives:**
  - Introduce the Cayley-Hamilton theorem.
  - Understand its statement and significance.
- **Key Concepts:**
  - Cayley-Hamilton Theorem
- **Teaching Strategies:**
  - Interactive simulations and group discussions
- **Activities:**
  - Present the statement of the Cayley-Hamilton theorem.
  - Work through examples to apply the theorem in finding characteristic polynomials.

Session 9: Minimal Polynomial

- **Duration:** 60 minutes
- **Objectives:**
  - Define the minimal polynomial for a linear operator.
  - Understand its properties and applications.
- **Key Concepts:**
  - Minimal Polynomial
- **Teaching Strategies:**
  - Problem-solving exercises and group discussions
- **Activities:**
  - Work through examples to find minimal polynomials for given linear operators.
  - Discuss how minimal polynomials relate to diagonalizability.

Session 10: Canonical Forms - Jordan Form

- **Duration:** 60 minutes
- **Objectives:**

- Introduce the Jordan canonical form.
    - Understand its construction and properties.
- **Key Concepts:**
    - Jordan Form
- **Teaching Strategies:**
    - Lecture and interactive discussions
- **Activities:**
    - Present the algorithm for finding the Jordan canonical form.
    - Work through examples to diagonalize matrices using the Jordan form.

Session 11: Canonical Forms - Rational Form

- **Duration:** 60 minutes
- **Objectives:**
    - Introduce the rational canonical form.
    - Understand its construction and applications.
- **Key Concepts:**
    - Rational Form
- **Teaching Strategies:**
    - Interactive simulations and group discussions
- **Activities:**
    - Present the algorithm for finding the rational canonical form.
    - Discuss the advantages of the rational canonical form in certain applications.

Session 12-20: Review and Application Sessions

- **Duration:** 60 minutes each (9 sessions)
- **Objectives:**
    - Review key concepts from previous sessions.
    - Apply the learned concepts to real-world problems and case studies.
- **Teaching Strategies:**
    - Group projects, case studies, and problem-solving sessions
- **Activities:**
    - Students work on group projects applying linear algebra concepts.
    - Present real-world applications and case studies related to the course material.

Advanced Algebra

Semesters : 5 Credits :

5+1*=6

Discipline Specific Elective- DSE-A (1) Full Marks :

65+15**+20***=100

Paper Code(Theory):MTM-A-DSE-A-5-1-TH

Paper Code(Tutorial):MTM-A-DSE-A-5-1-TU

Unit-1: Group Theory

Title	Group Theory in Mathematics
Subtitle	Group Actions and Permutation Representations
Duration	10 hours (divided into 60-minute sessions)
Teacher's Name	UTTAM ROY MANDAL (URM)
Date	[Date of the Lesson Plan]

Session 1: Introduction to Group Actions

- **Duration:** 60 minutes
- **Objectives:**
  - Define group actions and their properties.
  - Understand the concept of stabilizers.
- **Key Concepts:**
  - Group Actions
  - Stabilizers
- **Teaching Strategies:**
  - Lecture and interactive discussion
- **Activities:**
  - Discuss real-world examples of group actions.
  - Work through exercises on identifying stabilizers.

Session 2: Permutation Representation

- **Duration:** 60 minutes
- **Objectives:**
  - Introduce permutation representation associated with a given group action.
  - Understand its significance and applications.
- **Key Concepts:**
  - Permutation Representation
- **Teaching Strategies:**
  - Problem-solving exercises and group discussions
- **Activities:**
  - Work through examples to find permutation representations.
  - Discuss the applications of permutation representations in group theory.

Session 3: Generalized Cayley's Theorem

- **Duration:** 60 minutes
- **Objectives:**
  - Introduce Generalized Cayley's Theorem.
  - Understand its statement and proof.
- **Key Concepts:**
  - Generalized Cayley's Theorem

- **Teaching Strategies:**
    - Lecture and interactive discussions
- **Activities:**
    - Present the statement of Generalized Cayley's Theorem.
    - Work through examples illustrating the theorem's application.

Session 4: Applications of Group Actions

- **Duration:** 60 minutes
- **Objectives:**
    - Explore various applications of group actions.
    - Understand how group actions are used to solve problems in mathematics.
- **Key Concepts:**
    - Applications of Group Actions
- **Teaching Strategies:**
    - Interactive simulations and group discussions
- **Activities:**
    - Discuss real-world applications of group actions.
    - Work through case studies demonstrating the use of group actions in solving mathematical problems.

Session 5: Review and Practice

- **Duration:** 60 minutes
- **Objectives:**
    - Review key concepts covered so far.
    - Practice solving problems related to group actions.
- **Key Concepts:**
    - Group Actions
    - Permutation Representation
    - Generalized Cayley's Theorem
- **Teaching Strategies:**
    - Problem-solving exercises and group discussions
- **Activities:**
    - Work through practice problems related to group actions.
    - Discuss any difficulties or questions students may have.

Session 6: Index Theorem

- **Duration:** 60 minutes
- **Objectives:**
    - Introduce the Index Theorem.
    - Understand its statement and applications.
- **Key Concepts:**
    - Index Theorem
- **Teaching Strategies:**
    - Lecture and interactive discussions
- **Activities:**

- Present the statement of the Index Theorem.
- Work through examples illustrating its application.

Session 7: Further Applications of Group Actions

- **Duration:** 60 minutes
- **Objectives:**
  - Explore additional applications of group actions beyond Cayley's theorem and the index theorem.
- **Key Concepts:**
  - Additional Applications of Group Actions
- **Teaching Strategies:**
  - Interactive simulations and group discussions
- **Activities:**
  - Discuss real-world examples where group actions play a crucial role.
  - Work through problems showcasing diverse applications of group actions.

Session 8: Group Actions in Coding Theory

- **Duration:** 60 minutes
- **Objectives:**
  - Introduce the role of group actions in coding theory.
  - Understand how group actions are used in error detection and correction.
- **Key Concepts:**
  - Group Actions in Coding Theory
- **Teaching Strategies:**
  - Lecture and practical examples
- **Activities:**
  - Present the basics of coding theory and error correction codes.
  - Work through examples illustrating how group actions are used in coding theory.

Session 9: Real-world Applications of Group Actions

- **Duration:** 60 minutes
- **Objectives:**
  - Explore real-world applications of group actions beyond mathematics.
- **Key Concepts:**
  - Real-world Applications of Group Actions
- **Teaching Strategies:**
  - Case studies and interactive discussions
- **Activities:**
  - Discuss applications of group actions in physics, chemistry, computer science, and other fields.
  - Work through case studies illustrating the versatility of group actions in various domains.

Session 10: Review and Conclusion

- **Duration:** 60 minutes
- **Objectives:**
  - Review key concepts covered throughout the course.
  - Reflect on the significance and relevance of group actions in mathematics and beyond.
- **Teaching Strategies:**
  - Group discussions and reflection
- **Activities:**

- Review important theorems and applications of group actions.
- Engage in a discussion about the broader impact of group theory and its applications.

Title	Group Theory in Mathematics
Subtitle	Groups Acting on Themselves and Sylow's Theorems
Duration	15 hours (divided into 60-minute sessions)
Teacher's Name	UTTAM ROY MANDAL (URM)
Date	[Date of the Lesson Plan]

Session 1: Introduction to Groups Acting on Themselves

- **Duration:** 60 minutes
- **Objectives:**
  - Define groups acting on themselves by conjugation.
  - Understand the concept of conjugacy.
- **Key Concepts:**
  - Groups Acting on Themselves
  - Conjugacy
- **Teaching Strategies:**
  - Lecture and interactive discussion
- **Activities:**
  - Explore examples of groups acting on themselves.
  - Discuss real-world applications of conjugacy.

Session 2: Class Equation and Consequences

- **Duration:** 60 minutes
- **Objectives:**
  - Introduce the class equation in group theory.
  - Understand the consequences of the class equation.
- **Key Concepts:**
  - Class Equation
  - Consequences of the Class Equation
- **Teaching Strategies:**
  - Problem-solving exercises and group discussions
- **Activities:**
  - Work through examples to construct class equations.
  - Discuss how the class equation provides information about group structure.

Session 3: Conjugacy in Sn

- **Duration:** 60 minutes
- **Objectives:**
  - Explore conjugacy in the symmetric group Sn.
  - Understand the implications of conjugacy in permutation groups.
- **Key Concepts:**
  - Conjugacy in Sn
- **Teaching Strategies:**

- Interactive simulations and group discussions
- **Activities:**
  - Work through examples of conjugacy in Sn.
  - Discuss real-world applications of permutation groups.

Session 4: p-Groups

- **Duration:** 60 minutes
- **Objectives:**
  - Define p-groups in group theory.
  - Understand the properties of p-groups.
- **Key Concepts:**
  - p-Groups
- **Teaching Strategies:**
  - Lecture and problem-solving exercises
- **Activities:**
  - Work through examples to identify p-groups.
  - Discuss the significance of p-groups in various mathematical structures.

Session 5: Introduction to Sylow's Theorems

- **Duration:** 60 minutes
- **Objectives:**
  - Introduce Sylow's theorems in group theory.
  - Understand the conditions and implications of Sylow's theorems.
- **Key Concepts:**
  - Sylow's Theorems
- **Teaching Strategies:**
  - Interactive discussions and practical examples
- **Activities:**
  - Work through examples to apply Sylow's theorems.
  - Discuss how Sylow's theorems are used to analyze the structure of groups.

Session 6: Consequences of Sylow's Theorems

- **Duration:** 60 minutes
- **Objectives:**
  - Explore the consequences and applications of Sylow's theorems.
- **Key Concepts:**
  - Consequences of Sylow's Theorems
- **Teaching Strategies:**
  - Problem-solving exercises and group discussions
- **Activities:**
  - Work through examples to derive consequences from Sylow's theorems.
  - Discuss real-world applications of Sylow's theorems.

Session 7: Cauchy's Theorem

- **Duration:** 60 minutes

- **Objectives:**
    - Introduce Cauchy's theorem in group theory.
    - Understand the conditions for the existence of elements of prime order.
- **Key Concepts:**
    - Cauchy's Theorem
- **Teaching Strategies:**
    - Lecture and interactive discussions
- **Activities:**
    - Work through examples to apply Cauchy's theorem.
    - Discuss the implications of Cauchy's theorem on group structure.

Session 8: Simplicity of An for n ≥ 5

- **Duration:** 60 minutes
- **Objectives:**
    - Prove the simplicity of the alternating group An for n ≥ 5.
- **Key Concepts:**
    - Simplicity of An for n ≥ 5
- **Teaching Strategies:**
    - Interactive simulations and group discussions
- **Activities:**
    - Present the proof for the simplicity of An for n ≥ 5.
    - Discuss the significance of simplicity in group theory.

Session 9: Non-Simplicity Tests

- **Duration:** 60 minutes
- **Objectives:**
    - Understand tests for determining non-simplicity of groups.
- **Key Concepts:**
    - Non-Simplicity Tests
- **Teaching Strategies:**
    - Problem-solving exercises and group discussions
- **Activities:**
    - Work through examples to apply non-simplicity tests.
    - Discuss scenarios where groups may not be simple.

Session 10-15: Review and Application Sessions

- **Duration:** 60 minutes each (6 sessions)
- **Objectives:**
    - Review key concepts from previous sessions.
    - Apply the learned concepts to solve problems and real-world applications.
- **Teaching Strategies:**
    - Group projects, case studies, and problem-solving sessions
- **Activities:**
    - Students work on group projects applying group theory concepts.
    - Present real-world applications and case studies related to the course material.

Unit-2: Ring Theory

Title	Ring Theory in Mathematics
Subtitle	Principal Ideal Domains and Euclidean Domains
Duration	20 hours (divided into 60-minute sessions)
Teacher's Name	UTTAM ROY MANDAL (URM)
Date	[Date of the Lesson Plan]

Session 1: Introduction to Ring Theory

- **Duration:** 60 minutes
- **Objectives:**
  - Introduce the basic concepts of rings and ideals.
  - Understand the importance of ring theory in mathematics.
- **Key Concepts:**
  - Rings
  - Ideals
- **Teaching Strategies:**
  - Lecture and interactive discussion
- **Activities:**
  - Discuss real-world applications of rings.
  - Introduce examples of rings and ideals.

Session 2: Principal Ideal Domain (PID)

- **Duration:** 60 minutes
- **Objectives:**
  - Define principal ideal domains and their properties.
  - Understand the concept of a principal ideal ring.
- **Key Concepts:**
  - Principal Ideal Domain (PID)
  - Principal Ideal Ring
- **Teaching Strategies:**
  - Problem-solving exercises and group discussions
- **Activities:**
  - Work through examples to identify principal ideal domains.
  - Discuss properties of principal ideal rings.

Session 3: Prime Element and Irreducible Element

- **Duration:** 60 minutes
- **Objectives:**
  - Define prime elements and irreducible elements in a ring.
  - Understand their relationship with principal ideal domains.
- **Key Concepts:**
  - Prime Element
  - Irreducible Element
- **Teaching Strategies:**
  - Interactive simulations and group discussions
- **Activities:**

    - Identify prime and irreducible elements in given rings.
    - Discuss the significance of these elements in factorization.

Session 4: Greatest Common Divisor (GCD) and Least Common Multiple (LCM)

- **Duration:** 60 minutes
- **Objectives:**
    - Define gcd and lcm in the context of rings.
    - Understand their properties in principal ideal domains.
- **Key Concepts:**
    - Greatest Common Divisor (GCD)
    - Least Common Multiple (LCM)
- **Teaching Strategies:**
    - Lecture and problem-solving exercises
- **Activities:**
    - Work through examples to find gcd and lcm in rings.
    - Discuss properties of gcd and lcm in principal ideal domains.

Session 5: Expression of GCD

- **Duration:** 60 minutes
- **Objectives:**
    - Learn different ways to express gcd in principal ideal domains.
- **Key Concepts:**
    - Expression of GCD
- **Teaching Strategies:**
    - Interactive discussions and practical examples
- **Activities:**
    - Explore various methods for expressing gcd in rings.
    - Work through examples to demonstrate different expressions of gcd.

Session 6: Examples of Rings and GCD Existence

- **Duration:** 60 minutes
- **Objectives:**
    - Understand examples of rings where gcd may not exist.
- **Key Concepts:**
    - Examples of Rings
- **Teaching Strategies:**
    - Problem-solving exercises and group discussions
- **Activities:**
    - Present examples of rings and pairs of elements where gcd does not exist.
    - Discuss the implications of gcd non-existence in certain rings.

Session 7: Euclidean Domain

- **Duration:** 60 minutes
- **Objectives:**
    - Define Euclidean domains and their properties.
    - Understand their relationship with principal ideal domains.

- **Key Concepts:**
  - Euclidean Domain
- **Teaching Strategies:**
  - Lecture and interactive discussions
- **Activities:**
  - Work through examples to identify Euclidean domains.
  - Discuss properties of Euclidean domains compared to principal ideal domains.

Session 8: Relation between Euclidean Domain and PID

- **Duration:** 60 minutes
- **Objectives:**
  - Understand the relationship between Euclidean domains and principal ideal domains.
- **Key Concepts:**
  - Relation between Euclidean Domain and PID
- **Teaching Strategies:**
  - Interactive simulations and group discussions
- **Activities:**
  - Explore examples to illustrate the connection between Euclidean domains and principal ideal domains.
  - Discuss how properties of Euclidean domains extend to principal ideal domains.

Session 9-20: Review and Application Sessions

- **Duration:** 60 minutes each (12 sessions)
- **Objectives:**
  - Review key concepts from previous sessions.
  - Apply the learned concepts to solve problems and real-world applications.
- **Teaching Strategies:**
  - Group projects, case studies, and problem-solving sessions
- **Activities:**
  - Students work on group projects applying ring theory concepts.
  - Present real-world applications and case studies related to principal ideal domains and Euclidean domains.

Title: Introduction to Ring Theory in Mathematics
Subtitle: Understanding Polynomial Rings and Unique Factorization
Teacher's Name: UTTAM ROY MANDAL (URM)
Date: [Date]

Session 1: Introduction to Polynomial Rings

- **Duration:** 60 minutes
- **Objectives:**
  - Understand the concept of polynomial rings.
  - Define polynomials and polynomial operations.
- **Key Concepts:**
  - Polynomial rings.
  - Degree of polynomials.
- **Teaching Strategies:**
  - Lecture and discussion.
- **Activities:**
  - Introduction to polynomial notation.
  - Exploring polynomial operations (addition, subtraction, multiplication).
- **Assessment:**
  - Quiz on polynomial notation and operations.

Session 2: Division Algorithm and Consequences

- **Duration:** 120 minutes
- **Objectives:**
  - Learn the division algorithm for polynomials.
  - Understand the consequences of the division algorithm.
- **Key Concepts:**
  - Division algorithm.
  - Remainder theorem.
- **Teaching Strategies:**
  - Lecture, examples, and interactive problem-solving.
- **Activities:**
  - Work on division algorithm examples.
  - Discuss applications of the division algorithm.
- **Assessment:**
  - Worksheet on division algorithm problems.

Session 3: Factorization Domain

- **Duration:** 120 minutes
- **Objectives:**
  - Define factorization domain.
  - Explore properties of factorization domains.
- **Key Concepts:**
  - Factorization domain.
  - Irreducible elements.
- **Teaching Strategies:**
  - Lecture, examples, and class discussions.

- **Activities:**
  - Identifying irreducible elements in factorization domains.
  - Discussing factorization domain properties.
- **Assessment:**
  - Class participation and understanding demonstrated through discussions.

Session 4: Unique Factorization Domain (UFD)

- **Duration:** 120 minutes
- **Objectives:**
  - Define unique factorization domain.
  - Understand the significance of unique factorization.
- **Key Concepts:**
  - Unique factorization domain (UFD).
  - Prime elements.
- **Teaching Strategies:**
  - Lecture, examples, and guided practice.
- **Activities:**
  - Analyzing examples to identify UFDs.
  - Discussing the importance of unique factorization.
- **Assessment:**
  - Written assignment on identifying UFDs and prime elements.

Session 5: Irreducible and Prime Elements in UFD

- **Duration:** 120 minutes
- **Objectives:**
  - Differentiate between irreducible and prime elements in a UFD.
  - Understand their properties and significance.
- **Key Concepts:**
  - Irreducible elements.
  - Prime elements.
- **Teaching Strategies:**
  - Lecture, examples, and group discussions.
- **Activities:**
  - Identifying irreducible and prime elements in given examples.
  - Exploring properties and relationships between them.
- **Assessment:**
  - Quiz on distinguishing between irreducible and prime elements.

Session 6: Relationship between PID, UFD, FD, and Integral Domain

- **Duration:** 120 minutes
- **Objectives:**

- Understand the relationships between principal ideal domain (PID), unique factorization domain (UFD), factorization domain (FD), and integral domain.
- **Key Concepts:**
  - PID, UFD, FD, and integral domain.
- **Teaching Strategies:**
  - Lecture, examples, and comparison discussions.
- **Activities:**
  - Identifying properties of each type of domain.
  - Discussing how they relate to each other.
- **Assessment:**
  - Conceptual questions and class participation assessment.

Session 7: Eisenstein Criterion

- **Duration:** 120 minutes
- **Objectives:**
  - Learn Eisenstein's criterion for irreducibility of polynomials.
  - Apply Eisenstein's criterion to analyze polynomials.
- **Key Concepts:**
  - Eisenstein criterion.
- **Teaching Strategies:**
  - Lecture, examples, and problem-solving.
- **Activities:**
  - Exploring examples of polynomials using Eisenstein's criterion.
  - Discussing applications and limitations.
- **Assessment:**
  - Problem set on applying Eisenstein's criterion.

Session 8: Unique Factorization in Z[x]

- **Duration:** 120 minutes
- **Objectives:**
  - Understand unique factorization in the polynomial ring Z[x].
  - Analyze factorization properties in Z[x].
- **Key Concepts:**
  - Unique factorization in Z[x].
- **Teaching Strategies:**
  - Lecture, examples, and guided practice.
- **Activities:**
  - Analyzing examples of polynomial factorization in Z[x].
  - Discussing implications and applications.
- **Assessment:**
  - Quiz on unique factorization in Z[x].

Real-world Application:

Understanding unique factorization in rings has applications in cryptography, particularly in the field of public-key cryptography. Algorithms such as RSA rely on the difficulty of factoring large composite numbers into their prime factors, which is fundamentally based on the unique factorization property. By understanding ring theory concepts, students can appreciate the mathematical foundations behind secure communication systems used widely in the digital world.

Title	**Ring Theory: Exploring Ring Embedding and Regular Rings**
Subtitle	Understanding ring embedding, quotient fields, regular rings, and ideals
Duration	10 sessions, each session 60 minutes
Teacher's Name	UTTAM ROY MANDAL (URM)
Date	[Insert Date]

Session 1: Introduction to Ring Theory (60 minutes)

- **Objective:** Introduce students to the basic concepts of ring theory and its importance in mathematics.
- **Key Concepts:** Rings, elements, operations, properties.
- **Teaching Strategies:** Lecture, examples, interactive discussion.
- **Activities:** Define rings, illustrate with examples, discuss properties.
- **Assessment:** Quiz on basic ring properties.

Session 2: Ring Embedding (60 minutes)

- **Objective:** Understand the concept of ring embedding and its significance.
- **Key Concepts:** Ring homomorphism, subring, embedding.
- **Teaching Strategies:** Lecture, examples, group discussions.
- **Activities:** Explore ring homomorphisms, identify subrings, discuss embeddings.
- **Assessment:** Problems solving on identifying embeddings.

Session 3: Quotient Fields (60 minutes)

- **Objective:** Explore quotient fields and their relation to rings.
- **Key Concepts:** Quotient rings, ideals, quotient fields.
- **Teaching Strategies:** Lecture, examples, peer teaching.
- **Activities:** Define quotient rings, discuss ideals, explore quotient fields.
- **Assessment:** Problems solving on quotient ring constructions.

Session 4: Regular Rings Overview (60 minutes)

- **Objective:** Introduce the concept of regular rings and their importance.
- **Key Concepts:** Regular rings, properties.
- **Teaching Strategies:** Lecture, examples, brainstorming.
- **Activities:** Define regular rings, discuss properties, provide examples.
- **Assessment:** Class discussion on properties of regular rings.

Session 5: Examples of Regular Rings (60 minutes)

- **Objective:** Examine various examples of regular rings.

- **Key Concepts:** Examples, applications.
- **Teaching Strategies:** Lecture, case studies, group presentations.
- **Activities:** Present examples of regular rings, discuss applications.
- **Assessment:** Group presentations on examples of regular rings.

Session 6: Properties of Regular Rings (60 minutes)

- **Objective:** Investigate the properties of regular rings in detail.
- **Key Concepts:** Properties, characteristics.
- **Teaching Strategies:** Lecture, problem-solving, peer review.
- **Activities:** Discuss properties of regular rings, solve problems.
- **Assessment:** Problem sets on regular ring properties.

Session 7: Ideals in Regular Rings (60 minutes)

- **Objective:** Understand the role of ideals in regular rings.
- **Key Concepts:** Ideals, quotient rings, applications.
- **Teaching Strategies:** Lecture, examples, interactive exercises.
- **Activities:** Define ideals, discuss quotient rings, explore applications.
- **Assessment:** Problems solving on ideals in regular rings.

Session 8: Review and Practice (60 minutes)

- **Objective:** Review key concepts and provide practice opportunities.
- **Key Concepts:** Ring embedding, quotient fields, regular rings, ideals.
- **Teaching Strategies:** Review session, practice problems, Q&A.
- **Activities:** Review key concepts, solve practice problems.
- **Assessment:** Quiz on key concepts.

Session 9: Application in Algebraic Geometry (60 minutes)

- **Objective:** Explore the application of ring theory in algebraic geometry.
- **Key Concepts:** Algebraic geometry, rings, applications.
- **Teaching Strategies:** Lecture, examples, case studies.
- **Activities:** Introduce algebraic geometry, discuss ring-theoretic applications.
- **Assessment:** Group discussion on applications in algebraic geometry.

Session 10: Real-World Applications (60 minutes)

- **Objective:** Demonstrate real-world relevance of ring theory.
- **Key Concepts:** Real-world applications, problem-solving.
- **Teaching Strategies:** Lecture, case studies, open discussion.
- **Activities:** Present real-world applications, discuss problem-solving approaches.
- **Assessment:** Reflective essay on the relevance of ring theory in real-world scenarios.

Conclusion:

This comprehensive lesson plan aims to provide undergraduate students with a thorough understanding of ring theory, specifically focusing on ring embedding, quotient fields, regular rings, and ideals. Through a combination of lectures, examples, activities, and assessments, students will develop the necessary skills to apply ring theory concepts in various mathematical contexts. Additionally, by exploring real-world applications, students will gain insight into the practical relevance of ring theory beyond the classroom.

Linear Programming & Game Theory

Semesters : 5 Credits : 5+1*=6

Discipline Specific Elective- DSE-B(1) Full Marks : 65+15**+20***=100

Paper Code(Theory):MTM-A-DSE-B-5-1-TH

Paper Code(Tutorial):MTM-A-DSE-B-5-1-TU

Unit-1

Here's a detailed lesson plan for Linear Programming & Game Theory in Mathematics spanning 5 sessions, each lasting for exactly 60 minutes:

Title	Linear Programming & Game Theory Lesson Plan
Subtitle	Understanding Linear Programming & Game Theory
Duration	5 sessions, 60 minutes each
Teacher's Name	DR PAYEL GHOSH (PG)
Date	[Date of the Lesson Plan]

Session 1: Introduction to Linear Programming (60 minutes)

Objectives:

- Define Linear Programming Problem (L.P.P.).
- Understand the formation of L.P.P. from daily life involving inequations.
- Recognize the relevance of linear programming in real-world scenarios.

Key Concepts:

- Linear Programming Problem (L.P.P.)

- Inequations and their application in forming L.P.P.
- Real-world applications of linear programming.

Teaching Strategies:

- Lecture with examples to introduce the concept of L.P.P.
- Interactive discussion to relate L.P.P. to daily life scenarios.
- Visual aids to illustrate the formation of L.P.P. from inequations.

Activities:

1. Group discussion: Brainstorm examples of real-life situations that can be formulated as L.P.P.
2. Solve simple L.P.P. problems as a class.
3. Homework assignment: Identify and bring examples of L.P.P. from daily life.

Assessment:

- Class participation during group discussion.
- Completion and accuracy of homework assignment.

Session 2: Graphical Solution of L.P.P. (60 minutes)

Objectives:

- Learn the graphical method for solving L.P.P.
- Understand the concept of feasible region.
- Identify optimal solutions using graphical methods.

Key Concepts:

- Feasible region and feasible solutions.
- Optimal solution and objective function.
- Graphical interpretation of constraints and objective function.

Teaching Strategies:

- Demonstration of graphical method with step-by-step examples.
- Guided practice with solving L.P.P. graphically.
- Visual aids such as graphs and diagrams to illustrate concepts.

Activities:

1. Graphical representation of constraints and objective function.
2. Practice exercises on identifying feasible regions and optimal solutions.
3. Peer assessment: Review and provide feedback on graphical solutions.

Assessment:

- Accuracy of graphical representations.

- Completion of practice exercises with correct solutions.

Session 3: Basic Solutions and B.F.S. (60 minutes)

Objectives:

- Define Basic solutions and Basic Feasible Solution (B.F.S) in the context of L.P.P.
- Understand the significance of basic solutions in optimization problems.

Key Concepts:

- Basic solutions and their characteristics.
- Basic Feasible Solution (B.F.S) and its properties.
- Relationship between basic solutions and feasible regions.

Teaching Strategies:

- Lecture to explain the concept of basic solutions and B.F.S.
- Examples illustrating different types of basic solutions.
- Comparison between basic solutions and feasible solutions.

Activities:

1. Identification of basic solutions in given L.P.P.
2. Class discussion on the properties of B.F.S.
3. Group work: Analyze and discuss scenarios where basic solutions are optimal.

Assessment:

- Participation in class discussion.
- Accuracy in identifying basic solutions and B.F.S.

Session 4: Matrix Formulation of L.P.P. (60 minutes)

Objectives:

- Learn the matrix formulation of L.P.P.
- Understand the advantages of matrix representation in solving L.P.P.
- Practice converting L.P.P. into matrix form.

Key Concepts:

- Matrix representation of L.P.P. constraints and objective function.
- Advantages of matrix formulation in solving large-scale L.P.P.
- Matrix operations for solving L.P.P.

Teaching Strategies:

- Lecture with examples demonstrating matrix formulation.

- Guided practice with converting L.P.P. into matrix form.
- Visual aids and illustrations to explain matrix operations.

Activities:

1. Practice exercises on converting L.P.P. into matrix form.
2. Group work: Solve L.P.P. using matrix operations.
3. Homework assignment: Solve additional L.P.P. problems using matrix formulation.

Assessment:

- Accuracy in converting L.P.P. into matrix form.
- Completion and correctness of homework assignment.

Session 5: Degenerate and Non-degenerate B.F.S. (60 minutes)

Objectives:

- Define degenerate and non-degenerate Basic Feasible Solutions (B.F.S.).
- Understand the implications of degeneracy in solving L.P.P.
- Learn strategies to handle degeneracy in L.P.P.

Key Concepts:

- Degenerate and non-degenerate B.F.S.
- Causes and consequences of degeneracy in L.P.P.
- Techniques for resolving degeneracy in L.P.P.

Teaching Strategies:

- Lecture to explain degeneracy and its impact on L.P.P.
- Case studies illustrating real-world examples of degeneracy.
- Discussion on strategies to avoid or resolve degeneracy.

Activities:

1. Analysis of case studies involving degenerate solutions.
2. Group discussion: Brainstorm strategies to handle degeneracy in L.P.P.
3. Role-playing: Simulate scenarios where degeneracy occurs and propose solutions.

Assessment:

- Participation in group discussion and role-playing.
- Understanding of degeneracy and ability to propose solutions.

Real-World Applications:

- Supply chain management: Linear programming is used to optimize production, distribution, and inventory management.
- Financial portfolio optimization: Linear programming helps in asset allocation to maximize returns while managing risks.

- Game theory in economics: Linear programming models are used to analyze strategic interactions between players in various economic scenarios, such as pricing strategies and market competition.

This comprehensive lesson plan is designed to engage undergraduate students through a combination of lectures, activities, and real-world applications, ensuring a deep understanding of Linear Programming & Game Theory concepts.

Here's a comprehensive 10-hour lesson plan for Linear Programming & Game Theory:

Title	Linear Programming & Game Theory
Subtitle	Understanding Convex Sets and Extreme Points
Duration	10 Hours
Teacher's Name	DR PAYEL GHOSH (PG)
Date	[Date of the Lesson]

Session 1: Introduction to Convex Sets and Hyperplanes

- **Objective:** Introduce the concept of convex sets and hyperplanes.
- **Key Concepts:** Convex sets, hyperplanes, convex hull.
- **Teaching Strategies:** Lecture, visual aids.
- **Activities:** Examples of convex and non-convex sets, visualizing hyperplanes in 2D and 3D.
- **Assessment:** Quick quiz on identifying convex sets.

Session 2: Extreme Points and Convex Polyhedron

- **Objective:** Understand extreme points and convex polyhedra.
- **Key Concepts:** Extreme points, convex polyhedra.
- **Teaching Strategies:** Lecture, examples.
- **Activities:** Identifying extreme points in examples, constructing convex polyhedra.
- **Assessment:** Group activity to find extreme points of given convex sets.

Session 3: Supporting and Separating Hyperplanes

- **Objective:** Explore supporting and separating hyperplanes.
- **Key Concepts:** Supporting hyperplanes, separating hyperplanes.
- **Teaching Strategies:** Lecture, examples.
- **Activities:** Identifying supporting and separating hyperplanes in examples.
- **Assessment:** Individual problem-solving on determining supporting and separating hyperplanes.

Session 4: Feasible Solutions and Convex Sets

- **Objective:** Understand the connection between feasible solutions and convex sets.
- **Key Concepts:** Feasible solutions, convex sets.
- **Teaching Strategies:** Lecture, discussion.
- **Activities:** Examples linking feasible solutions to convex sets.
- **Assessment:** Short answer questions on the relationship between feasible solutions and convex sets.

Session 5: Bounded Feasible Solutions (B.F.S.)

- **Objective:** Learn about bounded feasible solutions.
- **Key Concepts:** Bounded feasible solutions.
- **Teaching Strategies:** Lecture, examples.
- **Activities:** Identifying bounded feasible solutions in examples.
- **Assessment:** Group problem-solving on finding bounded feasible solutions.

Session 6: Optimal Solutions and Extreme Points

- **Objective:** Understand the connection between optimal solutions and extreme points.
- **Key Concepts:** Optimal solutions, extreme points.
- **Teaching Strategies:** Lecture, examples.
- **Activities:** Examples linking optimal solutions to extreme points.
- **Assessment:** Individual problem-solving on determining optimal solutions from extreme points.

Session 7: Unbounded Convex Polyhedra

- **Objective:** Explore unbounded convex polyhedra.
- **Key Concepts:** Unbounded convex polyhedra.
- **Teaching Strategies:** Lecture, examples.
- **Activities:** Identifying unbounded convex polyhedra in examples.
- **Assessment:** Short answer questions on characteristics of unbounded convex polyhedra.

Session 8: Degeneracy in Linear Programming Problems

- **Objective:** Understand degeneracy in linear programming problems.
- **Key Concepts:** Degeneracy.
- **Teaching Strategies:** Lecture, examples.
- **Activities:** Examples illustrating degeneracy.
- **Assessment:** Group discussion on strategies to handle degeneracy in linear programming problems.

Session 9: Optimal BFS in LP Problems

- **Objective:** Learn about optimal BFS in LP problems.
- **Key Concepts:** Optimal BFS.
- **Teaching Strategies:** Lecture, examples.
- **Activities:** Identifying optimal BFS in LP problems.
- **Assessment:** Individual problem-solving on determining optimal BFS.

Session 10: Reduction of Feasible Solutions

- **Objective:** Understand the reduction of feasible solutions to BFS.

- **Key Concepts:** Reduction to BFS.
- **Teaching Strategies:** Lecture, examples.
- **Activities:** Examples illustrating reduction of feasible solutions to BFS.
- **Assessment:** Group problem-solving on reducing feasible solutions to BFS.

Real-World Applications:

- Supply chain optimization
- Portfolio optimization in finance
- Resource allocation in project management

This lesson plan provides a structured approach to cover the specified topics, ensuring engagement and understanding among undergraduate students. Each session is designed to fit within a 60-minute class period and includes a variety of teaching strategies and activities to cater to different learning styles. The real-world applications demonstrate the relevance of linear programming and game theory beyond the classroom.

Unit-2

<table>
<tr><td>| Title: Linear Programming & Game Theory Lesson Plan |</td></tr>
<tr><td>| Subtitle: Slack and Surplus Variables, Standard Form of L.P.P., Simplex Method Theory, Feasibility and Optimality Conditions |</td></tr>
<tr><td>| Duration: 10 Sessions (10 hours total) |</td></tr>
<tr><td>| Teacher's Name: DR PAYEL GHOSH (PG)</td></tr>
<tr><td>| Date: [Insert Date] |</td></tr>
<tr><td></td></tr>
</table>

Session 1: Introduction to Linear Programming (LP) and Game Theory

- **Duration:** 60 minutes
- **Objective:** Introduce students to the basic concepts of Linear Programming and its relevance in decision making.
- **Key Concepts:** Linear Programming, Optimization, Constraints, Objective Function.
- **Teaching Strategies:** Lecture, Visual Aids.
- **Activities:** Presentation on real-world applications of LP.
- **Assessment:** Quiz on basic LP concepts.

Session 2: Introduction to Slack and Surplus Variables

- **Duration:** 60 minutes
- **Objective:** Understand the concept of slack and surplus variables in LP.
- **Key Concepts:** Slack Variables, Surplus Variables.
- **Teaching Strategies:** Examples, Problem-solving.
- **Activities:** Work through examples to identify slack and surplus variables.
- **Assessment:** Homework assignment on identifying slack and surplus variables in LP problems.

Session 3: Standard Form of Linear Programming Problems (LPP)

- **Duration:** 60 minutes
- **Objective:** Learn to convert LP problems into standard form.
- **Key Concepts:** Standard Form, Equality Constraints, Inequality Constraints.
- **Teaching Strategies:** Lecture, Step-by-step conversion.
- **Activities:** Practice converting LP problems into standard form.
- **Assessment:** In-class exercises on converting LP problems.

Session 4: Theory of Simplex Method

- **Duration:** 60 minutes
- **Objective:** Understand the theory behind the Simplex Method.
- **Key Concepts:** Basic Feasible Solution, Pivot Operation, Optimality.
- **Teaching Strategies:** Lecture, Visual Demonstrations.
- **Activities:** Step-by-step explanation of the Simplex Method.
- **Assessment:** Quiz on the theory of the Simplex Method.

Session 5: Feasibility Conditions

- **Duration:** 60 minutes
- **Objective:** Learn the feasibility conditions for LP problems.
- **Key Concepts:** Feasible Region, Feasible Solution.
- **Teaching Strategies:** Examples, Discussion.
- **Activities:** Analyze real-world scenarios for feasibility.
- **Assessment:** Homework assignment on feasibility conditions.

Session 6: Optimality Conditions

- **Duration:** 60 minutes
- **Objective:** Understand the optimality conditions in LP.
- **Key Concepts:** Objective Function, Optimal Solution.
- **Teaching Strategies:** Lecture, Case Studies.
- **Activities:** Solve optimization problems using LP techniques.

- **Assessment:** In-class problem-solving exercises.

Session 7: Application of LP in Supply Chain Management

- **Duration:** 60 minutes
- **Objective:** Explore real-world applications of LP in supply chain optimization.
- **Key Concepts:** Supply Chain Optimization, Resource Allocation.
- **Teaching Strategies:** Case Studies, Group Discussions.
- **Activities:** Analyze supply chain problems and propose LP solutions.
- **Assessment:** Group presentation on LP applications in supply chain management.

Session 8: Application of LP in Finance

- **Duration:** 60 minutes
- **Objective:** Examine how LP is applied in financial portfolio optimization.
- **Key Concepts:** Portfolio Management, Risk Management.
- **Teaching Strategies:** Examples, Interactive Discussion.
- **Activities:** Analyze investment scenarios and apply LP techniques.
- **Assessment:** Case study analysis on LP in finance.

Session 9: Application of LP in Marketing

- **Duration:** 60 minutes
- **Objective:** Understand the role of LP in marketing strategy optimization.
- **Key Concepts:** Marketing Mix Optimization, Resource Allocation.
- **Teaching Strategies:** Role-playing, Case Studies.
- **Activities:** Develop marketing strategies using LP models.
- **Assessment:** Presentation on LP applications in marketing.

Session 10: Integration and Review

- **Duration:** 60 minutes
- **Objective:** Review key concepts and applications of LP and Game Theory.
- **Key Concepts:** LP Techniques, Real-world Applications.
- **Teaching Strategies:** Review Session, Q&A.
- **Activities:** Recap of LP techniques and applications discussed.
- **Assessment:** Final Exam covering all topics discussed in the course.

This lesson plan provides a comprehensive overview of Linear Programming and Game Theory, incorporating theoretical understanding, practical applications, and real-world relevance. Each session is designed to engage undergraduate students through a combination of lectures, activities, and assessments, ensuring a deep understanding of the subject matter.

Title	Linear Programming & Game Theory
Subtitle	Exploring the Algorithm and Two-Phase Method
Duration	10 Hours
Teacher's Name	DR PAYEL GHOSH (PG)
Date	[Date]

Session 1: Introduction to Linear Programming (LP) and Game Theory

- **Objectives:**
    - Understand the basic concepts of Linear Programming.
    - Introduce the relevance of Game Theory in decision making.
- **Key Concepts:**
    - Linear Programming problem (LPP)
    - Objective function and constraints
    - Basics of Game Theory
- **Teaching Strategies:**
    - Lecture with examples
    - Interactive discussion
- **Activities:**
    - Solve simple LP problems as a class
- **Assessment:**
    - Class participation
    - Quiz on basic concepts

Session 2: Understanding the Algorithm

- **Objectives:**
    - Learn the steps involved in solving LP problems using the algorithm.
- **Key Concepts:**
    - Simplex method
    - Feasible solutions
- **Teaching Strategies:**
    - Step-by-step explanation
    - Visual aids
- **Activities:**
    - Work through example problems
- **Assessment:**
    - Problem-solving exercise

Session 3: Two-Phase Method

- **Objectives:**
    - Understand the concept and application of the Two-Phase Method.
- **Key Concepts:**
    - Phase I and Phase II
    - Finding an initial basic feasible solution
- **Teaching Strategies:**
    - Comparative analysis
    - Worked examples

- **Activities:**
    - Solve problems using the Two-Phase Method
- **Assessment:**
    - Problem-solving assessment

Session 4: Degeneracy in LPP

- **Objectives:**
    - Identify degenerate solutions in LP problems.
- **Key Concepts:**
    - Definition and causes of degeneracy
    - Implications on simplex method
- **Teaching Strategies:**
    - Case studies
    - Discussion on real-world applications
- **Activities:**
    - Analyze and classify problem instances
- **Assessment:**
    - Case study analysis

Session 5: Resolving Degeneracy

- **Objectives:**
    - Learn techniques to resolve degeneracy in LP problems.
- **Key Concepts:**
    - Perturbation method
    - Cycling
- **Teaching Strategies:**
    - Problem-solving demonstration
    - Group discussions
- **Activities:**
    - Practice problems with degenerate solutions
- **Assessment:**
    - Problem-solving assessment

Session 6: Real-world Applications

- **Objectives:**
    - Apply LP and Game Theory concepts to real-world scenarios.
- **Key Concepts:**
    - Supply chain management
    - Resource allocation
    - Strategic decision making
- **Teaching Strategies:**
    - Case studies
    - Guest speaker (if available)
- **Activities:**
    - Analyze case studies
- **Assessment:**
    - Presentation on real-world applications

Session 7: Review and Reinforcement

- **Objectives:**
  - Reinforce understanding of key concepts covered so far.
- **Key Concepts:**
  - LP problem types
  - Algorithm steps
- **Teaching Strategies:**
  - Review questions
  - Group discussions
- **Activities:**
  - Problem-solving exercises
- **Assessment:**
  - Quiz on key concepts

Session 8: Practical Problem Solving

- **Objectives:**
  - Apply LP and Two-Phase Method to complex problem scenarios.
- **Key Concepts:**
  - Complex objective functions
  - Multiple constraints
- **Teaching Strategies:**
  - Guided practice
  - Step-by-step problem-solving
- **Activities:**
  - Work through challenging problems
- **Assessment:**
  - Problem-solving assessment

Session 9: Advanced Topics in Game Theory

- **Objectives:**
  - Explore advanced concepts in Game Theory.
- **Key Concepts:**
  - Nash equilibrium
  - Cooperative games
- **Teaching Strategies:**
  - Lecture with examples
  - Interactive discussion
- **Activities:**
  - Analyze game scenarios
- **Assessment:**
  - Participation in discussions

Session 10: Final Review and Reflection

- **Objectives:**
  - Review entire course content.
  - Reflect on learning outcomes and applications.
- **Key Concepts:**
  - LP problem-solving strategies
  - Game Theory applications
- **Teaching Strategies:**
  - Comprehensive review session
  - Open discussion
- **Activities:**
  - Group review exercises
- **Assessment:**
  - Course reflection assignment

Unit-3

Here's a structured 10-hour lesson plan for Linear Programming & Game Theory focusing on Duality Theory:

Title	**Linear Programming & Game Theory: Duality Theory**
Subtitle	Understanding the Dual of Dual and its Applications
Duration	10 hours
Teacher's Name	[Your Name]
Date	[Date of the Lesson]

Session 1: Introduction to Duality Theory

- Duration: 60 minutes

Objectives:

- Understand the concept of duality in linear programming.
- Recognize the relationship between primal and dual problems.
- Learn about complementary slackness.

Key Concepts:

- Primal and dual problems.
- Complementary slackness.
- Duality theorem.

Teaching Strategies:

- Lecture with examples to introduce duality theory.
- Visual aids to illustrate the concepts.

- Encourage questions and discussions.

Activities:

1. Present examples of primal and dual problems.
2. Discuss the duality theorem and its implications.
3. Solve sample problems demonstrating complementary slackness.

Assessment:

- Quiz on understanding the relationships between primal and dual problems.

Session 2: Relation Between Objective Values

- Duration: 60 minutes

Objectives:

- Understand the relationship between the objective values of dual and primal problems.
- Practice solving problems involving objective values.

Key Concepts:

- Objective values in primal and dual problems.
- Relationship between them.

Teaching Strategies:

- Work through examples illustrating the relationship.
- Use graphs and diagrams to visualize concepts.

Activities:

1. Solve problems comparing objective values of primal and dual problems.
2. Discuss real-world applications where understanding this relationship is crucial.

Assessment:

- Group activity: Analyze a real-world scenario and identify primal and dual problems, along with their objective values.

Session 3: Relation Between Optimal Values

- Duration: 60 minutes

Objectives:

- Explore the relationship between optimal values of primal and dual problems.
- Apply duality theory to optimization scenarios.

Key Concepts:

- Optimal values in primal and dual problems.
- Relationship between them.

Teaching Strategies:

- Work through examples demonstrating the relationship.
- Encourage students to think critically about the implications.

Activities:

1. Solve optimization problems to find optimal values in primal and dual problems.
2. Discuss scenarios where the optimal values are equal or different and why.

Assessment:

- Individual assignment: Solve optimization problems and compare optimal values of primal and dual problems.

Session 4: Complementary Slackness

- Duration: 60 minutes

Objectives:

- Understand the concept of complementary slackness.
- Learn how to apply complementary slackness in solving linear programming problems.

Key Concepts:

- Complementary slackness conditions.
- Application in linear programming.

Teaching Strategies:

- Present theory behind complementary slackness.
- Work through examples applying the conditions.

Activities:

1. Solve linear programming problems using complementary slackness conditions.
2. Discuss real-world applications where complementary slackness is relevant.

Assessment:

- In-class exercise: Solve problems applying complementary slackness conditions.

Session 5: Duality and Simplex Method

- Duration: 60 minutes

Objectives:

- Explore the relationship between duality theory and the simplex method.
- Understand how duality theory can aid in solving optimization problems.

Key Concepts:

- Relationship between duality and the simplex method.
- Utilizing duality in optimization.

Teaching Strategies:

- Compare and contrast duality theory with the simplex method.
- Work through examples integrating both concepts.

Activities:

1. Solve optimization problems using the simplex method and duality theory.
2. Discuss advantages and limitations of each approach.

Assessment:

- Case study analysis: Analyze a complex optimization problem and propose a solution using either the simplex method or duality theory.

Session 6-10: Application and Review

- Duration: 60 minutes each

Objectives:

- Apply duality theory to various real-world scenarios.
- Review key concepts and reinforce learning.

Key Concepts:

- Real-world applications of duality theory.
- Review of duality, complementary slackness, and simplex method.

Teaching Strategies:

- Group discussions on applying duality theory to real-world problems.
- Review sessions with quizzes and exercises.

Activities:

1. Analyze case studies and real-world examples.
2. Review previous sessions' materials and solve additional problems for practice.

Assessment:

- Final project: Apply duality theory to a real-world optimization problem and present findings.

This comprehensive lesson plan provides a structured approach to teaching duality theory in linear programming and game theory, ensuring engagement and understanding among undergraduate students.

Unit-4

| **Title:** Linear Programming & Game Theory Lesson Plan |
| **Subtitle:** Transportation and Assignment Problems |
| **Duration:** 10 Hours |
| **Teacher's Name:** DR PAYEL GHOSH (PG)
| **Date:** [Date of the lesson] |

Session 1: Introduction to Transportation and Assignment Problems

Objective:

- Introduce students to transportation and assignment problems.
- Understand the importance and relevance of these problems in real-world scenarios.

Key Concepts:

- Definition and characteristics of transportation and assignment problems.
- Formulation of transportation and assignment problems.
- Real-world applications.

Teaching Strategies:

- Lecture to introduce concepts.
- Examples to illustrate problem formulation.
- Discussion on real-world applications.

Activities:

1. Presentation on transportation and assignment problems.
2. Work through examples of problem formulation.
3. Group discussion on real-world applications.

Assessment:

- Informal assessment through participation in discussions and completion of examples.

Session 2: Mathematical Justification for Optimality Criterion

Objective:

- Understand the mathematical basis for determining optimality in transportation and assignment problems.

Key Concepts:

- Optimality criterion.
- Mathematical justification using linear algebra.

Teaching Strategies:

- Lecture to explain the mathematical background.
- Derive optimality conditions.
- Work through proofs and examples.

Activities:

1. Lecture on optimality criterion.
2. Derive optimality conditions.
3. Work through proofs and examples.

Assessment:

- Formative assessment through solving example problems.

Session 3: Hungarian Method

Objective:

- Learn about the Hungarian method for solving assignment problems.
- Understand the steps involved in the Hungarian method.

Key Concepts:

- Hungarian algorithm.
- Step-by-step procedure for solving assignment problems.

Teaching Strategies:

- Lecture on the Hungarian method.

- Break down the algorithm into steps.
- Work through examples.

Activities:

1. Presentation on the Hungarian method.
2. Step-by-step walkthrough of the algorithm.
3. Practice problems solving using the Hungarian method.

Assessment:

- Formative assessment through completion of practice problems.

Session 4: Traveling Salesman Problem (TSP)

Objective:

- Introduce the Traveling Salesman Problem (TSP).
- Understand the significance of TSP in optimization problems.

Key Concepts:

- Definition and characteristics of TSP.
- Different variations and complexities of TSP.

Teaching Strategies:

- Lecture on TSP.
- Discuss variations and applications.
- Work through examples.

Activities:

1. Presentation on TSP.
2. Discussion on variations and applications.
3. Work through examples.

Assessment:

- Informal assessment through participation in discussions.

Session 5: Real-World Applications

Objective:

- Explore real-world applications of transportation and assignment problems and TSP.

Key Concepts:

- Application of transportation and assignment problems in logistics, supply chain management, etc.
- Application of TSP in route optimization, tour planning, etc.

Teaching Strategies:

- Case studies of real-world applications.
- Discussion on challenges and solutions.
- Group activities to brainstorm applications in different industries.

Activities:

1. Case study analysis of transportation and assignment problems in logistics.
2. Brainstorming session on TSP applications.
3. Group activity to solve a real-world problem using learned concepts.

Assessment:

- Participation in group activities and case study analysis.

Session 6: Review and Recap

Objective:

- Review key concepts covered in previous sessions.
- Recap on problem-solving strategies.

Key Concepts:

- Transportation and assignment problems.
- Hungarian method.
- Traveling Salesman Problem.

Teaching Strategies:

- Review session with interactive quizzes.
- Q&A session to address any doubts.
- Recap of problem-solving strategies.

Activities:

1. Interactive quiz on key concepts.
2. Q&A session.
3. Problem-solving exercises as a recap.

Assessment:

- Formative assessment through participation in quizzes and problem-solving.

Session 7: Practice Session 1

Objective:

- Practice problem-solving skills on transportation and assignment problems.

Key Concepts:

- Application of learned concepts.
- Problem-solving strategies.

Teaching Strategies:

- Provide practice problems.
- Monitor and assist students as they work through the problems.
- Encourage peer collaboration.

Activities:

1. Distribute practice problem sheets.
2. Students work individually or in pairs to solve problems.
3. Review solutions as a class.

Assessment:

- Formative assessment through completion of practice problems.

Session 8: Practice Session 2

Objective:

- Further practice problem-solving skills on transportation and assignment problems.

Key Concepts:

- Reinforce problem-solving strategies.
- Address any lingering misconceptions.

Teaching Strategies:

- Provide more challenging practice problems.
- Monitor and assist students as they work through the problems.
- Encourage peer collaboration.

Activities:

1. Distribute practice problem sheets.
2. Students work individually or in pairs to solve problems.
3. Review solutions as a class.

Assessment:

- Formative assessment through completion of practice problems.

Session 9: Application Project

Objective:

- Apply learned concepts to solve a real-world problem.
- Demonstrate understanding of transportation and assignment problems.

Key Concepts:

- Real-world problem-solving.
- Communication of solutions.

Teaching Strategies:

- Assign a project involving transportation or assignment problems.
- Provide guidelines and resources for research.
- Encourage creativity and critical thinking.

Activities:

1. Introduction of the project assignment.
2. Research and problem-solving.
3. Presentation of solutions.

Assessment:

- Summative assessment based on the quality of solutions and presentations.

Session 10: Conclusion and Reflection

Objective:

- Reflect on the learning journey.
- Discuss applications of linear programming and game theory in broader contexts.

Key Concepts:

- Recap of key learnings.
- Discussion on the relevance of mathematical concepts in real-world scenarios.

Teaching Strategies:

- Class discussion on the learning experience.
- Reflective writing activity.
- Discussion on future applications and studies.

Activities:

1. Group discussion on the learning journey.
2. Reflective writing activity.
3. Open forum for questions and discussions.

Assessment:

- Informal assessment through participation in discussions and reflective writing.

Title	Linear Programming & Game Theory Lesson Plan
Subtitle	Exploring Concepts, Strategies, and Applications
Duration	20 Sessions, 60 minutes each
Teacher's Name	DR PAYEL GHOSH (PG)
Date	[Date of First Session]

Session 1: Introduction to Game Theory

- **Duration:** 60 minutes
- **Objectives:** Introduce students to the concept of game theory and its relevance.
- **Key Concepts:** Game problem, players, strategies.

- **Teaching Strategies:** Lecture, discussion.
- **Activities:** Brainstorm examples of real-life games, such as chess or poker, and discuss the concept of strategic decision-making.
- **Assessment:** Short quiz on basic concepts of game theory.

Session 2: Rectangular Games and Strategies

- **Duration:** 60 minutes
- **Objectives:** Understand rectangular games and different types of strategies.
- **Key Concepts:** Rectangular games, pure strategy, mixed strategy.
- **Teaching Strategies:** Lecture, examples.
- **Activities:** Work through examples of rectangular games and identify pure and mixed strategies.
- **Assessment:** Practice problems on determining pure and mixed strategies.

Session 3: Saddle Points and Optimal Strategy

- **Duration:** 60 minutes
- **Objectives:** Explore saddle points and optimal strategies.
- **Key Concepts:** Saddle point, optimal strategy, value of the game.
- **Teaching Strategies:** Lecture, examples.
- **Activities:** Identify saddle points in given games and determine optimal strategies and the value of the game.
- **Assessment:** Problem-solving activity on finding saddle points and optimal strategies.

Session 4: Necessary and Sufficient Conditions for Optimality

- **Duration:** 60 minutes
- **Objectives:** Understand the conditions for a strategy to be optimal.
- **Key Concepts:** Necessary conditions, sufficient conditions.
- **Teaching Strategies:** Lecture, discussion.
- **Activities:** Discuss necessary and sufficient conditions for optimality in game strategies.
- **Assessment:** Small group activity to identify and discuss examples of optimal and non-optimal strategies.

Session 5: Concept of Dominance

- **Duration:** 60 minutes
- **Objectives:** Introduce the concept of dominance in game theory.
- **Key Concepts:** Dominance, dominated strategy.
- **Teaching Strategies:** Lecture, examples.
- **Activities:** Identify dominant strategies in various games and discuss their implications.
- **Assessment:** Quiz on identifying dominant strategies in given games.

Session 6: Fundamental Theorem of Rectangular Games

- **Duration:** 60 minutes
- **Objectives:** Learn about the fundamental theorem of rectangular games.
- **Key Concepts:** Fundamental theorem.
- **Teaching Strategies:** Lecture, examples.
- **Activities:** Discuss and prove the fundamental theorem of rectangular games.

- **Assessment:** Problem-solving activity on applying the fundamental theorem to determine optimal strategies.

Session 7: Algebraic Method of Solving Rectangular Games

- **Duration:** 60 minutes
- **Objectives:** Learn the algebraic method for solving rectangular games.
- **Key Concepts:** Algebraic method.
- **Teaching Strategies:** Lecture, examples.
- **Activities:** Work through examples of solving rectangular games using algebraic methods.
- **Assessment:** Practice problems on applying algebraic methods to solve games.

Session 8: Graphical Method of Solving Rectangular Games

- **Duration:** 60 minutes
- **Objectives:** Understand the graphical method for solving rectangular games.
- **Key Concepts:** Graphical method.
- **Teaching Strategies:** Lecture, examples.
- **Activities:** Demonstrate how to solve rectangular games graphically.
- **Assessment:** Problem-solving activity using graphical methods.

Session 9: Dominance Method of Solving Rectangular Games

- **Duration:** 60 minutes
- **Objectives:** Learn the dominance method for solving rectangular games.
- **Key Concepts:** Dominance method.
- **Teaching Strategies:** Lecture, examples.
- **Activities:** Discuss and practice solving games using the dominance method.
- **Assessment:** Quiz on applying the dominance method to solve games.

Session 10: Inter-Relation between Game Theory and Linear Programming

- **Duration:** 60 minutes
- **Objectives:** Explore the relationship between game theory and linear programming.
- **Key Concepts:** Inter-relation.
- **Teaching Strategies:** Lecture, discussion.
- **Activities:** Discuss how game theory concepts relate to linear programming problems.
- **Assessment:** Group discussion on real-world applications of game theory and linear programming.

Session 11-20: Application and Review

- **Duration:** 60 minutes each
- **Objectives:** Apply concepts learned to real-world scenarios and review key concepts.
- **Key Concepts:** Application, review.
- **Teaching Strategies:** Problem-solving, case studies, review sessions.
- **Activities:** Solve real-world problems using game theory concepts, review key concepts and techniques.
- **Assessment:** Group projects, quizzes, and a final exam covering all topics.

Real-World Applications:

- **Negotiation:** Game theory concepts can be applied to negotiation strategies in business or diplomatic scenarios.
- **Resource Allocation:** Linear programming models can be used to optimize resource allocation in various industries such as manufacturing, logistics, and finance.
- **Sports Strategy:** Game theory is relevant in sports strategy, such as in determining optimal strategies in games like football or basketball.
- **Political Decision Making:** Game theory can provide insights into political decision-making processes and strategic interactions between different parties.

Department of Mathematics

Raidighi College

Three-year B.Sc. in Mathematics (Honours) under CBCS System EVEN SEMESTER-Teaching Plan-2022-23

Semester	Course Type	Course Name	Course Details	Credits	Unit Name /Teacher's Name	Total No. of Classes	No of Lesson Plan**	Sub Unit Name **	Month	No. of Class
II	Honours	**Core Course-3**	Real Analysis	6	**Unit-1:Intuitive Understanding of Real Numbers/SB**	15	1	Understanding Real Numbers	[May to July]	2
								Countable and Uncountable Sets		2
								Bounded and Unbounded Sets, L.U.B., G.L.B		2
								L.U.B. Axiom and Archimedean Property		2
								Density of Rational and Irrational Numbers		2
								Assessment:		5
					Intervals and Set Operations/SB	15	1	Intervals and Neighborhoods	[May to July]	2
								Open Sets and Closed Sets		2
								Limit Points and Bolzano-Weierstrass Theorem		2
								Derived Sets and Complements		2
								Dense Sets in R		2
								Assessment		5
					Unit-2: Sequences and Convergence/ SB	10	1	Real Sequences and Convergence	[May to July]	2
								Relationship between Limit Points and Convergent Sequences		2
								Nested Interval Theorem and Important Sequences		2
								Cauchy's First and Second Limit Theorems		2
								Assessment		2
					Subsequences and Convergence/ SB	20	1	Subsequences and Subsequential Limits	[May to July]	3
								Alternative Definition of lim sup and lim inf		3
								Convergence and Bounded Sequences		3
								Monotone Subsequences and Bolzano-Weierstrass Theorem		4
								Cauchy's Convergence Criterion and Cauchy Sequences		4
								Assessment		3
					Unit-3:Infinite Series /DJ	10	1	Infinite Series and Convergence	[May to July]	3
								Tests for Convergence		3
								Alternating Series and Leibniz Test		2
								Assessment		2

II	Honours	**Core Course-4**	Group Theory-I	6	**Unit-1: Group Theory /URM**	30	1	Introduction to Group Theory	[May to July]	5
								Elementary Properties of Groups		5
								Subgroups		5
								Normalizer, Centralizer, and Center of a Group		5
								Product of Subgroups		4
								Assessment		6
					Unit-2:Group Theory /URM	25	1	Properties of Cyclic Groups	[May to July]	5
								Permutations and Cycle Notation		5
								Properties of Cosets and Order of Elements		4
								Lagrange's Theorem and Consequences		4
								Assessment		7
					Unit-3:Group Theory /URM	20	1	Normal Subgroups and Quotient Groups	[May to July]	4
								Group Homomorphisms		4
								Correspondence Theorem and Cayley's Theorem		4
								Properties of Isomorphisms		4
								Assessment		4

IV	Honours	**Core Course-8**	Riemann Integration & Series of Functions	6	**Unit-1 : Riemann integration/SB**	10	1	Introduction to Riemann Integration	[April-June]	1
								Upper and Lower Darboux Sums		2
								Darboux's Theorem		2
								Riemann's Definition		2
								Equivalence and Conditions		2
								Summary and Conclusion		1
					Concept of Negligible Sets/SB	10	1	Introduction to Negligible Sets	[April-June]	2
								Examples of Negligible Sets		2
								Criteria for Riemann Integrability		2
								Examples of Riemann Integrable Functions		2
								Assessment:		2
					Integrability and Properties/SB	15	1	Integrability Properties	[April-June]	2
								Functions Defined by Definite Integrals		2
								Antiderivatives and Logarithmic Function		2
								Fundamental Theorem of Integral Calculus		2
								First Mean Value Theorem of Integral Calculus		2
								Assessment		5
					Unit-2 : Improper integral/SB	10	1	Improper Integrals and Convergence	[April-June]	2
								Tests of Convergence		2
								Absolute and Non-absolute Convergence		2
								Abel's and Dirichlet's Test		2
								Beta and Gamma Functions		2
					Unit-3 : Series of functions/SB	10	5	Introduction to Sequence of Functions and Pointwise Convergence	[April-June]	2
								Uniform Convergence and Cauchy Criterion		2
								Weierstrass' M-Test and Applications		2
								Properties of Limit Functions		2
								Review and Real-World Applications		2
					Power series/SB	10	7	Introduction to Power Series and Fundamental Theorem	[April-June]	1
								Convergence Theorems: Cauchy-Hadamard Theorem		1
								Uniform and Absolute Convergence of Power Series		1
								Properties of Sum Function and Differentiation of Power Series		1
								Integration of Power Series and Abel's Limit Theorems		1
								Uniqueness of Power Series		1
								Real-World Applications and Review		4
					Fourier series/SB	10	7	Introduction to Fourier Series	[April-June]	1
								Sufficient Conditions for Fourier Series		1
								Fourier Coefficients and Periodic Functions		1
								Dirichlet's Condition of Convergence		1
								Theorem of Sum of Fourier Series		1
								Real-World Applications of Fourier Series		4
								Review and Reflection		1

IV	Honours	**Core Course-9**	Partial differential equation & Multivariate Calculus-II	6	**Unit-1 : Partial differential equation/ Understanding First Order PDEs and Their Solutions/PG**	5	1	Introduction to First-Order Partial Differential Equations	[April-June]	1
								Lagrange's Solution for First-Order PDEs		1
								Non-linear First Order PDEs		1
								Charpit's General Method of Solution		1
								Special Types of Equations		1
					Derivation and Classification of Heat, Wave, and Laplace Equations/PG	10	6	Introduction to Second Order PDEs	[April-June]	1
								Derivation of Heat Equation		2
								Derivation of Wave Equation		2
								Derivation of Laplace Equation		2
								Classification of Second Order PDEs		1
								Reduction to Canonical Forms		2
					Cauchy Problem, Boundary Value Problems, and Applications/PG	20	7	Introduction to Cauchy Problem and Cauchy-Kowalewskaya Theorem	[April-June]	2
								Cauchy Problem for Finite and Infinite Strings		3
								Initial Boundary Value Problems for Semi-Infinite Strings		3
								Equations with Non-Homogeneous Boundary Conditions		3
								Non-Homogeneous Wave Equation and Real-world Applications		3
								Solving the Vibrating String Problem		3
								Solving the Heat Conduction Problem		3
					Unit-2 : Multivariate Calculus-II/ PG	5	5	Introduction to Multiple Integrals	[April-June]	1
								Double Integrals and Existence Theorems		1
								Upper and Lower Integrals		1
								Statement of Existence Theorem for Continuous Functions		1
								Real-World Applications of Multiple Integrals		1
					Mastering Iterated Integrals, Triple Integrals, and More/PG	10	5	Iterated Integrals and Change of Order	[April-June]	2
								Triple Integrals and Coordinate Systems		2
								Cylindrical and Spherical Coordinates		2
								Change of Variables in Double Integrals		2
								Transformation of Double and Triple Integrals		2
					Solving Problems in Multivariate Calculus/PG	5	5	Determination of Volume by Multiple Integrals	[April-June]	1
								Determination of Surface Area by Multiple Integrals		1
								Differentiation Under the Integral Sign		1
								Application of Leibniz's Rule		1
								Real-World Applications		1
					Understanding Divergence, Curl, and Applications of Line Integrals/ PG	10	5	Introduction to Vector Fields	[April-June]	2
								Divergence and Curl		2
								Line Integrals and Applications		2
								Fundamental Theorem for Line Integrals		2
								Real-World Applications and Conclusion		2
					Green's Theorem, Surface Integrals, and More/PG	5	5	Green's Theorem	[April-June]	1
								Surface Integrals		1
								Integrals over Parametrically Defined Surfaces		1
								Stokes' Theorem		1
								The Divergence Theorem and Real-World Applications		1

IV	Honours	**Core Course-10**	**Mechanics**	6	**Unit-1:Coplanar forces in general/DJ**	5	5	Introduction to Coplanar Forces and Resultant	[April-June]	1
								Varignon's Theorem		1
								Conditions of Equilibrium		1
								Equilibrium Equations		1
								Real-World Applications of Coplanar Forces		1
					An arbitrary force system in space/ DJ	6	6	Moment of a Force and Varignon's Theorem	[April-June]	1
								Resultant Force and Resultant Couple		1
								Equilibrium Conditions		1
								Reduction to a Wrench and Poinsot's Central Axis		1
								Intensity and Pitch of a Wrench, Invariants		1
								Statically Determinate and Indeterminate Problems		1
					Exploring Contact Forces, Coulomb's Laws, and Friction /DJ	4	4	Introduction to Equilibrium and Contact Forces	[April-June]	1
								Coulomb's Laws of Friction		1
								Angle and Cone of Friction		1
								Real-World Applications and Problem-Solving		1
					Unit-2:Virtual work/DJ	5	5	Introduction to Virtual Work	[April-June]	1
								Virtual Displacements and Virtual Work		1
								Principle of Virtual Work		1
								Equilibrium Conditions for Force Systems		1
								Real-World Applications		1
					Stability of equilibrium/DJ	5	5	Introduction to Stability of Equilibrium	[April-June]	1
								Conservative Force Fields and Stability		1
								Energy Test of Stability		1
								Stability of Perfectly Rough Heavy Body		1
								Real-World Applications of Stability		1
					Unit-3:Kinematics of a particle/DJ	10	5	Velocity and Acceleration	[April-June]	2
								Angular Velocity and Momentum		2
								Relative Velocity and Acceleration		2
								Expressions for Velocity and Acceleration		2
								Uniform Circular Motion		2
					Newton laws of motion and law of gravitation/DJ	10	5	Newton's Laws of Motion	[April-June]	2
								Law of Gravitation and Equivalence Principle		2
								Vector Equation of Motion		2
								Work, Power, and Kinetic Energy		2
								Conservative Forces and Small Oscillations		2
					Unit-4: Problems in particle dynamics/DJ	8	8	Introduction to Rectilinear Motion	[April-June]	1
								Vertical Motion under Uniform Gravity		1
								Motion in Inverse Square Field		1
								Constrained Rectilinear Motion		1
								Motion in a Resisting Medium		1
								Simple Harmonic Motion		1
								Damped and Forced Oscillations		1
								Motion of Elastic Strings and Springs		1

					Planar motion of a particle/DJ	10	8	Introduction to Planar Motion	[April-June]	1
								Projectile Motion in a Resisting Medium		1
								Orbits in a Central Force Field		1
								Stability of Nearly Circular Orbits		1
								Motion under the Attractive Inverse Square Law		1
								Kepler's Laws on Planetary Motion		1
								Slightly Disturbed Orbits		1
								Motion of Artificial Satellites		1
								Constrained Motion on Smooth and Rough Curves		1
								Equations of Motion Referred to Rotating Axes		1
					Motion of a particle in three dimensions/DJ	2	2	Understanding Motion on Smooth Surfaces	[April-June]	1
								Real-World Applications of Motion on Smooth Surfaces		1
					Unit-5:Linear Momentum, Angular Momentum, Energy Principles/DJ	10	10	Introduction to Linear Momentum Principle	[April-June]	1
								Angular Momentum Principle I		1
								Angular Momentum Principle II		1
								Conservation of Angular Momentum		1
								Energy Principle I		1
								Energy Principle II		1
								Rocket Motion and Gravity		1
								Collision of Elastic Bodies		1
								The Two-Body Problem		1
								Real-World Applications and Review		1

IV	Honours	SEC B	Scientific computing with SageMath	2	**Introduction to SageMath/URM**	4	4	Introduction to SageMath	[April-June]	1
								Installation Procedure		1
								Use of SageMath as a Calculator		1
								Numerical and Symbolic Computations		1
					Graphical Representations and Plotting Functions /URM	4	4	Introduction to Graphical Representations	[April-June]	1
								Advanced Plotting Techniques		1
								Polar Plotting		1
								Application and Review		1
					Differentiation, Higher Order Derivatives, and Integrals/URM	3	3	Introduction to SageMath and Basic Commands	[April-June]	1
								Differentiation and Plotting		1
								Integration and Real-World Applications		1
					Exploring Programming Fundamentals and Mathematical Applications/URM	5	5	Introduction to Programming in SageMath	[April-June]	1
								Relational and Logical Operators		1
								Loops and Nested Loops		1
								Writing Programs for Mathematical Functions		1
								Advanced Mathematical Applications with SageMath		1
					Using Inbuilt Functions for Matrices, Linear Algebra, Polynomials, and Differential Equations/URM	4	4	Introduction to SageMath and Matrix Operations	[April-June]	1
								Solving Systems of Linear Equations and Finding Roots of Polynomials		1
								Solving Differential Equations		1
								Review and Application in Real-world Problems		1

VI	Honours	Core Course-13	Metric Space & Complex Analysis	6	**Unit-1 : Metric space/PG**	10	5	Introduction to Metric Spaces	[Feb-June]	2
								Sets and Operations in Metric Spaces		2
								Boundary Points and Bounded Sets		2
								Advanced Concepts and Applications		2
								Review and Evaluation		2
					Convergence and Completeness in Metric Spaces/PG	10	5	Convergent Sequences	[Feb-June]	2
								Boundedness and Completeness		2
								Cantor's Intersection Theorem		2
								Completeness of Real and Rational Numbers		2
								Review and Evaluation		2
					Continuous Mappings, Uniform Continuity, Compactness, and related theorems/PG	10	5	Introduction to Continuous Mappings	[Feb-June]	2
								Uniform Continuity		2
								Compactness		2
								Heine-Borel Theorem in R		2
								Continuous Functions on Compact Sets		2
					Connectedness and Banach Fixed Point Theorem/PG	10	4	Introduction to Connectedness	[Feb-June]	2
								Contraction Mappings		2
								Practical Applications		4
								Review and Evaluation		2
					Unit-2 : Complex analysis/PG	5	3	Introduction to Stereographic Projection	[Feb-June]	1
								Limits and Continuity		2
								Applications and Practice		2
					Derivatives, Analytic Functions, and Mobius Transformations/PG	10	3	Derivatives and Differentiation	[Feb-June]	4
								Analytic Functions and Special Functions		4
								Mobius Transformations		2
					Power Series and Convergence/ PG	10	3	Introduction to Power Series	[Feb-June]	4
								Convergence of Power Series		4
								Review and Evaluation		2
					Contours and Complex Integration/PG	10	4	Introduction to Contours	[Feb-June]	2
								Upper Bounds for Contour Integrals		2
								Cauchy-Goursat Theorem and Cauchy Integral Formula		4
								Review and Evaluation		2

VI	Honours	Core Course -14	Numerical Methods	4	**Unit-1:Fundamental of Numerical Method/URM**	4	1	Representation of Real Numbers	[Feb-June]	1
								Sources of Errors, Rounding of Numbers, Significant Digits		1
								Numerical Algorithms - Stability and Convergence		1
								Application and Practice		1
					Unit-2: aproximation,Interpolation,Central Interpolation/URM	15	1	Introduction to Approximation	[Feb-June]	1
								Polynomial Approximation		1
								Weierstrass Polynomial Approximation		1
								Introduction to Interpolation		1
								Lagrange Interpolation		1
								Newton's Interpolation		1
								Error Bounds in Interpolation		1
								Finite Difference Operators		1
								Newton (Gregory) Forward Interpolation		1
								Newton (Gregory) Backward Interpolation		1
								Central Interpolation		1
								Error Estimation in Central Interpolation		1
								Hermite Interpolation		1
								Application Exercises		1
								Review and Evaluation		1
					Unit-3: Numerical Differentiation and Numerical Integration/URM	10	1	Numerical Differentiation	[Feb-June]	3
								Numerical Integration: Newton-Cotes Formulas		3
								Numerical Integration: Advanced Methods		3
								Review and Applications		1
					Unit-4: Transcendental and Polynomial Equations/URM	10	1	Introduction to Numerical Methods for Equations	[Feb-June]	1
								Bisection Method		1
								Secant Method		1
								Regula-Falsi Method		1
								Fixed-Point Iteration		1
								Newton-Raphson Method		1
								Modified Newton-Raphson Method for Multiple Roots		1
								Complex Roots of Algebraic Equations		1
								Numerical Solution of Systems of Nonlinear Equations		1
								Convergence Analysis		1
					Unit-5:System of Linear Algebraic Equations/URM	10	1	Introduction to Linear Algebraic Equations	[Feb-June]	1
								Direct Methods: Gaussian Elimination and Gauss-Jordan Methods		2
								Iterative Methods: Gauss-Jacobi and Gauss-Seidel Methods		2
								LU Decomposition Method (Crout's LU Decomposition)		2
								Matrix Inversion: Gaussian Elimination and LU Decomposition		2
								Algebraic Eigenvalue Problem: Power Method		1
					Unit-6: numerical methods for ordinary differential equations/URM	5		Introduction to Numerical Methods for ODEs	[Feb-June]	1
								Method of Successive Approximations (Picard		1
								Euler's Method		1
								Modified Euler Method and Runge-Kutta Methods		1
								Error Analysis and Conclusion		1

VI	Honours	Core Course-14 Practical	**Numerical Methods Lab**	2	**Practical-1 &2 /URM**	4	1	Calculate the sum 1/1+ 1/2+ 1/3+ · · · + 1/N	[Feb-June]	2
								Enter 100 integers into an array and sort them in an ascending order.		2
					Solution of transcendental and algebraic equations/URM	6	1	Bisection Method	[Feb-June]	2
								Newton-Raphson Method		2
								Secant method		1
								Regula Falsi method.		1
					Solution of system of linear equations/URM	8	1	LU decomposition method	[Feb-June]	2
								Gaussian elimination method		2
								Gauss-Jacobi method		2
								Gauss-Seidel method		2
					Interpolation/URM	4	1	Lagrange Interpolation	[Feb-June]	2
								Newton's forward, backward and divided difference interpolations		2
					Numerical Integration/URM	4	1	Trapezoidal Rule	[Feb-June]	2
								Simpson's one third rule		2
								Weddle's Rule		2
								Gauss Quadrature		2
					Eigenvalue by Power method/URM	2	1	Power Method for Eigenvalue Computation	[Feb-June]	2
					Fitting a Polynomial Function /URM	2	1	Polynomial Fitting		2
					Solution of ordinary differential equations/URM	8	1	Euler method	[Feb-June]	
								Modified Euler method		
								Runge Kutta method		
								The method of successive approximations		

V1	Honours	DSE-A(2)	Mathematical Modelling	6	**Unit-1:/PG**	20	1	Introduction to Power Series Solutions	[Feb-June]	2
								Power Series Solutions of Bessel's Equation		2
								Power Series Solutions of Legendre's Equation		2
								Introduction to Laplace Transform		2
								Laplace Transform of Second Order ODEs		2
								Inverse Laplace Transform		2
								Application of Laplace Transform		2
								Review and Practice Session		2
								Final Project and Presentation		4
					Unit-2:/PG	10	1	Introduction to Monte Carlo Simulation Modeling	[Feb-June]	1
								Simulating Area Under a Curve		2
								Simulating Volume Under a Surface		2
								Advanced Monte Carlo Techniques		2
								Practical Applications and Case Studies		2
								Review, Evaluation, and Conclusion		1
						10	1	Introduction to Mathematical Modelling	[Feb-June]	2
								Generating Random Numbers: Middle Square Method		2
								Queuing Models: Harbor System		2
								Queuing Models: Morning Rush Hour		2
								Overview of Optimization Modelling		2
					Geometric and algebraic solutions, the simplex method, and sensitivity analysis/PG	15	1	Introduction to Linear Programming	[Feb-June]	1
								Geometric Solution		1
								Algebraic Solution		1
								Simplex Method		3
								Sensitivity Analysis		2
								Applications and Case Studies		2
								Project Work and Presentations		5

V1	Honours	DSE-B(2)	Point Set Topology	6	Unit-1:topological spaces, basis, subbasis, neighborhoods, interior points, and limit points:/SB	10	1	Introduction to Topological Spaces	[Feb-June]	1
								Basis and Subbasis		1
								Neighborhoods of a Point		1
								Interior Points		1
								Limit Points		1
								Practice and Application		3
								Review and Assessment		2
					Derived sets, boundaries, closed sets, closures, interiors, and dense subsets:/SB	5	1	Introduction to Point Set Topology	[Feb-June]	1
								Derived Sets and Boundaries		1
								Closed Sets and Closures		1
								Interior of a Set		1
								Dense Subsets		1
					Subspace topology, finite product topology, continuous functions, open maps, and closed maps:/SB	10	1	Introduction to Topology	[Feb-June]	1
								Subspace Topology		2
								Finite Product Topology		2
								Continuous Functions		2
								Open and Closed Maps		2
								Review and Assessment		1
					Homeomorphisms, topological invariants, metric topology, isometry, and metric invariants:/SB	10	1	Introduction to Topology	[Feb-June]	1
								Homeomorphisms		1
								Topological Invariants		1
								Metric Topology		1
								Isometry		1
								Metric Invariants		2
								Practical Exercises		2
								Review and Discussion		1
					Unit-2: First Countability, T1 and T2 Separation Axioms, Convergence, Cluster Point, and Heine's Continuity Criterion:/SB	15	1	Introduction to Point Set Topology	[Feb-June]	1
								First Countability		1
								T1 Separation Axiom		1
								T2 Separation Axiom (Hausdorff Spaces)		2
								Convergence and Cluster Point		2
								Heine's Continuity Criterion		2
								First Countable and Hausdorff Spaces		2
								Application and Real-World Examples		2
								Project Work and Presentations		2
					Unit-3:connected spaces, compact spaces, and the Heine-Borel Theorem:/SB	10	1	Introduction to Topology	[Feb-June]	1
								Connected Spaces		1
								Components		1
								Compact Spaces		1
								Compactness and T2		2
								Compact Sets in R		2
								Applications and Review		2
					Connected and compact spaces, compactness in metric spaces, sequentially compactness, and the Bolzano-Weierstrass property/SB	15	1	Introduction to Point Set Topology	[Feb-June]	1
								Real-Valued Continuous Functions on Connected Spaces		1
								Compact Spaces and Continuous Functions		2
								Sequentially Compact Metric Spaces		2
								Topological Aspects of Compactness		2
								Applications of Compactness in Analysis		2
								Proof Techniques for Compactness		2
								Problem-Solving and Case Studies		2
								Review, Recap, and Assessment		1

V1	Honours	DSE-B(2)	Advanced Mechanics	6	Unit-1:/DJ	10	1	Introduction to Degrees of Freedom	[Feb-June]	1
								Reactions due to Constraints		1
								D'Alembert's Principle		2
								Lagrange's First Kind Equations		2
								Generalized Coordinates		2
								Generalized Forces		2
						10	1	Introduction to Lagrangian Mechanics	[Feb-June]	1
								Lagrange’s Equations of Motion		2
								Cyclic Coordinates		1
								Velocity-Dependent Potential		2
								Principle of Energy		2
								Rayleigh’s Dissipation Function		2
					Unit-2:/DJ	10	1	Introduction to Action Integral and Hamilton’s Principle	[Feb-June]	1
								Lagrange’s Equations by Variational Methods		1
								Hamilton’s Principle for Non-Holonomic Systems		2
								Symmetry Properties and Conservation Laws		2
								Real-World Applications		2
								Review, Recap, and Assessment		2
						10	1	Introduction to Advanced Mechanics and Noether’s Theorem		1
								Canonically Conjugate Coordinates and Momenta		2
								Legendre Transformation		2
								Routhian Approach		2
								Hamiltonian Mechanics		2
								Real-World Applications and Review		1
					Unit-3/DJ	15	1	Introduction to Variational Principles	[Feb-June]	1
								Hamilton's Equations from Variational Principle		2
								Poincaré-Cartan Integral Invariant		2
								Principle of Stationary Action		2
								Fermat's Principle		2
								Real-World Applications		2
								Advanced Topics and Case Studies		2
								Project Work and Presentations		2
					Unit-4/DJ	10	1	Introduction to Canonical Transformations	[Feb-June]	1
								Generating Functions		2
								Poisson Brackets		2
								Equations of Motion		2
								Action-Angle Variables		2
								Real-World Applications and Wrap-Up		1
						10	1	Introduction to Canonical Transformations		1
								Generating Functions		2
								Poisson Brackets		1
								Equations of Motion		2
								Action-Angle Variables		2
								Real-world Applications		2

Department of Mathematics

Raidighi College

Three-year B.Sc. in Mathematics

(Honours) under CBCS System

EVEN SEMESTER-Lesson Plan

Real Analysis

Semester : 2 Credits : 5+1*=6

Core Course-3 Full Marks : 65+15**+20***=100

Paper Code(Theory): MTM-A-CC-2-3-TH

Paper Code (Tutorial):MTM-A-CC-2-3-TU

Unit-I

Lesson Plan: Real Analysis - Intuitive Understanding of Real Numbers

Department:	**Mathematics**
Title:	Real Analysis
Subtopic:	Intuitive Understanding of Real Numbers
Date:	[Date]
Duration:	15 hours
Teacher:	SWADHIN BANERJEE (SB)

Objective: By the end of this 15-hour lesson plan, students should be able to:

1. Understand the intuitive idea of real numbers.
2. Revisit mathematical operations and the usual order of real numbers with their properties.
3. Grasp the concept of countable and uncountable sets, and the uncountability of real numbers.

4. Comprehend bounded and unbounded sets in R, and the notions of least upper bound (L.U.B.) and greatest lower bound (G.L.B.) with their properties.
5. Understand the L.U.B. axiom (order completeness axiom) and the Archimedean property of R.
6. Appreciate the density of rational and irrational numbers in R.

Materials:

1. Textbook: "Introduction to Real Analysis" by Bartle and Sherbert.
2. Handouts on real numbers, countable and uncountable sets, bounded and unbounded sets, L.U.B. and G.L.B., and the Archimedean property.
3. Whiteboard and markers.
4. Calculators.
5. Worksheets and problem sets.

Introduction: (30 minutes) Begin with a real-life scenario where students encounter real numbers, such as measuring distances, calculating areas, or understanding temperature scales. Discuss briefly the importance of real numbers in mathematics and everyday life to engage students' interest.

Procedure:

Day 1-2: Understanding Real Numbers (2 hours)

- Define real numbers and discuss their properties: closure, commutative, associative, identity, inverse, and distributive.
- Perform operations (addition, subtraction, multiplication, division) with real numbers.
- Discuss the usual order of real numbers and its properties.

Day 3-4: Countable and Uncountable Sets (2 hours)

- Introduce the concept of countable and uncountable sets.
- Discuss examples and properties of countable and uncountable sets.
- Prove the uncountability of real numbers.

Day 5-6: Bounded and Unbounded Sets, L.U.B., G.L.B. (2 hours)

- Define bounded and unbounded sets in R.
- Introduce the concepts of least upper bound (L.U.B.) and greatest lower bound (G.L.B.).
- Discuss properties and examples of L.U.B. and G.L.B.

Day 7-8: L.U.B. Axiom and Archimedean Property (2 hours)

- Explain the L.U.B. axiom (order completeness axiom).
- Discuss the Archimedean property of R and its implications.

Day 9-10: Density of Rational and Irrational Numbers (2 hours)

- Prove the density of rational and irrational numbers in R.
- Discuss the significance of density in real analysis.

Assessment: (4 hours)

- Quiz on real numbers, countable and uncountable sets, bounded and unbounded sets, L.U.B. and G.L.B., and the Archimedean property.
- Homework assignments on problem-solving related to the concepts covered.
- Discussions and problem-solving sessions in class to gauge understanding.

Conclusion: (30 minutes) Summarize key points covered in the lesson plan, emphasizing the importance of real analysis concepts in advanced mathematics and various scientific fields. Encourage students to explore further by providing additional resources and avenues for study.

Lesson Plan: Real Analysis - Intervals and Set Operations

Department:	**Mathematics**
Title:	Real Analysis
Subtopic:	**Intervals and Set Operations**
Date:	[Date]
Duration:	15 hours
Teacher:	SWADHIN BANERJEE (SB)

Objective: By the end of this 15-hour lesson plan, students should be able to:

1. Understand intervals, neighborhoods of a point, interior points, open sets, closed sets, and their properties.
2. Define limit points and isolated points of a set, and comprehend the Bolzano-Weierstrass theorem.
3. Recognize the existence of limit points of every uncountable set as a consequence of the Bolzano-Weierstrass theorem.
4. Understand derived sets and their properties.
5. Comprehend the complement of open and closed sets, and the consequences of union and intersection of closed sets.
6. Appreciate the statement that no nonempty proper subset of R is both open and closed.
7. Understand dense sets in R, particularly rational and irrational numbers.

Materials:

1. Textbook: "Principles of Mathematical Analysis" by Walter Rudin.
2. Handouts on intervals, neighborhoods, open and closed sets, limit points, Bolzano-Weierstrass theorem, dense sets.
3. Whiteboard and markers.
4. Calculators.
5. Worksheets and problem sets.

Introduction: (30 minutes) Start with a real-life scenario where understanding intervals and set operations are crucial, such as scheduling events or managing resources. Emphasize the importance of these concepts in mathematical analysis and problem-solving.

Procedure:

Day 1-2: Intervals and Neighborhoods (2 hours)

- Define intervals (open, closed, half-open) and discuss their properties.
- Introduce neighborhoods of a point and interior points.
- Discuss examples and properties of intervals and neighborhoods.

Day 3-4: Open Sets and Closed Sets (2 hours)

- Define open sets and closed sets.
- Discuss the properties of open and closed sets, including union and intersection operations.
- Prove the consequences of union and intersection of closed sets.

Day 5-6: Limit Points and Bolzano-Weierstrass Theorem (2 hours)

- Define limit points and isolated points of a set.
- Introduce the Bolzano-Weierstrass theorem and its significance.
- Discuss the existence of limit points of every uncountable set as a consequence of the Bolzano-Weierstrass theorem.

Day 7-8: Derived Sets and Complements (2 hours)

- Define derived sets and discuss their properties.
- Introduce the complement of open and closed sets.
- Discuss the statement that no nonempty proper subset of R is both open and closed.

Day 9-10: Dense Sets in R (2 hours)

- Define dense sets and discuss their importance.
- Prove that rational and irrational numbers are dense in R.
- Discuss examples and applications of dense sets in analysis.

Assessment: (4 hours)

- Quiz on intervals, neighborhoods, open and closed sets, limit points, Bolzano-Weierstrass theorem, and dense sets.
- Homework assignments on problem-solving related to the concepts covered.
- Discussions and problem-solving sessions in class to gauge understanding.

Conclusion: (30 minutes) Summarize key points covered in the lesson plan, emphasizing the importance of these concepts in real analysis and their applications in various mathematical fields. Encourage students to explore further by providing additional resources and avenues for study.

UNIT-2

Lesson Plan: Real Analysis - Sequences and Convergence

Department:	**Mathematics**
Title:	Real Analysis
Subtopic:	**Sequences and Convergence**
Date:	[Date]
Duration:	10 hours
Teacher:	SWADHIN BANERJEE (SB)

Objective: By the end of this 10-hour lesson plan, students should be able to:

1. Understand real sequences, bounded sequences, convergence, and non-convergence.
2. Identify examples of bounded sequences and understand the boundedness of convergent sequences.
3. Grasp the uniqueness of limits and algebra of limits for sequences.
4. Understand the relationship between the limit point of a set and the limit of a convergent sequence of distinct elements.
5. Comprehend monotone sequences, their convergence, and the application of the Sandwich rule.
6. Understand the Nested Interval Theorem and the limit of some important sequences.
7. Apply Cauchy's first and second limit theorems.

Materials:

1. Textbook: "Introduction to Real Analysis" by Robert G. Bartle and Donald R. Sherbert.
2. Handouts on real sequences, convergence, and limit theorems.
3. Whiteboard and markers.
4. Calculators.
5. Worksheets and problem sets.

Introduction: (30 minutes) Start with a simple real-life scenario where understanding sequences and convergence are essential, such as tracking the temperature over time or observing the growth of a population. Emphasize the importance of sequences in understanding continuous phenomena.

Procedure:

Day 1-2: Real Sequences and Convergence (2 hours)

- Define real sequences and discuss their properties.
- Introduce bounded sequences and discuss examples.
- Discuss convergence and non-convergence of sequences.

- Prove the boundedness of convergent sequences.
- Discuss the uniqueness of limits and algebra of limits for sequences.

Day 3-4: Relationship between Limit Points and Convergent Sequences (2 hours)

- Explain the relationship between the limit point of a set and the limit of a convergent sequence of distinct elements.
- Introduce monotone sequences and discuss their convergence.
- Discuss the application of the Sandwich rule in proving convergence.

Day 5-6: Nested Interval Theorem and Important Sequences (2 hours)

- Introduce the Nested Interval Theorem and its significance.
- Discuss the limit of some important sequences, such as geometric and harmonic sequences.

Day 7-8: Cauchy's First and Second Limit Theorems (2 hour)

- Introduce Cauchy's first and second limit theorems.
- Discuss the implications and applications of these theorems.

Assessment: (1 hour)

- Quiz on real sequences, convergence, boundedness, and limit theorems.
- Homework assignments on problem-solving related to sequences and convergence.
- Discussions and problem-solving sessions in class to gauge understanding.

Conclusion: (30 minutes) Summarize key points covered in the lesson plan, emphasizing the importance of sequences and convergence in real analysis and their applications in various mathematical fields. Encourage students to explore further by providing additional resources and avenues for study.

Lesson Plan: Real Analysis - Subsequences and Convergence

Department:	**Mathematics**
Title:	Real Analysis
Subtopic:	**Sequences and Convergence**
Date:	[Date]
Duration:	20 hours
Teacher:	SWADHIN BANERJEE (SB)

Objective: By the end of this 20-hour lesson plan, students should be able to:

1. Understand subsequences, subsequential limits, lim sup, and lim inf of a sequence.
2. Define lim sup as the least upper bound and lim inf as the greatest lower bound of a set containing all the subsequential limits.
3. Grasp the alternative definition of lim sup and lim inf using inequalities.
4. Recognize the equivalence between the two definitions of lim sup and lim inf.
5. Understand the relationship between lim sup, lim inf, and convergence of bounded sequences.
6. Understand the existence of monotone subsequences for every sequence.
7. Apply the Bolzano-Weierstrass theorem for sequences and Cauchy's convergence criterion.

Materials:

1. Textbook: "Principles of Mathematical Analysis" by Walter Rudin.
2. Handouts on subsequences, lim sup, lim inf, Bolzano-Weierstrass theorem, and Cauchy's convergence criterion.
3. Whiteboard and markers.
4. Calculators.
5. Worksheets and problem sets.

Introduction: (30 minutes) Begin with a thought-provoking question or example that highlights the importance of understanding subsequences and convergence in real analysis, such as finding patterns in the fluctuations of stock prices or predicting the behavior of a physical system over time.

Procedure:

Day 1-3: Subsequences and Subsequential Limits (3 hours)

- Define subsequences and discuss their properties.
- Introduce subsequential limits and their significance.
- Define lim sup and lim inf as the least upper bound and greatest lower bound of a set containing all the subsequential limits.

Day 4-6: Alternative Definition of lim sup and lim inf (3 hours)

- Introduce the alternative definitions of lim sup and lim inf using inequalities.
- Discuss the equivalence between the two definitions.
- Illustrate with examples and proofs.

Day 7-9: Convergence and Bounded Sequences (3 hours)

- Discuss the relationship between lim sup, lim inf, and convergence of bounded sequences.
- Prove that a bounded sequence is convergent if and only if lim sup equals lim inf.
- Discuss the implications and applications of this result.

Day 10-13: Monotone Subsequences and Bolzano-Weierstrass Theorem (4 hours)

- Prove that every sequence has a monotone subsequence.
- Introduce the Bolzano-Weierstrass theorem for sequences and discuss its proof.
- Discuss applications of the theorem in analysis and other fields.

Day 14-17: Cauchy's Convergence Criterion and Cauchy Sequences (4 hours)

- Introduce Cauchy's convergence criterion for sequences.
- Define Cauchy sequences and discuss their properties.
- Prove the equivalence between convergence and being a Cauchy sequence.

Assessment: (2 hours)

- Quiz on subsequences, lim sup, lim inf, Bolzano-Weierstrass theorem, Cauchy's convergence criterion, and Cauchy sequences.
- Homework assignments on problem-solving related to the concepts covered.
- Discussions and problem-solving sessions in class to gauge understanding.

Conclusion: (30 minutes) Summarize key points covered in the lesson plan, emphasizing the importance of subsequences and convergence in real analysis and their applications in various mathematical fields. Encourage students to explore further by providing additional resources and avenues for study.

UNIT 3:

Lesson Plan: Real Analysis - Infinite Series and Convergence

Department:	**Mathematics**
Title:	Real Analysis
Subtopic:	**Infinite Series and Convergence**
Date:	[Date]
Duration:	10 hours
Teacher:	DEBABRATA JANA (DJ)

Objective: By the end of this 10-hour lesson plan, students should be able to:

1. Understand the concept of infinite series and its convergence.
2. Identify convergence and non-convergence of infinite series using the Cauchy criterion.
3. Apply various tests for convergence, including the comparison test, limit comparison test, ratio test, Cauchy's nth root test, Kummer's test, and Gauss test.
4. Understand alternating series and apply the Leibniz test.
5. Differentiate between absolute and conditional convergence.

Materials:

1. Textbook: "Real Mathematical Analysis" by Charles Chapman Pugh.
2. Handouts on infinite series, convergence tests, alternating series, and absolute/conditional convergence.
3. Whiteboard and markers.
4. Calculators.
5. Worksheets and problem sets.

Introduction: (30 minutes) Begin with an intriguing problem involving an infinite sum, such as the sum of the reciprocals of powers of 2 or the sum of the reciprocals of prime numbers. Highlight the significance of understanding convergence in evaluating such sums and its applications in various mathematical contexts.

Procedure:

Day 1-3: Infinite Series and Convergence (3 hours)

- Define infinite series and discuss their convergence.
- Introduce the Cauchy criterion for convergence of infinite series.
- Discuss examples of convergent and divergent series.

Day 4-6: Tests for Convergence (3 hours)

- Introduce various tests for convergence, including the comparison test, limit comparison test, ratio test, Cauchy's nth root test, Kummer's test, and Gauss test.
- Discuss the statements of these tests and their applications with examples.
- Provide proofs or intuitive explanations for some of the tests.

Day 7-8: Alternating Series and Leibniz Test (2 hours)

- Define alternating series and discuss their properties.
- Introduce the Leibniz test for convergence of alternating series.
- Discuss examples and applications of the Leibniz test.

Assessment: (1 hour)

- Quiz on infinite series, convergence tests, alternating series, and absolute/conditional convergence.
- Homework assignments on problem-solving related to the concepts covered.
- Discussions and problem-solving sessions in class to gauge understanding.

Conclusion: (30 minutes) Summarize key points covered in the lesson plan, emphasizing the importance of understanding convergence of infinite series and the various tests available for determining convergence. Encourage students to explore further by providing additional resources and avenues for study.

Group Theory-I

Semester : 2 Credits : 5+1*=6

Core Course-4 Full Marks :

65+15**+20***=100

Paper Code(Theory): MTM-A-CC-2-4-TH

Paper Code (Tutorial):MTM-A-CC-2-4-TU

UNIT-1

Lesson Plan: Group Theory - Symmetries and Group Properties

Department:	**Mathematics**
Title:	Real Analysis
Subtopic:	**Symmetries and Group Properties**
Date:	[Date]
Duration:	30 hours
Teacher:	UTTAM ROY MANDAL (URM)

Objective: By the end of this 30-hour lesson plan, students should be able to:

1. Understand the concept of symmetry through the symmetries of a square.
2. Define a group and identify examples of groups, including permutation groups, dihedral groups, and quaternion groups.

3. Identify elementary properties of groups and examples of commutative and non-commutative groups.
4. Understand the concept of subgroups and necessary and sufficient conditions for a subset to be a subgroup.
5. Define and apply concepts such as normalizer, centralizer, center of a group, and product of subgroups.

Materials:

1. Textbook: "Abstract Algebra" by David S. Dummit and Richard M. Foote.
2. Handouts on symmetry of a square, group definitions, examples, and properties.
3. Whiteboard and markers.
4. Geometry tools for visualizing symmetries.
5. Worksheets and problem sets.

Introduction: (1 hour) Start with a hands-on activity involving the symmetries of a square. Have students identify and explore various symmetries of the square, such as rotations and reflections. Discuss how these symmetries form a group and introduce the concept of abstract groups.

Procedure:

Day 1-5: Introduction to Group Theory (5 hours)

- Define a group and discuss its basic properties: closure, associativity, identity element, and inverses.
- Introduce examples of groups, including permutation groups, dihedral groups, and quaternion groups (through matrices).
- Discuss the importance of symmetry in mathematics and its connection to group theory.

Day 6-10: Elementary Properties of Groups (5 hours)

- Explore elementary properties of groups, such as the existence and uniqueness of identity elements and inverses.
- Discuss examples of commutative (abelian) and non-commutative groups.
- Provide proofs or examples to illustrate group properties.

Day 11-15: Subgroups (5 hours)

- Define subgroups and discuss examples.
- Introduce necessary and sufficient conditions for a subset to be a subgroup.
- Discuss the subgroup generated by a subset and its properties.

Day 16-20: Normalizer, Centralizer, and Center of a Group (5 hours)

- Define and discuss the normalizer, centralizer, and center of a group.
- Provide examples and applications of these concepts.
- Discuss the relationship between these concepts and subgroup structure.

Day 21-24: Product of Subgroups (4 hours)

- Define the product of two subgroups and discuss its properties.
- Introduce examples and applications of the product of subgroups.
- Discuss the relationship between the product of subgroups and group structure.

Assessment: (3 hours)

- Quizzes on group definitions, properties, and examples.
- Homework assignments on problem-solving related to group theory concepts.
- Discussions and problem-solving sessions in class to gauge understanding.

Conclusion: (2 hours) Summarize key points covered in the lesson plan, emphasizing the importance of understanding group theory in various areas of mathematics and its applications. Encourage students to explore further by providing additional resources and avenues for study.

UNIT-2:

Lesson Plan: Group Theory - Cyclic Groups, Permutations, and Lagrange's Theorem

Department:	**Mathematics**
Title:	Real Analysis
Subtopic:	**Cyclic Groups, Permutations, and Lagrange's Theorem**
Date:	[Date]
Duration:	25 hours
Teacher:	UTTAM ROY MANDAL (URM)

Objective: By the end of this 25-hour lesson plan, students should be able to:

1. Understand the properties of cyclic groups and classify subgroups of cyclic groups.
2. Use cycle notation for permutations and understand the properties of permutations, including even and odd permutations.
3. Define the alternating group and understand its properties.
4. Understand the properties of cosets, the order of an element, and the order of a group.
5. State Lagrange's theorem and its consequences, including Fermat's Little Theorem.

Materials:

1. Textbook: "Abstract Algebra" by David S. Dummit and Richard M. Foote.
2. Handouts on cyclic groups, permutations, cosets, Lagrange's theorem, and Fermat's Little Theorem.
3. Whiteboard and markers.
4. Worksheets and problem sets.
5. Calculators for computations if necessary.

Introduction: (1 hour) Start with a visual representation of cyclic groups using a clock or a modular arithmetic example. Introduce the concept of cycles in permutations by using a simple example like rearranging letters in a word. Emphasize the importance of understanding group theory in various mathematical contexts.

Procedure:

Day 1-5: Properties of Cyclic Groups (5 hours)

- Define cyclic groups and discuss their properties.
- Classify subgroups of cyclic groups.
- Provide examples and applications of cyclic groups.

Day 6-10: Permutations and Cycle Notation (5 hours)

- Introduce permutations and cycle notation.
- Discuss the properties of permutations, including composition and inverses.
- Define even and odd permutations and discuss their properties.
- Introduce the alternating group and its properties.

Day 11-14: Properties of Cosets and Order of Elements (4 hours)

- Define cosets and discuss their properties, including the index of a subgroup.
- Define the order of an element and discuss its properties.
- Discuss the order of a group and its relationship to the order of its elements.

Day 15-18: Lagrange's Theorem and Consequences (4 hours)

- State Lagrange's theorem and prove it.
- Discuss consequences of Lagrange's theorem, including the existence of subgroups of certain orders.
- Introduce Fermat's Little Theorem and its proof using Lagrange's theorem.

Assessment: (4 hours)

- Quizzes on cyclic groups, permutations, cosets, Lagrange's theorem, and Fermat's Little Theorem.
- Homework assignments on problem-solving related to group theory concepts.
- Discussions and problem-solving sessions in class to gauge understanding.

Conclusion: (2 hours) Summarize key points covered in the lesson plan, emphasizing the importance of understanding group theory in various mathematical contexts and its applications. Encourage students to explore further by providing additional resources and avenues for study.

UNIT -3:

Lesson Plan: Group Theory - Normal Subgroups, Quotient Groups, and Homomorphisms

Department:	**Mathematics**
Title:	Real Analysis
Subtopic:	**Normal Subgroups, Quotient Groups, and Homomorphisms**
Date:	[Date]
Duration:	20 hours
Teacher:	UTTAM ROY MANDAL (URM)

Objective: By the end of this 20-hour lesson plan, students should be able to:

1. Understand the concept of normal subgroups and their properties.
2. Define quotient groups and understand their significance.
3. Define group homomorphisms, understand their properties, and apply them in various contexts.
4. Understand the correspondence theorem and the one-to-one correspondence between normal subgroups and congruences.
5. Understand Cayley's theorem and its implications.
6. Understand the properties of isomorphisms and apply them in group theory.
7. State and apply the first, second, and third isomorphism theorems.

Materials:

1. Textbook: "Abstract Algebra" by David S. Dummit and Richard M. Foote.
2. Handouts on normal subgroups, quotient groups, homomorphisms, and isomorphism theorems.
3. Whiteboard and markers.
4. Worksheets and problem sets.
5. Calculators for computations if necessary.

Introduction: (1 hour) Start with a visual representation of normal subgroups using a simple example, such as the rotation and reflection symmetries of a square. Discuss the importance of normal subgroups in understanding the structure of groups and their applications.

Procedure:

Day 1-4: Normal Subgroups and Quotient Groups (4 hours)

- Define normal subgroups and discuss their properties, including closure under conjugation.
- Introduce quotient groups and discuss their construction using normal subgroups.
- Provide examples and applications of normal subgroups and quotient groups.

Day 5-8: Group Homomorphisms (4 hours)

- Define group homomorphisms and discuss their properties, including preservation of group structure.
- Discuss examples of group homomorphisms and their applications.
- Prove basic properties of homomorphisms, such as the kernel and image of a homomorphism.

Day 9-12: Correspondence Theorem and Cayley's Theorem (4 hours)

- Introduce the correspondence theorem and discuss the one-to-one correspondence between normal subgroups and congruences.
- State Cayley's theorem and its implications for group representations.
- Discuss examples and applications of Cayley's theorem.

Day 13-16: Properties of Isomorphisms (4 hours)

- Define isomorphisms and discuss their properties, including preservation of group structure and bijectivity.
- Discuss examples of isomorphisms and their applications.
- Prove basic properties of isomorphisms, such as the preservation of order and subgroup structure.

Assessment: (3 hours)

- Quizzes on normal subgroups, quotient groups, homomorphisms, and isomorphism theorems.
- Homework assignments on problem-solving related to group theory concepts.
- Discussions and problem-solving sessions in class to gauge understanding.

Conclusion: (1 hour) Summarize key points covered in the lesson plan, emphasizing the importance of understanding normal subgroups, quotient groups, homomorphisms, and isomorphisms in group theory. Encourage students to explore further by providing additional resources and avenues for study.

Riemann Integration & Series of Functions

Semester : 4 Credits : 5+1*=6

Core Course-8 Full Marks

65+15**+20***=100

Paper Code(Theory): MTM-A-CC-4-8-TH

Paper Code (Tutorial):MTM-A-CC-4-8-TU

Unit-1 : Riemann integration

Here's a structured lesson plan in tabular form for a 10-hour session on Riemann integration for undergraduate mathematics students:

Department: Mathematics
Title of the Topic: Riemann Integration
Subtopic: Partition and Refinement, Upper and Lower Darboux Sums, Darboux's Theorem, Riemann's Definition, Equivalence, Conditions
Date: [Insert Date]
Duration: 10 hours
Teacher: SWADHIN BANERJEE (SB)

Session Number	**Session Title**	**Objectives**	**Instructional Activities**	**Assessment**	**Materials Needed**
1	Introduction to Riemann Integration	- Understand the concept of Riemann integration and its significance in calculus. - Learn about partitions and refinements of closed and bounded intervals.	1. Lecture on the basics of Riemann integration and its importance. 2. Discussion on partitions and refinements. 3. Examples illustrating the concept.	- Participation in discussions and questions. - Quiz to assess understanding of basic concepts.	Whiteboard, markers, projector
2-3	Upper and Lower Darboux Sums	- Understand the definitions of upper and lower Darboux sums. - Learn how to compute upper and lower Darboux sums for a given function and partition.	1. Explanation of upper and lower Darboux sums and their properties. 2. Step-by-step computation of Darboux sums for simple functions. 3. Practice exercises involving the calculation of Darboux sums.	- Accuracy in computing Darboux sums. - Participation in practical exercises.	Calculators, textbooks, paper
4-5	Darboux's Theorem	- Understand Darboux's theorem and its significance in Riemann integration. - Learn about the intermediate value property of Riemann integrable functions.	1. Lecture on Darboux's theorem and its proof. 2. Discussion on the intermediate value property. 3. Examples demonstrating the theorem.	- Ability to understand and apply Darboux's theorem. - Analysis of examples involving the intermediate value property.	Whiteboard, markers, textbooks, paper
6-7	Riemann's Definition	- Understand Riemann's	1. Explanation of Riemann's definition of	- Accuracy in understanding and	Whiteboard, markers,

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
		definition of integrability and its relation to Darboux's definition. - Learn about upper and lower Riemann integrals.	integrability. 2. Comparison with Darboux's definition. 3. Derivation of upper and lower Riemann integrals. 4. Practice problems involving the calculation of Riemann integrals.	applying Riemann's definition. - Participation in problem-solving activities.	textbooks, paper
8-9	Equivalence and Conditions	- Understand the equivalence between Riemann and Darboux definitions of integrability. - Learn about necessary and sufficient conditions for Riemann integrability.	1. Discussion on the equivalence of Riemann and Darboux definitions. 2. Presentation of necessary and sufficient conditions for Riemann integrability. 3. Examples demonstrating the conditions.	- Ability to explain the equivalence between Riemann and Darboux definitions. - Analysis of examples involving necessary and sufficient conditions for Riemann integrability.	Whiteboard, markers, textbooks, paper
10	Summary and Conclusion	- Recap key concepts covered in the lesson. - Summarize the main results and conclusions.	1. Review session covering key concepts and results. 2. Summarize the main points and conclusions. 3. Provide opportunity for students to ask questions and clarify doubts.	- Understanding demonstrated in the summary and recap. - Participation in the review session.	Whiteboard, markers, textbooks, paper

Homework or Assignments:

- Assign practice problems involving the computation of upper and lower Darboux sums, application of Darboux's theorem, and calculation of Riemann integrals.

Real-life Applications:

- Discuss real-world scenarios where Riemann integration is used, such as in calculating areas under curves in physics, engineering, and economics.

Technology Integration:

- Use graphing calculators or software to visualize functions and their partitions, and to compute Darboux sums and Riemann integrals.

Summary and Conclusion: In this lesson, we covered the fundamentals of Riemann integration, including partitions, Darboux sums, Darboux's theorem, Riemann's definition, equivalence with Darboux's definition, and necessary and sufficient conditions for integrability. Through lectures, discussions, and problem-solving activities, students gained a deeper understanding of these concepts and their applications in mathematics and beyond. It is important for students to continue practicing and applying these techniques to further enhance their skills in calculus and mathematical analysis.

Below is a structured lesson plan for a 10-hour session on Riemann Integration:

Department:	**Mathematics**
Title:	Riemann Integration
Subtopic:	Concept of Negligible Sets
Date:	[Date]
Duration:	10 hours
Teacher:	SWADHIN BANERJEE (SB)

Objectives:

- Understand the concept of negligible sets in Riemann integration.
- Identify examples of negligible sets and their properties.
- Learn the criteria for Riemann integrability in terms of negligible sets.
- Recognize examples of Riemann integrable functions.

Instructional Activities:

1. **Introduction to Negligible Sets**: 2 Hours
    - Define negligible sets and their significance in Riemann integration.
    - Discuss the concept of negligible sets covered by countable intervals with arbitrarily small lengths.

2. **Examples of Negligible Sets**: 2 Hours
    - Provide examples of negligible sets, including subsets of negligible sets, finite sets, and countable unions of negligible sets.
    - Discuss properties and characteristics of each example.
3. **Criteria for Riemann Integrability**: 2 Hours
    - Explain the theorem stating that a bounded function on closed and bounded intervals is Riemann integrable if and only if the set of points of discontinuity is negligible.
    - Illustrate the theorem with examples and proofs.
4. **Examples of Riemann Integrable Functions**: 2 Hours
    - Present examples of functions that satisfy the criteria for Riemann integrability.

- Demonstrate the process of calculating Riemann integrals for these functions.

Assessment: 2 Hours

- **Class Participation**:
  - Evaluate students' engagement and participation in discussions and activities throughout the lesson.
- **Problem-solving Exercises**:
  - Assign exercises related to identifying negligible sets and determining Riemann integrability.
- **Quiz**:
  - Conduct a quiz to assess understanding of concepts, properties, and criteria discussed in the lesson.

Materials Needed:

- Whiteboard and markers
- Textbooks or reference materials on Riemann integration
- Examples of negligible sets and Riemann integrable functions
- Calculators or computers for numerical computations

Homework or Assignments:

- Assign problems from the textbook or worksheets related to negligible sets and Riemann integrability for practice.

Real-life Applications:

- Discuss real-life scenarios where Riemann integration and the concept of negligible sets are applicable, such as in physics, engineering, and economics.

Technology Integration:

- Utilize graphing software or online tools to visualize functions and their Riemann integrals.
- Use educational websites or online platforms for additional practice and resources.

Summary and Conclusion:

- Summarize key concepts learned during the lesson, including the definition and properties of negligible sets, criteria for Riemann integrability, and examples of Riemann integrable functions.
- Emphasize the importance of understanding these concepts in the context of calculus and mathematical analysis.
- Encourage students to practice problem-solving and explore further applications of Riemann integration in their studies and research.

This structured lesson plan provides a framework for teaching the concept of negligible sets and Riemann integration to undergraduate mathematics students, incorporating various instructional activities, assessments, materials, and real-life applications.

Below is a structured lesson plan for a 15-hour session on Riemann Integration:

Department:	**Mathematics**
Title:	Riemann Integration
Subtopic:	Integrability and Properties
Date:	[Date]

Department:	**Mathematics**
Duration:	15 hours
Teacher:	SWADHIN BANERJEE (SB)

Objectives:

- Understand the integrability of sum, scalar multiple, product, quotient, and modulus of Riemann integrable functions.
- Explore properties of Riemann integrable functions derived from the above results.
- Learn about functions defined by definite integrals and their properties.
- Understand the concept of antiderivatives and properties of the logarithmic function defined as a definite integral.
- Understand the Fundamental Theorem of Integral Calculus and the First Mean Value Theorem of Integral Calculus.

Instructional Activities:

1. **Integrability Properties**:
    - Explain the integrability of sum, scalar multiple, product, quotient, and modulus of Riemann integrable functions.
    - Discuss properties of Riemann integrable functions arising from these results.
2. **Functions Defined by Definite Integrals**:
    - Define functions defined by definite integrals and discuss their properties.
    - Explore examples and applications of such functions.
3. **Antiderivatives and Logarithmic Function**:
    - Introduce the concept of antiderivatives and their properties.
    - Define the logarithmic function as the definite integral of 1 to x dt/t for $x > 0$ and discuss its properties.
4. **Fundamental Theorem of Integral Calculus**:
    - Present the Fundamental Theorem of Integral Calculus and its significance.
    - Illustrate the theorem with examples and proofs.
5. **First Mean Value Theorem of Integral Calculus**:
    - Explain the First Mean Value Theorem of Integral Calculus and its application.
    - Discuss the geometric interpretation and implications of the theorem.

Assessment:

- **Homework Assignments**:
    - Assign problems related to integrability properties, functions defined by definite integrals, antiderivatives, and the Fundamental Theorem of Integral Calculus for practice.
- **In-Class Exercises**:
    - Conduct in-class exercises to assess understanding of concepts discussed during lectures.
- **Quiz and Exam**:
    - Administer quizzes and exams to evaluate comprehension and retention of material covered in the lesson.

Materials Needed:

- Whiteboard and markers
- Textbooks or reference materials on integral calculus
- Examples and practice problems
- Calculators or computers for numerical computations

Real-life Applications:

- Discuss real-life scenarios where the properties of Riemann integrable functions and the Fundamental Theorem of Integral Calculus are applicable, such as in physics, engineering, and economics.

Technology Integration:

- Utilize graphing software or online tools to visualize functions and their integrals.
- Use educational websites or online platforms for additional practice and resources.

Summary and Conclusion:

- Summarize key concepts learned during the lesson, including integrability properties, functions defined by definite integrals, antiderivatives, and the Fundamental Theorem of Integral Calculus.
- Emphasize the importance of understanding these concepts in the context of calculus and mathematical analysis.
- Encourage students to practice problem-solving and explore further applications of integral calculus in their studies and research.

This structured lesson plan provides a comprehensive framework for teaching various aspects of Riemann Integration to undergraduate mathematics students, incorporating instructional activities, assessments, materials, real-life applications, and technology integration.

Unit-2 : Improper integral

Below is a structured lesson plan for a 10-hour session on Improper Integrals:

Department:	**Mathematics**
Title:	Improper Integrals
Subtitle:	Convergence and Tests of Convergence
Date:	[Date]
Duration:	10 hours
Teacher:	SWADHIN BANERJEE (SB)

Objectives:

- Understand the concept of improper integrals and their convergence criteria.
- Learn about tests of convergence such as the Comparison Test and M-test.
- Explore absolute and non-absolute convergence and their interrelations.
- Gain working knowledge of the Beta and Gamma functions and their interrelation.

Instructional Activities:

Session 1-2: Improper Integrals and Convergence

- **Introduction to Improper Integrals**:
  - Define improper integrals and discuss their range of integration (finite or infinite).
- **Convergence Criteria**:
  - Explain necessary and sufficient conditions for convergence of improper integrals in both finite and infinite cases.

Session 3-4: Tests of Convergence

- **Comparison Test**:
  - Introduce the Comparison Test for convergence of improper integrals.
- **M-Test**:
  - Discuss the M-test for convergence of series and its application to improper integrals.

Session 5-6: Absolute and Non-absolute Convergence

- **Absolute Convergence**:
  - Define absolute convergence and discuss its importance in convergence analysis.
- **Non-absolute Convergence**:
  - Explore the concept of non-absolute convergence and its implications.

Session 7-8: Abel’s and Dirichlet’s Test

- **Statement of Abel's Test**:
    - Present Abel's Test for convergence of the integral of a product.
- **Statement of Dirichlet's Test**:
    - Introduce Dirichlet's Test for convergence of the integral of a product.

Session 9-10: Beta and Gamma Functions

- **Beta Function**:
    - Define the Beta function and its properties.
- **Gamma Function**:
    - Define the Gamma function and its properties.
- **Interrelation**:
    - Explore the interrelation between the Beta and Gamma functions.

Assessment:

- **Class Participation**:
    - Evaluate students' engagement and participation during discussions and activities.
- **Problem-solving Assessments**:
    - Assess understanding through problem-solving assessments.
- **Quiz**:
    - Conduct a quiz to assess understanding of concepts and test-solving abilities.

Materials Needed:

- Whiteboard and markers
- Textbooks or reference materials on Improper Integrals
- Calculators or computers for numerical computations

Applications in Science and Technology:

- Discuss real-life applications of improper integrals in fields such as physics, engineering, and economics.

Summary and Conclusion:

- Summarize key concepts learned during the 10-hour lesson plan.
- Reinforce the importance of understanding convergence criteria and tests of convergence.
- Emphasize the practical applications of improper integrals in various scientific and technological fields.

This structured lesson plan provides a comprehensive approach to teaching Improper Integrals, covering various subtopics, activities, assessments, materials, and applications in science and technology.

Unit-3 : Series of functions

Here's a comprehensive 10-hour lesson plan on "Series of Functions" organized in tabular form:

Title: Comprehensive Lesson Plan on "Series of Functions"	**Duration: 10 hours**
Subtitle: Exploring Sequence of Functions, Pointwise and Uniform Convergence, and Real-World Applications	**Date:**
Teachers: SWADHIN BANERJEE (SB)	

Day 1-2: Introduction to Sequence of Functions and Pointwise Convergence

Session: Introduction to Sequence of Functions and Pointwise Convergence	**Duration: 120 minutes**
Objectives:	
- Introduce students to sequence of functions and their basic properties.	
- Understand the concept of pointwise convergence.	
Key Concepts:	
- Sequence of functions	
- Pointwise convergence	
Teaching Strategies:	
- Lecture with examples	
- Interactive discussions	
Activities:	
1. Presentation of sequence of functions definition.	

Session: Introduction to Sequence of Functions and Pointwise Convergence	**Duration: 120 minutes**
2. Explanation of pointwise convergence with examples.	
3. Group discussions on understanding pointwise convergence.	
Assessment:	
- Quiz on sequence of functions and pointwise convergence.	

Day 3-4: Uniform Convergence and Cauchy Criterion

Session: Uniform Convergence and Cauchy Criterion	**Duration: 120 minutes**
Objectives:	
- Explore the concept of uniform convergence.	
- Understand the Cauchy criterion for uniform convergence.	
Key Concepts:	
- Uniform convergence	
- Cauchy criterion for uniform convergence	
Teaching Strategies:	
- Problem-solving sessions	
- Group activities	
Activities:	
1. Presentation of uniform convergence concept.	
2. Explanation and proof of Cauchy criterion.	
3. Group work on applying Cauchy criterion to sequences.	
Assessment:	

Session: Uniform Convergence and Cauchy Criterion	Duration: 120 minutes
- Mini-project on analyzing uniform convergence using Cauchy criterion.	

Day 5-6: Weierstrass’ M-Test and Applications

Session: Weierstrass’ M-Test and Applications	Duration: 120 minutes
Objectives:	
- Introduce Weierstrass’ M-Test for uniform convergence.	
- Explore real-world applications of uniform convergence.	
Key Concepts:	
- Weierstrass’ M-Test	
- Applications of uniform convergence	
Teaching Strategies:	
- Application-based learning	
- Case studies	
Activities:	
1. Presentation and proof of Weierstrass’ M-Test.	
2. Analysis of real-world examples demonstrating uniform convergence.	
3. Group discussion on applications of uniform convergence.	
Assessment:	
- Presentation on real-world applications of uniform convergence.	

Day 7-8: Properties of Limit Functions

Session: Properties of Limit Functions	**Duration: 120 minutes**
Objectives:	
- Understand properties of limit functions under uniform convergence.	
- Explore boundedness, continuity, integrability, and differentiability.	
Key Concepts:	
- Boundedness, continuity, integrability, and differentiability of limit functions	
Teaching Strategies:	
- Theoretical discussions with examples	
- Problem-solving sessions	
Activities:	
1. Explanation of properties of limit functions.	
2. Worked examples illustrating boundedness, continuity, integrability, and differentiability.	
3. Application-based exercises to solidify understanding.	
Assessment:	
- Problem sets on properties of limit functions.	

Day 9-10: Review and Real-World Applications

Session: Review and Real-World Applications	**Duration: 120 minutes**
Objectives:	
- Review key concepts covered in the lesson plan.	

Session: Review and Real-World Applications	**Duration: 120 minutes**
- Reflect on real-world applications of series of functions.	
Key Concepts:	
- Recap of sequence of functions, convergence, and limit function properties.	
- Real-world applications of series of functions.	
Teaching Strategies:	
- Interactive review session	
- Open discussion on real-world applications	
Activities:	
1. Review of key concepts through Q&A.	
2. Group discussion on potential real-world applications.	
3. Reflection on the importance of series of functions in modern applications.	
Assessment:	
- Group presentation on a chosen real-world application of series of functions.	

Real-World Applications:

- **Engineering:** Used in signal processing for audio and image compression.
- **Finance:** Employed in option pricing models in financial mathematics.
- **Physics:** Crucial in quantum mechanics for understanding wave functions.

Conclusion: This comprehensive lesson plan provides undergraduate students with a thorough understanding of series of functions, including sequence of functions, convergence, Weierstrass' M-Test, and limit function properties. By exploring real-world applications, students gain insight into the relevance of mathematical concepts beyond the classroom, fostering a deeper appreciation for the subject.

Here's a comprehensive 10-hour lesson plan on "Power Series" organized in tabular form:

Title: Comprehensive Lesson Plan on "Power Series"	**Duration: 10 hours**
Subtitle: Exploring Power Series, Convergence Theorems, and Real-World Applications	**Date:**
Teachers: Professor John Smith and Professor Emily Johnson	

Day 1: Introduction to Power Series and Fundamental Theorem

Session: Introduction to Power Series and Fundamental Theorem	**Duration: 60 minutes**
Objectives:	
- Introduce students to power series and their properties.	
- Understand the Fundamental Theorem of Power Series.	
Key Concepts:	
- Power series	

Session: Introduction to Power Series and Fundamental Theorem	**Duration: 60 minutes**
- Fundamental Theorem of Power Series	
Teaching Strategies:	
- Lecture with examples	
- Interactive discussions	
Activities:	
1. Presentation of power series definition.	
2. Explanation of the Fundamental Theorem with examples.	
3. Group discussions on understanding the theorem.	
Assessment:	
- Quiz on power series definition and the Fundamental Theorem.	

Day 2: Convergence Theorems: Cauchy-Hadamard Theorem

Session: Convergence Theorems: Cauchy-Hadamard Theorem	**Duration: 60 minutes**
Objectives:	
- Explore the Cauchy-Hadamard Theorem for determining convergence of power series.	
Key Concepts:	
- Cauchy-Hadamard Theorem	
- Determination of radius of convergence	
Teaching Strategies:	
- Problem-solving sessions	

Session: Convergence Theorems: Cauchy-Hadamard Theorem	**Duration: 60 minutes**
- Group activities	
Activities:	
1. Presentation of the Cauchy-Hadamard Theorem.	
2. Explanation of determining radius of convergence.	
3. Group work on applying the theorem to various power series.	
Assessment:	
- Mini-project on analyzing convergence using the Cauchy-Hadamard Theorem.	

Day 3: Uniform and Absolute Convergence of Power Series

Session: Uniform and Absolute Convergence of Power Series	**Duration: 60 minutes**
Objectives:	
- Understand the concepts of uniform and absolute convergence.	
Key Concepts:	
- Uniform convergence	
- Absolute convergence	
Teaching Strategies:	
- Application-based learning	
- Case studies	
Activities:	
1. Presentation of uniform and absolute convergence.	

Session: Uniform and Absolute Convergence of Power Series	Duration: 60 minutes
2. Analysis of real-world examples demonstrating both types of convergence.	
3. Group discussion on properties and differences between uniform and absolute convergence.	
Assessment:	
- Presentation on applications of uniform and absolute convergence in different fields.	

Day 4: Properties of Sum Function and Differentiation of Power Series

Session: Properties of Sum Function and Differentiation of Power Series	Duration: 60 minutes
Objectives:	
- Explore properties of the sum function of a power series.	
- Understand the differentiation of power series.	
Key Concepts:	
- Properties of sum function	
- Differentiation of power series	
Teaching Strategies:	
- Theoretical discussions with examples	
- Problem-solving sessions	
Activities:	
1. Explanation of properties of the sum function.	
2. Worked examples illustrating differentiation of power series.	

Session: Properties of Sum Function and Differentiation of Power Series	Duration: 60 minutes
3. Application-based exercises to solidify understanding.	
Assessment:	
- Problem sets on properties of sum function and differentiation of power series.	

Day 5: Integration of Power Series and Abel's Limit Theorems

Session: Integration of Power Series and Abel's Limit Theorems	Duration: 60 minutes
Objectives:	
- Understand the integration of power series.	
- Explore Abel's Limit Theorems.	
Key Concepts:	
- Integration of power series	
- Abel's Limit Theorems	
Teaching Strategies:	
- Lecture with examples	
- Interactive discussions	
Activities:	
1. Presentation of integration techniques for power series.	
2. Explanation and proof of Abel's Limit Theorems.	
3. Group work on applying Abel's Limit Theorems to analyze convergence.	

Session: Integration of Power Series and Abel's Limit Theorems	**Duration: 60 minutes**
Assessment:	
- Mini-project on analyzing convergence using Abel's Limit Theorems.	

Day 6: Uniqueness of Power Series

Session: Uniqueness of Power Series	**Duration: 60 minutes**
Objectives:	
- Understand the concept of uniqueness of power series.	
Key Concepts:	
- Uniqueness of power series	
Teaching Strategies:	
- Problem-solving sessions	
- Group activities	
Activities:	
1. Explanation of the concept of uniqueness of power series.	
2. Worked examples illustrating uniqueness.	
3. Group discussions on the significance of uniqueness in various contexts.	
Assessment:	
- Quiz on the concept of uniqueness of power series.	

Day 7-10: Real-World Applications and Review

Session: Real-World Applications and Review	**Duration: 240 minutes (4 hours)**
Objectives:	
- Explore real-world applications of power series.	
- Review key concepts covered in the lesson plan.	
Key Concepts:	
- Applications of power series in engineering, physics, finance, etc.	
Teaching Strategies:	
- Application-based learning	
- Interactive review sessions	
Activities:	
1. Group presentations on real-world applications of power series.	
2. Interactive review sessions covering key concepts.	
3. Problem-solving exercises to reinforce understanding.	
Assessment:	
- Group projects on analyzing real-world problems using power series concepts.	
- Final exam covering all topics discussed in the lesson plan.	

Real-World Applications:

- **Engineering:** Used in signal processing for audio and image compression.
- **Physics:** Applied in quantum mechanics for wave function analysis.
- **Finance:** Utilized in option pricing models in financial mathematics.

Conclusion: This comprehensive 10-hour lesson plan provides undergraduate students with a thorough understanding of power series, convergence theorems, differentiation, integration, and real-world applications. By incorporating various teaching strategies and assessments, students are engaged and equipped with the knowledge and skills to apply power series concepts in different fields beyond the classroom.

Title: Comprehensive Lesson Plan on "Fourier Series: Trigonometric Series"

Subtitle: Exploring Fourier Series and its Applications

Total Duration: 10 hours

Teachers: SWADHIN BANERJEE (SB)

Date:

Session	Duration	Objectives	Key Concepts	Teaching Strategies	Activities	Assessments

Session	Duration	Objectives	Key Concepts	Teaching Strategies	Activities	Assessments
Introduction to Fourier Series	60 mins	- Introduce students to Fourier series	- Definition of Fourier series	- Lecture with visual aids	1. Presentation of Fourier series definition.	- Quiz on the definition of Fourier series.
Sufficient Conditions for Fourier Series	60 mins	- Understand the conditions for a trigonometric series to be a Fourier series	- Sufficient conditions for a trigonometric series to be a Fourier series	- Lecture with examples	1. Explanation of sufficient conditions for Fourier series.	- Mini-project on analyzing trigonometric series to determine if they meet the conditions for a Fourier series.
Fourier Coefficients and Periodic Functions	60 mins	- Define Fourier coefficients for periodic functions on the interval [-π, π]	- Definition of Fourier coefficients for periodic functions on [-π, π]	- Problem-solving sessions	1. Derivation of Fourier coefficients formula.	- Problem sets on calculating Fourier coefficients.
Dirichlet's Condition of Convergence	60 mins	- Understand Dirichlet's condition of convergence for Fourier series	- Statement and implications of Dirichlet's condition of convergence for Fourier series	- Group discussions	1. Presentation of Dirichlet's condition of convergence.	- Mini-project on applying Dirichlet's condition to analyze convergence of a given Fourier series.
Theorem of Sum of Fourier Series	60 mins	- Learn about the theorem of the sum of Fourier series	- Statement and proof of the theorem of the sum of Fourier series	- Interactive proofs	1. Presentation and proof of the theorem of the sum of Fourier series.	- Problem sets on applying the theorem of the sum of Fourier series.
Real-World Applications of Fourier Series	4 hours	- Explore real-world applications of Fourier series	- Applications of Fourier series in engineering, signal processing, and physics	- Case studies	1. Discussion on applications of Fourier series in various fields.	- Group presentation on a chosen real-world application of Fourier series.
Review and Reflection	60 mins	- Review key concepts covered in the lesson plan	- Reflect on the importance and applications of Fourier series	- Interactive review sessions	1. Review of key concepts through Q&A.	- Reflection essay on the relevance of Fourier series in modern applications.

Real-World Applications:

- **Engineering:** Used in signal processing for audio and image compression.
- **Physics:** Utilized in analyzing periodic phenomena and waveforms.

- **Mathematics:** Applied in solving partial differential equations and boundary value problems.

Conclusion: This 10-hour lesson plan provides undergraduate students with a comprehensive understanding of Fourier series, covering topics such as trigonometric series, sufficient conditions for Fourier series, Fourier coefficients, Dirichlet's condition of convergence, and the theorem of the sum of Fourier series. By exploring real-world applications, students gain insight into the relevance and importance of Fourier series in various fields beyond the classroom. The combination of lectures, problem-solving sessions, and group activities ensures active engagement and thorough comprehension of the material.

Partial differential equation & Multivariate Calculus-II

Semester : 4 Credits : 5+1*=6

Core Course-9 Full Marks :

65+15**+20***=100

Paper Code(Theory): MTM-A-CC-4-9-TH

Paper Code (Tutorial):MTM-A-CC-4-9-TU

Unit-1 : Partial differential equation

Lesson Plan: Partial Differential Equations in Mathematics

Title	**Comprehensive Study of Partial Differential Equations**
Subtitle	Understanding First Order PDEs and Their Solutions
Duration	5 hours
Teacher's Name	DR. PAYEL GHOSH (PG)
Date	[Date]

Objective: By the end of this lesson series, students should be able to:

1. Understand the concept of partial differential equations of the first order.
2. Apply Lagrange's method to solve first-order PDEs.
3. Solve non-linear first-order partial differential equations.
4. Apply Charpit's general method of solution to solve first-order PDEs.
5. Recognize special types of equations and solve them using appropriate methods.

Session 1: Introduction to First-Order Partial Differential Equations (60 minutes)

Objective: Introduce students to the concept of first-order PDEs and their significance.

- **Key Concepts**:
  - Definition of partial differential equations.
  - First-order PDEs.
  - Examples and motivations from real-world problems.
- **Teaching Strategies**:
  - Lecture with examples to illustrate concepts.
  - Interactive discussions to engage students.
- **Activities**:
  - Solve simple first-order PDEs as a class.
  - Brainstorm real-world problems that can be modeled using PDEs.
- **Assessment**:
  - Quick quiz to assess understanding of basic concepts.

Session 2: Lagrange's Solution for First-Order PDEs (60 minutes)

Objective: Teach students how to apply Lagrange's method to solve first-order PDEs.

- **Key Concepts**:
  - Lagrange's method for solving first-order PDEs.
  - Characteristics curves.
- **Teaching Strategies**:
  - Step-by-step explanation of Lagrange's method.
  - Derive and discuss characteristic curves.
- **Activities**:
  - Work through examples of applying Lagrange's method.
  - Group problem-solving exercises.
- **Assessment**:
  - Homework assignment involving Lagrange's method.

Session 3: Non-linear First Order PDEs (60 minutes)

Objective: Explore techniques for solving non-linear first-order PDEs.

- **Key Concepts**:
  - Non-linearity in PDEs.
  - Change of variables method.
- **Teaching Strategies**:
  - Discuss the challenges posed by non-linear PDEs.
  - Introduce change of variables method as a solution technique.
- **Activities**:
  - Work through examples of solving non-linear PDEs.
  - Peer-to-peer problem-solving.

- **Assessment**:
    - In-class exercises to assess understanding of non-linear PDEs.

Session 4: Charpit's General Method of Solution (60 minutes)

Objective: Introduce Charpit's method for solving first-order PDEs.

- **Key Concepts**:
    - Charpit's method.
    - Transformations to simplify PDEs.
- **Teaching Strategies**:
    - Step-by-step explanation of Charpit's method.
    - Discuss how to identify suitable transformations.
- **Activities**:
    - Solve problems using Charpit's method.
    - Class discussion on the advantages and limitations of Charpit's method.
- **Assessment**:
    - Group presentation on a problem solved using Charpit's method.

Session 5: Special Types of Equations (60 minutes)

Objective: Explore special types of first-order PDEs and their solutions.

- **Key Concepts**:
    - Homogeneous PDEs.
    - Exact and Inexact PDEs.
- **Teaching Strategies**:
    - Define and classify special types of PDEs.
    - Discuss specific solution methods for each type.
- **Activities**:
    - Solve problems involving homogeneous, exact, and inexact PDEs.
    - Compare and contrast solution techniques.
- **Assessment**:
    - Take-home assignment on solving special types of PDEs.

Real-World Applications (Ongoing Throughout Sessions)

Throughout the course, emphasize real-world applications of PDEs, such as:

- Heat conduction in materials.
- Fluid flow in engineering.
- Electromagnetic wave propagation.
- Option pricing in finance.

Encourage students to explore these applications further and relate them to the mathematical concepts learned in class.

This lesson plan provides a structured approach to teaching undergraduate students about first-order partial differential equations, incorporating various solution methods and real-world applications to enhance engagement and understanding.

Title	Understanding Second Order Partial Differential Equations
Subtitle	Derivation and Classification of Heat, Wave, and Laplace Equations
Duration	10 hours
Teacher's Name	DR. PAYEL GHOSH (PG)
Date	[Date]

Objective: By the end of this lesson series, students should be able to:

1. Derive the heat, wave, and Laplace equations from physical principles.
2. Classify second-order linear PDEs as hyperbolic, parabolic, or elliptic.
3. Reduce second-order linear equations to canonical forms.
4. Recognize real-world applications of these equations in various fields.

Session 1: Introduction to Second Order PDEs (60 minutes)

Objective: Introduce students to second-order partial differential equations and their significance.

- **Key Concepts**:
  - Definition of second-order PDEs.
  - Motivation behind studying second-order PDEs.
  - Examples of physical phenomena described by second-order PDEs.
- **Teaching Strategies**:
  - Lecture with examples to illustrate concepts.
  - Visual aids to explain physical phenomena.
- **Activities**:
  - Discuss real-world examples of heat conduction, wave propagation, and potential fields.
  - Brainstorm applications of second-order PDEs in different disciplines.
- **Assessment**:
  - Quick quiz to assess understanding of basic concepts.

Session 2: Derivation of Heat Equation (120 minutes)

Objective: Derive the heat equation from physical principles and understand its significance.

- **Key Concepts**:
  - Heat conduction equation.
  - Fourier's law.
- **Teaching Strategies**:
  - Derive the heat equation using Fourier's law and conservation of energy.
  - Discuss boundary and initial conditions.
- **Activities**:
  - Solve simple heat conduction problems.
  - Discuss the implications of different boundary conditions.
- **Assessment**:
  - Homework assignment involving solving heat conduction problems.

Session 3: Derivation of Wave Equation (120 minutes)

Objective: Derive the wave equation and understand its applications.

- **Key Concepts**:
  - Wave equation.
  - Wave propagation in homogeneous media.
- **Teaching Strategies**:
  - Derive the wave equation from Newton's second law.
  - Discuss the characteristics of wave propagation.
- **Activities**:
  - Solve problems involving wave propagation.
  - Explore the concept of wave reflection and transmission.
- **Assessment**:
  - In-class exercises to assess understanding of wave equation derivation.

Session 4: Derivation of Laplace Equation (120 minutes)

Objective: Derive the Laplace equation and understand its role in potential theory.

- **Key Concepts**:
  - Laplace equation.
  - Potential fields.
- **Teaching Strategies**:
  - Derive the Laplace equation from the divergence of the gradient.
  - Discuss applications in electrostatics and fluid flow.
- **Activities**:
  - Solve problems involving Laplace's equation in two dimensions.
  - Explore boundary value problems in potential theory.
- **Assessment**:

- Group problem-solving activity on Laplace equation applications.

Session 5: Classification of Second Order PDEs (60 minutes)

Objective: Classify second-order linear PDEs based on their characteristics.

- **Key Concepts**:
  - Hyperbolic, parabolic, and elliptic equations.
  - Characteristics of each type of equation.
- **Teaching Strategies**:
  - Define and classify second-order PDEs based on their coefficients.
  - Discuss the physical interpretation of each classification.
- **Activities**:
  - Identify and classify given PDEs.
  - Discuss the implications of classification on solution techniques.
- **Assessment**:
  - Quiz on classifying second-order PDEs.

Session 6: Reduction to Canonical Forms (120 minutes)

Objective: Learn techniques for reducing second-order PDEs to canonical forms.

- **Key Concepts**:
  - Transformation of variables.
  - Canonical forms of second-order PDEs.
- **Teaching Strategies**:
  - Introduce transformations to simplify PDEs.
  - Derive canonical forms for hyperbolic, parabolic, and elliptic equations.
- **Activities**:
  - Work through examples of reducing PDEs to canonical forms.
  - Discuss advantages of working with canonical forms.
- **Assessment**:
  - Homework assignment involving reduction of PDEs to canonical forms.

Real-World Applications (Ongoing Throughout Sessions)

Throughout the course, emphasize real-world applications of the heat, wave, and Laplace equations, such as:

- Heat transfer in engineering.
- Seismic wave propagation in geophysics.
- Electrostatics in electrical engineering.

Encourage students to explore these applications further and relate them to the mathematical concepts learned in class.

This lesson plan provides a structured approach to teaching undergraduate students about second-order partial differential equations, including their derivation, classification, reduction to canonical forms, and real-world applications.

Title	**Advanced Studies in Partial Differential Equations: Cauchy Problem, Boundary Value Problems, and Applications**
Subtitle	Exploring the Dynamics of Strings and Heat Conduction
Duration	20 hours
Teacher's Name	DR. PAYEL GHOSH (PG)
Date	[Date]

Objective: By the end of this comprehensive session, students should be able to:

1. Understand the Cauchy problem and its relevance in mathematical modeling.
2. Apply the Cauchy-Kowalewskaya theorem to ensure the existence and uniqueness of solutions.
3. Solve the Cauchy problem for finite and infinite strings.
4. Analyze initial boundary value problems for semi-infinite strings with fixed and free ends.
5. Apply the method of separation of variables to solve non-homogeneous wave equations.
6. Solve real-world problems related to vibrating strings and heat conduction using partial differential equations.

Session 1-2: Introduction to Cauchy Problem and Cauchy-Kowalewskaya Theorem (120 minutes)

Objective: Introduce students to the concept of the Cauchy problem and ensure the existence and uniqueness of solutions using the Cauchy-Kowalewskaya theorem.

- **Key Concepts**:
  - Definition of the Cauchy problem.
  - Statement and proof of the Cauchy-Kowalewskaya theorem.
- **Teaching Strategies**:
  - Lecture to establish foundational knowledge.
  - Collaborative problem-solving exercises.
- **Activities**:
  - Derive and solve simple Cauchy problems.
  - Group discussions on applications of the Cauchy-Kowalewskaya theorem.
- **Assessment**:
  - In-class quiz on the Cauchy problem and theorem.

Session 3-4-5: Cauchy Problem for Finite and Infinite Strings (180 minutes)

Objective: Explore the application of the Cauchy problem to finite and infinite strings.

- **Key Concepts**:
  - Solving the Cauchy problem for finite strings.
  - Analyzing the behavior of infinite strings.
- **Teaching Strategies**:
  - Derive solutions for the Cauchy problem in various string scenarios.
  - Interactive demonstrations using visual aids.
- **Activities**:
  - Solve practical problems involving finite and infinite strings.
  - Simulate and visualize wave propagation in infinite strings.
- **Assessment**:
  - Group projects on modeling and solving real-world scenarios using the Cauchy problem.

Session 6-7-8: Initial Boundary Value Problems for Semi-Infinite Strings (180 minutes)

Objective: Analyze and solve initial boundary value problems for semi-infinite strings with fixed and free ends.

- **Key Concepts**:
  - Formulating initial boundary value problems.
  - Analyzing solutions for semi-infinite strings with fixed and free ends.
- **Teaching Strategies**:
  - Step-by-step problem-solving sessions.
  - Interactive discussions on boundary conditions.
- **Activities**:
  - Work through examples of semi-infinite strings with different end conditions.
  - Collaborative problem-solving on practical applications.
- **Assessment**:
  - Individual assessments on formulating and solving initial boundary value problems.

Session 9-10-11: Equations with Non-Homogeneous Boundary Conditions (180 minutes)

Objective: Introduce equations with non-homogeneous boundary conditions and their solutions.

- **Key Concepts**:
  - Non-homogeneous boundary conditions.
  - Modification of solution techniques.
- **Teaching Strategies**:
  - Discuss challenges posed by non-homogeneous conditions.
  - Derive modified solution methods.
- **Activities**:
  - Solve problems with non-homogeneous boundary conditions.
  - Analyze the impact of various boundary conditions on solutions.
- **Assessment**:
  - In-class exercises on equations with non-homogeneous conditions.

Session 12-13-14: Non-Homogeneous Wave Equation and Real-world Applications (180 minutes)

Objective: Apply the method of separation of variables to solve non-homogeneous wave equations and explore real-world applications.

- **Key Concepts**:
  - Method of separation of variables for wave equations.
  - Real-world applications in physics and engineering.
- **Teaching Strategies**:
  - Derive and discuss the method of separation of variables.
  - Highlight applications through case studies.
- **Activities**:
  - Solve non-homogeneous wave equations using separation of variables.
  - Explore and present real-world applications.
- **Assessment**:
  - Group projects on solving and presenting a real-world problem related to non-homogeneous wave equations.

Session 15-16-17: Solving the Vibrating String Problem (180 minutes)

Objective: Apply the accumulated knowledge to solve complex problems related to vibrating strings.

- **Key Concepts**:
  - Synthesis of knowledge for solving complex vibrating string problems.
  - Advanced problem-solving techniques.
- **Teaching Strategies**:
  - Solve intricate problems step-by-step.
  - Encourage critical thinking and creativity in problem-solving.
- **Activities**:
  - Collaborative problem-solving on advanced vibrating string scenarios.
  - Analyze and discuss various solution approaches.
- **Assessment**:
  - Individual assessments on solving complex vibrating string problems.

Session 18-19-20: Solving the Heat Conduction Problem (180 minutes)

Objective: Apply mathematical methods to solve heat conduction problems.

- **Key Concepts**:
  - Modeling heat conduction using partial differential equations.
  - Solution techniques for heat conduction problems.
- **Teaching Strategies**:
  - Discuss the physical principles of heat conduction.
  - Derive and solve heat conduction problems.
- **Activities**:
  - Work through examples of heat conduction in various materials.

- Analyze the impact of different parameters on heat conduction.
- **Assessment**:
  - In-class assessments on solving heat conduction problems.

Real-World Applications (Ongoing Throughout Sessions)

Throughout the course, relate mathematical concepts to real-world applications such as:

- Structural engineering (vibrating strings).
- Heat transfer in materials.
- Environmental modeling.

Encourage students to explore and present additional real-world applications, fostering a deeper understanding of the practical significance of the mathematical concepts covered.

This lesson plan provides a structured and comprehensive approach to studying advanced topics in partial differential equations, incorporating various solution techniques and real-world applications. The plan is designed to enhance student engagement and understanding over a 20-hour period, with each session carefully organized and focused on specific concepts and applications.

Unit-2 : Multivariate Calculus-II

Title	Exploring Multiple Integrals: Concepts and Applications
Subtitle	Understanding Upper and Lower Sums in Multivariate Calculus
Duration	5 hours
Teacher's Name	DR. PAYEL GHOSH (PG)
Date	[Date]

Objective: By the end of this 5-hour session, students should be able to:

1. Understand the concept of multiple integrals, including upper and lower sums.
2. Define upper and lower integrals in the context of double integrals.
3. Recognize the importance of existence theorems for continuous functions.
4. Apply the concepts to solve real-world problems.

Session 1: Introduction to Multiple Integrals (60 minutes)

Objective: Introduce students to the concept of multiple integrals and the role of upper and lower sums.

- **Key Concepts**:
  - Definition of multiple integrals.
  - Concept of upper and lower sums.
- **Teaching Strategies**:
  - Visual aids and geometric interpretation.
  - Examples to illustrate the difference between upper and lower sums.
- **Activities**:
  - Calculate upper and lower sums for simple functions.
  - Engage in a class discussion on the geometric interpretation.
- **Assessment**:
  - In-class quiz on basic concepts of multiple integrals.

Session 2: Double Integrals and Existence Theorems (60 minutes)

Objective: Define double integrals and understand the existence theorem for continuous functions.

- **Key Concepts**:
  - Definition of double integrals.
  - Statement of existence theorem for continuous functions.
- **Teaching Strategies**:
  - Derive the concept of double integrals.
  - Explain the importance of existence theorems.
- **Activities**:
  - Solve problems involving double integrals.
  - Discuss the significance of continuity in the existence theorem.
- **Assessment**:
  - Homework assignment on calculating double integrals.

Session 3: Upper and Lower Integrals (60 minutes)

Objective: Explore upper and lower integrals in the context of double integrals.

- **Key Concepts**:
  - Definition of upper and lower integrals for double integrals.
  - Comparison with upper and lower sums.
- **Teaching Strategies**:
  - Visual demonstrations of upper and lower integrals.
  - Step-by-step calculations.
- **Activities**:
  - Calculate upper and lower integrals for various functions.
  - Group exercises to reinforce understanding.
- **Assessment**:
  - In-class problems to evaluate comprehension of upper and lower integrals.

Session 4: Statement of Existence Theorem for Continuous Functions (60 minutes)

Objective: Understand the statement and application of the existence theorem for continuous functions in the context of multiple integrals.

- **Key Concepts**:
  - Statement of the existence theorem for continuous functions.
  - Implications for solving double integrals.
- **Teaching Strategies**:
  - Provide examples illustrating the existence theorem.
  - Discuss how the theorem aids in practical problem-solving.
- **Activities**:
  - Apply the existence theorem to solve real-world problems.
  - Group discussions on the significance of the theorem.
- **Assessment**:
  - Individual or group projects demonstrating the application of the existence theorem.

Session 5: Real-World Applications of Multiple Integrals (60 minutes)

Objective: Explore real-world applications of multiple integrals to demonstrate their relevance beyond the classroom.

- **Key Concepts**:
  - Applications in physics, engineering, and economics.
  - Problem-solving techniques for real-world scenarios.
- **Teaching Strategies**:
  - Case studies showcasing applications in various fields.
  - Discuss the interdisciplinary nature of multiple integrals.
- **Activities**:
  - Group projects on real-world problem-solving.
  - Encourage students to find and present additional applications.
- **Assessment**:
  - Evaluation of group projects and class participation.

Conclusion: Conclude the session by summarizing the key concepts learned, highlighting the practical applications of multiple integrals, and encouraging students to explore further on their own.

This lesson plan provides a structured approach to introducing multiple integrals in a 5-hour session, balancing theoretical concepts with practical applications. The plan is designed to engage undergraduate students with clear objectives, interactive teaching strategies, and real-world examples, ensuring a comprehensive understanding of the topic.

Title	**Exploring Advanced Multiple Integrals: Techniques and Applications**
Subtitle	Mastering Iterated Integrals, Triple Integrals, and More

Title	Exploring Advanced Multiple Integrals: Techniques and Applications
Duration	10 hours
Teacher's Name	DR. PAYEL GHOSH (PG)
Date	[Date]

Objective: By the end of this 10-hour session, students should be able to:

1. Understand and apply iterated or repeated integrals in multivariable calculus.
2. Demonstrate proficiency in changing the order of integration.
3. Solve problems involving triple integrals in various coordinate systems.
4. Apply cylindrical and spherical coordinates in triple integrals.
5. Master change of variables techniques in double and triple integrals.

Session 1-2: Iterated Integrals and Change of Order (120 minutes)

Objective: Introduce students to iterated integrals and changing the order of integration.

- **Key Concepts**:
  - Definition and properties of iterated integrals.
  - Techniques for changing the order of integration.
- **Teaching Strategies**:
  - Step-by-step explanations and derivations.
  - Work through examples illustrating the process.
- **Activities**:
  - Practice problems involving iterated integrals.
  - Collaborative problem-solving sessions.
- **Assessment**:
  - In-class exercises to assess understanding of iterated integrals and changing the order of integration.

Session 3-4: Triple Integrals and Coordinate Systems (120 minutes)

Objective: Explore triple integrals and their application in different coordinate systems.

- **Key Concepts**:
  - Definition and properties of triple integrals.
  - Introduction to cylindrical and spherical coordinates.
- **Teaching Strategies**:
  - Visual aids and geometric interpretations.
  - Derive formulas for triple integrals in various coordinate systems.
- **Activities**:
  - Solve problems involving triple integrals.
  - Convert between rectangular, cylindrical, and spherical coordinates.
- **Assessment**:
  - Group projects on applying triple integrals in real-world scenarios.

Session 5-6: Cylindrical and Spherical Coordinates (120 minutes)

Objective: Deepen understanding of cylindrical and spherical coordinates and their application in triple integrals.

- **Key Concepts**:
  - Definition and conversion between cylindrical and spherical coordinates.
  - Advantages of using different coordinate systems.
- **Teaching Strategies**:
  - Comparative analysis of coordinate systems.
  - Work through examples highlighting the simplicity of integration in cylindrical and spherical coordinates.
- **Activities**:
  - Solve problems requiring the use of cylindrical and spherical coordinates.
  - Explore real-world applications of these coordinate systems.
- **Assessment**:
  - Individual assessments on converting between coordinate systems and solving triple integrals.

Session 7-8: Change of Variables in Double Integrals (120 minutes)

Objective: Introduce change of variables techniques in double integrals.

- **Key Concepts**:
  - Change of variables formula for double integrals.
  - Methods for selecting appropriate transformations.
- **Teaching Strategies**:
  - Step-by-step explanation of change of variables.
  - Work through examples demonstrating different transformation techniques.
- **Activities**:
  - Solve problems using change of variables.
  - Group discussions on the choice of transformations.
- **Assessment**:
  - In-class exercises on applying change of variables in double integrals.

Session 9-10: Transformation of Double and Triple Integrals (120 minutes)

Objective: Master the transformation of double and triple integrals through extensive problem-solving.

- **Key Concepts**:
  - General transformation formulas for double and triple integrals.
  - Techniques for evaluating transformed integrals.
- **Teaching Strategies**:
  - Practice problems covering a variety of transformations.
  - Encourage students to explore different approaches to integration.
- **Activities**:
  - Work through a series of challenging problems involving transformations.
  - Apply transformations to real-world scenarios.

- **Assessment**:
  - Final assessment comprising problem-solving tasks requiring the use of transformation techniques.

Real-World Applications (Ongoing Throughout Sessions)

Throughout the course, incorporate real-world applications such as:

- Volume and mass calculations in physics and engineering.
- Probability density functions in statistics.
- Electric charge distributions in electromagnetism.

Encourage students to relate mathematical concepts to practical situations, fostering a deeper understanding of their relevance beyond the classroom.

Conclusion: Conclude the session by summarizing key concepts learned, reinforcing the importance of mastering multiple integral techniques, and encouraging students to continue exploring applications in their field of study.

This lesson plan provides a comprehensive and structured approach to mastering advanced topics in multiple integrals over a 10-hour session. Through clear objectives, interactive teaching strategies, and real-world applications, students will develop a deep understanding of the concepts and their practical significance.

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Title	**Exploring Multiple Integrals: Volume, Surface Area, and Differentiation**
Subtitle	Solving Problems in Multivariate Calculus
Duration	5 hours
Teacher's Name	DR. PAYEL GHOSH (PG)
Date	[Date]

Objective: By the end of this 5-hour session, students should be able to:

1. Determine volumes and surface areas using multiple integrals.
2. Apply differentiation under the integral sign and Leibniz's rule to solve problems.
3. Understand the practical applications of these concepts in various fields.

Session 1: Determination of Volume by Multiple Integrals (60 minutes)

Objective: Introduce students to the concept of determining volumes using multiple integrals.

- **Key Concepts**:
  - Defining volume as a triple integral.
  - Establishing bounds for integration.
- **Teaching Strategies**:
  - Geometric interpretation using visual aids.
  - Step-by-step problem-solving approach.
- **Activities**:
  - Calculate volumes of simple geometric shapes.
  - Engage in group discussions on setting up integrals for irregular shapes.
- **Assessment**:
  - In-class exercises on calculating volumes of various solids.

Session 2: Determination of Surface Area by Multiple Integrals (60 minutes)

Objective: Explore the concept of determining surface areas using multiple integrals.

- **Key Concepts**:
  - Defining surface area as a double integral.
  - Parametrization of surfaces.
- **Teaching Strategies**:
  - Visualization of surface area using 3D models.
  - Derivation of surface area formulas.
- **Activities**:
  - Calculate surface areas of simple surfaces.
  - Discuss challenges and strategies for parametrizing complex surfaces.
- **Assessment**:
  - Problem-solving exercises involving surface area calculations.

Session 3: Differentiation Under the Integral Sign (60 minutes)

Objective: Introduce differentiation under the integral sign as a technique for solving problems.

- **Key Concepts**:
  - Basic principles of differentiation under the integral sign.
  - Leibniz's rule.
- **Teaching Strategies**:
  - Derivation and explanation of Leibniz's rule.
  - Application of the technique to simple functions.
- **Activities**:
  - Solve problems involving differentiation under the integral sign.
  - Explore applications in physics and engineering.
- **Assessment**:
  - In-class problems on applying Leibniz's rule to solve integrals.

Session 4: Application of Leibniz's Rule (60 minutes)

Objective: Apply Leibniz's rule to solve problems involving multiple integrals.

- **Key Concepts**:
  - Advanced applications of Leibniz's rule.
  - Solving integrals with varying parameters.
- **Teaching Strategies**:
  - Presenting challenging problems to apply Leibniz's rule.
  - Step-by-step problem-solving approach.
- **Activities**:
  - Work through examples of applying Leibniz's rule to solve complex integrals.
  - Discuss the significance of the technique in mathematical analysis.
- **Assessment**:
  - Homework assignment involving the application of Leibniz's rule to solve integrals.

Session 5: Real-World Applications (60 minutes)

Objective: Explore real-world applications of volume calculation, surface area determination, and differentiation under the integral sign.

- **Key Concepts**:
  - Applications in physics, engineering, and economics.
  - Problem-solving techniques for real-world scenarios.
- **Teaching Strategies**:
  - Case studies showcasing applications in various fields.
  - Discuss the interdisciplinary nature of the concepts.
- **Activities**:
  - Group projects on real-world problem-solving.
  - Encourage students to find and present additional applications.
- **Assessment**:
  - Evaluation of group projects and class participation.

Conclusion: Conclude the session by summarizing the key concepts learned, highlighting the practical applications of multiple integrals and differentiation techniques, and encouraging students to explore further on their own.

This lesson plan provides a structured approach to exploring volume determination, surface area calculation, and differentiation techniques in a 5-hour session. The plan incorporates a mix of theoretical concepts, problem-solving activities, and real-world applications to engage undergraduate students and deepen their understanding of multivariate calculus.

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Title	Exploring Vector Fields and Line Integrals in Multivariate Calculus

Title	**Exploring Vector Fields and Line Integrals in Multivariate Calculus**
Subtitle	Understanding Divergence, Curl, and Applications of Line Integrals
Duration	10 hours
Teacher's Name	DR. PAYEL GHOSH (PG)
Date	[Date]

Objective: By the end of this 10-hour session, students should be able to:

1. Define vector fields and understand their significance in multivariate calculus.
2. Compute divergence and curl of vector fields and interpret their physical meaning.
3. Understand line integrals and their applications in calculating mass and work.
4. Apply the fundamental theorem for line integrals and identify conservative vector fields.
5. Demonstrate the independence of path in conservative vector fields.

Session 1-2: Introduction to Vector Fields (120 minutes)

Objective: Introduce students to the concept of vector fields and their representation in multivariate calculus.

- **Key Concepts**:
  - Definition of vector fields.
  - Visualization of vector fields in two and three dimensions.
- **Teaching Strategies**:
  - Visual demonstrations using software or physical models.
  - Examples to illustrate vector fields in various contexts.
- **Activities**:
  - Plotting and analyzing simple vector fields.
  - Group discussions on the interpretation of vector fields.
- **Assessment**:
  - In-class quiz on basic concepts of vector fields.

Session 3-4: Divergence and Curl (120 minutes)

Objective: Define and compute divergence and curl of vector fields and discuss their physical interpretations.

- **Key Concepts**:
  - Definition of divergence and curl.
  - Interpretation of divergence and curl in terms of flow and rotation.
- **Teaching Strategies**:
  - Derive formulas for divergence and curl.
  - Provide intuitive explanations using real-world examples.
- **Activities**:
  - Calculate divergence and curl for various vector fields.

- Analyze vector fields and discuss their behavior based on divergence and curl.
- **Assessment**:
  - Homework assignment on calculating divergence and curl.

Session 5-6: Line Integrals and Applications (120 minutes)

Objective: Introduce line integrals and explore their applications in calculating mass and work.

- **Key Concepts**:
  - Definition of line integrals.
  - Applications in physics and engineering: mass and work.
- **Teaching Strategies**:
  - Define line integrals and discuss their geometric interpretation.
  - Work through examples of calculating mass and work using line integrals.
- **Activities**:
  - Solve problems involving line integrals and applications.
  - Group discussions on the physical significance of line integrals.
- **Assessment**:
  - In-class exercises on calculating mass and work using line integrals.

Session 7-8: Fundamental Theorem for Line Integrals (120 minutes)

Objective: Present the fundamental theorem for line integrals and discuss its implications.

- **Key Concepts**:
  - Statement of the fundamental theorem for line integrals.
  - Identification of conservative vector fields.
- **Teaching Strategies**:
  - Explain the fundamental theorem and its proof.
  - Discuss the concept of conservative vector fields and independence of path.
- **Activities**:
  - Work through examples illustrating the fundamental theorem.
  - Explore the connection between conservative vector fields and path independence.
- **Assessment**:
  - Group projects demonstrating the application of the fundamental theorem.

Session 9-10: Real-World Applications and Conclusion (120 minutes)

Objective: Explore real-world applications of vector fields and line integrals and conclude the session.

- **Key Concepts**:
  - Applications of vector fields and line integrals in various fields.
  - Review of key concepts covered throughout the session.
- **Teaching Strategies**:
  - Present case studies and examples of real-world applications.
  - Summarize key concepts and provide additional resources for further exploration.

- **Activities**:
  - Group projects on real-world applications of vector fields and line integrals.
  - Open discussion on the relevance and importance of the topics covered.
- **Assessment**:
  - Evaluation of group projects and class participation.

Conclusion: Conclude the session by summarizing the key concepts learned, highlighting the practical applications of vector fields and line integrals, and encouraging students to explore further on their own.

This lesson plan provides a comprehensive exploration of vector fields and line integrals over a 10-hour session, incorporating theoretical concepts, practical applications, and real-world examples. The plan is designed to engage undergraduate students with clear objectives, interactive teaching strategies, and opportunities for hands-on learning, ensuring a thorough understanding of the topic.

Title	Exploring Advanced Concepts in Multivariate Calculus
Subtitle	Green's Theorem, Surface Integrals, and More
Duration	5 hours
Teacher's Name	DR. PAYEL GHOSH (PG)
Date	[Date]

Objective: By the end of this 5-hour session, students should be able to:

1. Understand and apply Green's theorem to evaluate line integrals over simple closed curves.
2. Define surface integrals and apply them to calculate flux across surfaces.
3. Evaluate integrals over parametrically defined surfaces.
4. Understand and apply Stokes' theorem and the Divergence theorem to evaluate integrals in vector fields.
5. Apply the concepts to solve real-world problems.

Session 1: Green's Theorem (60 minutes)

Objective: Introduce students to Green's theorem and its applications in evaluating line integrals.

- **Key Concepts**:
  - Statement of Green's theorem.
  - Relationship between line integrals and double integrals.
- **Teaching Strategies**:
  - Visual aids to illustrate Green's theorem.
  - Step-by-step examples of applying the theorem.
- **Activities**:
  - Work through examples of evaluating line integrals using Green's theorem.
  - Collaborative problem-solving exercises.
- **Assessment**:

- In-class exercises to assess understanding of Green's theorem.

Session 2: Surface Integrals (60 minutes)

Objective: Define surface integrals and understand their applications in calculating flux across surfaces.

- **Key Concepts**:
  - Definition of surface integrals.
  - Calculation of flux across surfaces.
- **Teaching Strategies**:
  - Geometric interpretation of surface integrals.
  - Examples to demonstrate the calculation of flux.
- **Activities**:
  - Solve problems involving surface integrals and flux calculation.
  - Group discussions on real-world applications.
- **Assessment**:
  - Homework assignment on surface integrals and flux calculation.

Session 3: Integrals over Parametrically Defined Surfaces (60 minutes)

Objective: Explore integrals over surfaces defined parametrically and understand their applications.

- **Key Concepts**:
  - Parametric representation of surfaces.
  - Evaluation of integrals over parametric surfaces.
- **Teaching Strategies**:
  - Derive the formula for integrating over parametric surfaces.
  - Examples to illustrate the concept.
- **Activities**:
  - Work through problems involving integrals over parametric surfaces.
  - Peer-to-peer problem-solving exercises.
- **Assessment**:
  - In-class quiz on integrating over parametric surfaces.

Session 4: Stokes' Theorem (60 minutes)

Objective: Introduce Stokes' theorem and understand its application in evaluating line integrals over closed curves.

- **Key Concepts**:
  - Statement of Stokes' theorem.
  - Relationship between line integrals and surface integrals.
- **Teaching Strategies**:
  - Step-by-step explanation of Stokes' theorem.
  - Examples to demonstrate its application.
- **Activities**:

- Solve problems involving Stokes' theorem.
  - Discuss real-world applications of the theorem.
- **Assessment**:
  - Group projects on applying Stokes' theorem to practical problems.

Session 5: The Divergence Theorem and Real-World Applications (60 minutes)

Objective: Introduce the Divergence theorem and understand its application in evaluating flux integrals.

- **Key Concepts**:
  - Statement of the Divergence theorem.
  - Relationship between flux integrals and volume integrals.
- **Teaching Strategies**:
  - Derive the Divergence theorem and explain its significance.
  - Discuss applications in various fields.
- **Activities**:
  - Solve problems involving the Divergence theorem.
  - Explore real-world applications through case studies.
- **Assessment**:
  - Individual assessments on understanding and applying the Divergence theorem.

Real-World Applications (Ongoing Throughout Sessions)

Throughout the course, relate mathematical concepts to real-world applications such as:

- Fluid dynamics and flow analysis.
- Electromagnetic field analysis.
- Structural engineering and stress analysis.

Encourage students to explore and present additional real-world applications, fostering a deeper understanding of the practical significance of the mathematical concepts covered.

Conclusion: Conclude the session by summarizing the key concepts learned, highlighting the practical applications of Green's theorem, Stokes' theorem, and the Divergence theorem, and encouraging students to explore further on their own.

This lesson plan provides a structured approach to exploring advanced concepts in multivariate calculus over a 5-hour session, balancing theoretical concepts with practical applications. The plan is designed to engage undergraduate students with clear objectives, interactive teaching strategies, and real-world examples, ensuring a comprehensive understanding of the topic.

Mechanics

Semester : 4 Credits : 5+1*=6

Core Course- 10 Full Marks : 65+15**+20***=100

Paper Code(Theory): MTM-A-CC-4-10-TH

Paper Code (Tutorial):MTM-A-CC-4-10-TU

Unit-1:

Title	Exploring Coplanar Forces in Mechanics
Subtitle	Understanding Resultant Forces, Couples, and Equilibrium
Duration	5 hours
Teacher's Name	DEBABRATA JANA (DJ)
Date	[Date]

Objective: By the end of this 5-hour session, students should be able to:

1. Understand the concept of coplanar forces and their resultant.
2. Apply Varignon's theorem to analyze coplanar force systems.
3. Define necessary and sufficient conditions of equilibrium.
4. Derive and apply equilibrium equations of the first, second, and third kind.
5. Apply the concepts to solve real-world problems.

Session 1: Introduction to Coplanar Forces and Resultant (60 minutes)

Objective: Introduce students to coplanar forces, resultant forces, and couples.

- **Key Concepts**:
  - Definition of coplanar forces.
  - Resultant force and resultant couple.
- **Teaching Strategies**:
  - Visual demonstrations of coplanar force systems.
  - Examples to illustrate the concept of resultant force and couple.
- **Activities**:
  - Calculate resultant forces and couples for simple coplanar force systems.
  - Collaborative problem-solving exercises.
- **Assessment**:
  - In-class quiz on basic concepts of coplanar forces and resultants.

Session 2: Varignon's Theorem (60 minutes)
Objective: Explore Varignon's theorem and its applications in analyzing coplanar force systems.

- **Key Concepts**:
  - Statement of Varignon's theorem.
  - Application to resolve forces and moments.
- **Teaching Strategies**:
  - Step-by-step explanation of Varignon's theorem.
  - Examples to demonstrate its application.
- **Activities**:
  - Solve problems involving Varignon's theorem.
  - Group discussions on practical applications.
- **Assessment**:
  - Homework assignment on applying Varignon's theorem to coplanar force systems.

Session 3: Conditions of Equilibrium (60 minutes)
Objective: Define necessary and sufficient conditions of equilibrium for coplanar force systems.

- **Key Concepts**:
  - Definition of equilibrium.
  - Necessary and sufficient conditions of equilibrium.
- **Teaching Strategies**:
  - Discuss the concept of equilibrium in coplanar force systems.
  - Derive conditions for equilibrium.
- **Activities**:
  - Analyze coplanar force systems to determine equilibrium.
  - Collaborative problem-solving exercises.
- **Assessment**:
  - In-class exercises to assess understanding of equilibrium conditions.

Session 4: Equilibrium Equations (60 minutes)
Objective: Derive and apply equilibrium equations of the first, second, and third kind.

- **Key Concepts**:
  - Equilibrium equations for coplanar force systems.
  - Methods to solve equilibrium problems.

- **Teaching Strategies**:
  - Derive equilibrium equations from Newton's laws.
  - Discuss strategies for solving equilibrium problems.
- **Activities**:
  - Solve problems using equilibrium equations.
  - Group problem-solving exercises.
- **Assessment**:
  - Individual assessments on applying equilibrium equations to solve problems.

Session 5: Real-World Applications of Coplanar Forces (60 minutes)

Objective: Explore real-world applications of coplanar forces to demonstrate their relevance beyond the classroom.

- **Key Concepts**:
  - Applications in engineering, architecture, and physics.
  - Problem-solving techniques for real-world scenarios.
- **Teaching Strategies**:
  - Case studies showcasing applications in various fields.
  - Discuss the interdisciplinary nature of coplanar force analysis.
- **Activities**:
  - Group projects on analyzing real-world structures using coplanar force concepts.
  - Encourage students to find and present additional applications.
- **Assessment**:
  - Evaluation of group projects and class participation.

Conclusion: Conclude the session by summarizing the key concepts learned, highlighting the practical applications of coplanar force analysis, and encouraging students to explore further on their own.

This lesson plan provides a structured approach to exploring coplanar forces in mechanics over a 5-hour session, balancing theoretical concepts with practical applications. The plan is designed to engage undergraduate students with clear objectives, interactive teaching strategies, and real-world examples, ensuring a comprehensive understanding of the topic.

Title	Exploring Mechanics: Analysis of Force Systems in Space
Subtitle	Understanding Equilibrium and Resultants

Title	Exploring Mechanics: Analysis of Force Systems in Space
Duration	6 hours
Teacher's Name	DEBABRATA JANA (DJ)
Date	[Date]

Objective: By the end of this 6-hour session, students should be able to:

1. Understand the concept of moment of a force about an axis and Varignon's theorem.
2. Define resultant force and resultant couple and identify their properties.
3. Recognize the necessary and sufficient conditions of equilibrium and apply equilibrium equations.
4. Analyze problems involving reduction to a wrench and Poinsot's central axis.
5. Calculate the intensity and pitch of a wrench and understand invariants of a system of forces.
6. Solve statically determinate and indeterminate problems in mechanics.

Session 1: Moment of a Force and Varignon's Theorem (60 minutes)
Objective: Introduce students to the concept of moment of a force about an axis and Varignon's theorem.

- **Key Concepts**:
  - Definition of moment of a force.
  - Statement and application of Varignon's theorem.
- **Teaching Strategies**:
  - Geometric interpretation of moments.
  - Derivation and explanation of Varignon's theorem.
- **Activities**:
  - Solve problems involving moments and Varignon's theorem.
  - Collaborative problem-solving exercises.
- **Assessment**:
  - In-class quiz on moments and Varignon's theorem.

Session 2: Resultant Force and Resultant Couple (60 minutes)
Objective: Define resultant force and resultant couple and explore their properties.

- **Key Concepts**:
  - Definition of resultant force and resultant couple.
  - Properties and characteristics.

- **Teaching Strategies**:
  - Visual aids to illustrate the concept of resultants.
  - Examples to demonstrate properties.
- **Activities**:
  - Calculate resultant force and resultant couple for various force systems.
  - Group discussions on real-world applications.
- **Assessment**:
  - Homework assignment on calculating resultants.

Session 3: Equilibrium Conditions (60 minutes)

Objective: Understand the necessary and sufficient conditions of equilibrium and apply equilibrium equations.

- **Key Concepts**:
  - Necessary and sufficient conditions of equilibrium.
  - Equilibrium equations for force systems.
- **Teaching Strategies**:
  - Derive equilibrium equations for 2D and 3D force systems.
  - Solve problems applying equilibrium conditions.
- **Activities**:
  - Work through examples of equilibrium problems.
  - Peer-to-peer problem-solving exercises.
- **Assessment**:
  - In-class problems to assess understanding of equilibrium conditions.

Session 4: Reduction to a Wrench and Poinsot's Central Axis (60 minutes)

Objective: Explore reduction to a wrench and understand Poinsot's central axis.

- **Key Concepts**:
  - Concept of reducing a force system to a wrench.
  - Definition and significance of Poinsot's central axis.
- **Teaching Strategies**:
  - Explain the concept of reducing force systems.
  - Discuss the properties of Poinsot's central axis.
- **Activities**:
  - Solve problems involving reduction to a wrench.
  - Analyze force systems to determine Poinsot's central axis.
- **Assessment**:
  - Group projects on applying reduction to a wrench.

Session 5: Intensity and Pitch of a Wrench, Invariants (60 minutes)
Objective: Calculate the intensity and pitch of a wrench and understand invariants of a system of forces.

- **Key Concepts**:
    - Definition of intensity and pitch of a wrench.
    - Invariants of a system of forces.
- **Teaching Strategies**:
    - Derive formulas for calculating intensity and pitch.
    - Discuss the significance of invariants.
- **Activities**:
    - Calculate intensity and pitch for given wrenches.
    - Analyze force systems to identify invariants.
- **Assessment**:
    - In-class problems to evaluate comprehension of intensity, pitch, and invariants.

Session 6: Statically Determinate and Indeterminate Problems (60 minutes)
Objective: Differentiate between statically determinate and indeterminate problems and solve examples.

- **Key Concepts**:
    - Definition and characteristics of statically determinate and indeterminate problems.
    - Methods for solving indeterminate problems.
- **Teaching Strategies**:
    - Explain the concept of determinacy and indeterminacy.
    - Discuss solution methods for indeterminate problems.
- **Activities**:
    - Solve examples of statically determinate and indeterminate problems.
    - Group discussions on solution approaches.
- **Assessment**:
    - Individual or group projects on solving indeterminate problems.

Real-World Applications (Ongoing Throughout Sessions)
Throughout the course, relate mechanical concepts to real-world applications such as:

- Structural engineering and design.
- Analysis of machinery and equipment.
- Aerospace engineering and vehicle design.

Encourage students to explore and present additional real-world applications, fostering a deeper understanding of the practical significance of the mechanical concepts covered.

Conclusion: Conclude the session by summarizing the key concepts learned, highlighting the practical applications of mechanics in various fields, and encouraging students to explore further on their own.

This lesson plan provides a structured approach to studying mechanics over a 6-hour session, balancing theoretical concepts with practical applications. The plan is designed to engage undergraduate students with clear objectives, interactive teaching strategies, and real-world examples, ensuring a comprehensive understanding of the topic.

Title	**Understanding Equilibrium and Friction Forces in Mechanics**
Subtitle	Exploring Contact Forces, Coulomb's Laws, and Friction
Duration	4 hours
Teacher's Name	DEBABRATA JANA (DJ)
Date	[Date]

Objective: By the end of this 4-hour session, students should be able to:

1. Understand the concept of equilibrium in the presence of sliding friction forces.
2. Define contact forces between bodies and their role in maintaining equilibrium.
3. Apply Coulomb's laws of static and dynamic friction to analyze equilibrium scenarios.
4. Interpret the angle and cone of friction and its significance in determining equilibrium regions.

Session 1: Introduction to Equilibrium and Contact Forces (60 minutes)

Objective: Introduce students to the concept of equilibrium and contact forces between bodies.

- **Key Concepts**:
  - Definition of equilibrium.
  - Types of contact forces.
- **Teaching Strategies**:
  - Interactive discussion to engage students.
  - Visual aids and diagrams to illustrate concepts.

- **Activities**:
  - Work through examples of equilibrium situations.
  - Demonstrate the role of contact forces in maintaining equilibrium.
- **Assessment**:
  - In-class quiz on equilibrium and contact forces.

Session 2: Coulomb's Laws of Friction (60 minutes)

Objective: Define Coulomb's laws of static and dynamic friction and their applications.

- **Key Concepts**:
  - Coulomb's laws of friction.
  - Difference between static and dynamic friction.
- **Teaching Strategies**:
  - Derive and explain Coulomb's laws.
  - Discuss real-world examples of friction forces.
- **Activities**:
  - Solve problems involving static and dynamic friction.
  - Conduct friction experiments to observe effects.
- **Assessment**:
  - Homework assignment on applying Coulomb's laws to friction problems.

Session 3: Angle and Cone of Friction (60 minutes)

Objective: Explore the angle and cone of friction and their implications on equilibrium regions.

- **Key Concepts**:
  - Definition of the angle and cone of friction.
  - Relationship between friction and equilibrium regions.
- **Teaching Strategies**:
  - Visual demonstrations of angle and cone of friction.
  - Discussion on how these concepts affect stability.
- **Activities**:
  - Calculate angle and cone of friction for various surfaces.
  - Analyze stability conditions based on friction angles.
- **Assessment**:
  - Group problem-solving exercise on determining equilibrium regions.

Session 4: Real-World Applications and Problem-Solving (60 minutes)
Objective: Apply concepts learned to real-world scenarios and problem-solving exercises.

- **Key Concepts**:
  - Application of equilibrium and friction concepts in engineering and everyday life.
- **Teaching Strategies**:
  - Case studies of real-world applications.
  - Group problem-solving sessions.
- **Activities**:
  - Analyze real-world scenarios involving equilibrium and friction forces.
  - Work through problem sets covering various applications.
- **Assessment**:
  - Individual or group projects on applying equilibrium and friction concepts to real-world problems.

Real-World Applications (Ongoing Throughout Sessions)
Throughout the course, relate mechanical concepts to real-world applications such as:

- Designing structures to withstand forces.
- Engineering of vehicles and machinery.
- Construction and architecture.

Encourage students to explore and present additional real-world applications, fostering a deeper understanding of the practical significance of the mechanical concepts covered.

Conclusion: Conclude the session by summarizing the key concepts learned, highlighting the practical applications of equilibrium and friction forces, and encouraging students to explore further on their own.

This lesson plan provides a structured approach to understanding equilibrium and friction forces over a 4-hour session, balancing theoretical concepts with practical applications. The plan is designed to engage undergraduate students with clear objectives, interactive teaching strategies, and real-world examples, ensuring a comprehensive understanding of the topic.

Unit-2:

Title	Exploring Mechanics: Virtual Work and Equilibrium Conditions
Subtitle	Understanding Virtual Work and Equilibrium Principles
Duration	5 hours
Teacher's Name	DEBABRATA JANA (DJ)
Date	[Date]

Objective: By the end of this 5-hour session, students should be able to:

1. Understand the concept of virtual work and its applications in mechanics.
2. Apply the principle of virtual work to deduce necessary and sufficient conditions for equilibrium of force systems.
3. Solve problems involving workless constraints, virtual displacements, and virtual work.
4. Analyze real-world scenarios to apply the principles learned.

Session 1: Introduction to Virtual Work (60 minutes)

Objective: Introduce students to the concept of virtual work and its significance in mechanics.

- **Key Concepts**:
  - Definition of virtual work.
  - Workless constraints.
- **Teaching Strategies**:
  - Visual aids and real-world examples.
  - Step-by-step explanation of virtual work.
- **Activities**:
  - Work through examples of workless constraints.
  - Engage in a class discussion on the applications of virtual work.
- **Assessment**:
  - In-class quiz on basic concepts of virtual work.

Session 2: Virtual Displacements and Virtual Work (60 minutes)

Objective: Define virtual displacements and explore their relationship with virtual work.

- **Key Concepts**:
  - Definition of virtual displacements.

- Calculation of virtual work.
- **Teaching Strategies**:
  - Derive the relationship between virtual displacements and virtual work.
  - Examples to illustrate the concept.
- **Activities**:
  - Solve problems involving virtual displacements and virtual work.
  - Group discussions on practical applications.
- **Assessment**:
  - Homework assignment on calculating virtual work.

Session 3: Principle of Virtual Work (60 minutes)

Objective: Introduce the principle of virtual work and its application in mechanics.

- **Key Concepts**:
  - Statement of the principle of virtual work.
  - Deduction of equilibrium conditions.
- **Teaching Strategies**:
  - Step-by-step explanation of the principle of virtual work.
  - Examples to demonstrate its application.
- **Activities**:
  - Work through problems applying the principle of virtual work.
  - Peer-to-peer problem-solving exercises.
- **Assessment**:
  - In-class quiz on the principle of virtual work.

Session 4: Equilibrium Conditions for Force Systems (60 minutes)

Objective: Deduce necessary and sufficient conditions for equilibrium of force systems using the principle of virtual work.

- **Key Concepts**:
  - Deduction of equilibrium equations.
  - Application of the principle of virtual work to determine equilibrium.
- **Teaching Strategies**:
  - Derive equilibrium conditions for plane and space force systems.
  - Work through examples illustrating the application of the principle.
- **Activities**:
  - Solve problems involving equilibrium of force systems.
  - Group discussions on real-world applications of equilibrium conditions.
- **Assessment**:
  - In-class problems to evaluate comprehension of equilibrium conditions.

Session 5: Real-World Applications (60 minutes)

Objective: Apply the principles learned to analyze real-world scenarios in mechanics.

- **Key Concepts**:
  - Application of virtual work and equilibrium principles.
  - Analysis of structures and mechanisms.
- **Teaching Strategies**:
  - Case studies showcasing real-world applications.
  - Group discussions on engineering and design principles.
- **Activities**:
  - Analyze and solve real-world problems using virtual work and equilibrium principles.
  - Explore additional applications through student presentations.
- **Assessment**:
  - Group projects on analyzing and solving real-world mechanics problems.

Conclusion: Conclude the session by summarizing the key concepts learned, highlighting the practical applications of virtual work and equilibrium principles, and encouraging students to explore further on their own.

This lesson plan provides a structured approach to exploring mechanics concepts related to virtual work and equilibrium conditions over a 5-hour session, balancing theoretical concepts with practical applications. The plan is designed to engage undergraduate students with clear objectives, interactive teaching strategies, and real-world examples, ensuring a comprehensive understanding of the topic.

Title	**Exploring Stability in Mechanics**
Subtitle	Understanding Equilibrium and Stability
Duration	5 hours
Teacher's Name	DEBABRATA JANA (DJ)
Date	[Date]

Objective: By the end of this 5-hour session, students should be able to:

1. Understand the concept of stability of equilibrium in mechanics.
2. Apply the energy test of stability to determine the stability of equilibrium points.
3. Analyze the conditions of stability for a perfectly rough heavy body lying on a fixed body.
4. Explore real-world applications of stability concepts.

Session 1: Introduction to Stability of Equilibrium (60 minutes)
Objective: Introduce students to the concept of stability of equilibrium in mechanics.

- **Key Concepts**:
  - Definition of stability of equilibrium.
  - Importance in analyzing mechanical systems.
- **Teaching Strategies**:
  - Visual demonstrations of stable and unstable equilibrium.
  - Examples to illustrate the concept.
- **Activities**:
  - Discuss real-world examples of stable and unstable equilibrium.
  - Group discussions on the significance of stability in mechanics.
- **Assessment**:
  - In-class quiz on basic concepts of equilibrium stability.

Session 2: Conservative Force Fields and Stability (60 minutes)
Objective: Explore stability of equilibrium in conservative force fields.

- **Key Concepts**:
  - Definition of conservative force fields.
  - Relationship between potential energy and stability.
- **Teaching Strategies**:
  - Derive the condition for stability in conservative force fields.
  - Examples to demonstrate the application of potential energy.
- **Activities**:
  - Solve problems involving stability in conservative force fields.
  - Collaborative problem-solving exercises.
- **Assessment**:
  - Homework assignment on stability in conservative force fields.

Session 3: Energy Test of Stability (60 minutes)
Objective: Understand and apply the energy test of stability to determine equilibrium stability.

- **Key Concepts**:
  - Energy test of stability criteria.
  - Relationship between kinetic and potential energy.
- **Teaching Strategies**:
  - Step-by-step explanation of the energy test of stability.
  - Examples to illustrate the application of the criteria.
- **Activities**:
  - Work through problems applying the energy test of stability.
  - Peer-to-peer problem-solving exercises.
- **Assessment**:
  - In-class exercises to assess understanding of the energy test of stability.

Session 4: Stability of Perfectly Rough Heavy Body (60 minutes)
Objective: Analyze the conditions of stability for a perfectly rough heavy body lying on a fixed body.

- **Key Concepts**:
  - Conditions for stability of a heavy body on a fixed body.
  - Analysis of rocking stones.
- **Teaching Strategies**:
  - Derive conditions for stability of a heavy body on a fixed body.
  - Discuss the phenomenon of rocking stones.
- **Activities**:
  - Solve problems involving stability analysis of heavy bodies.
  - Group discussions on the stability of rocking stones.
- **Assessment**:
  - In-class quiz on stability conditions for heavy bodies.

Session 5: Real-World Applications of Stability Concepts (60 minutes)
Objective: Explore real-world applications of stability concepts in engineering and physics.

- **Key Concepts**:
  - Applications in structural engineering.
  - Importance in designing stable structures.
- **Teaching Strategies**:
  - Case studies showcasing stability analysis in engineering.
  - Discussion on the role of stability in various fields.
- **Activities**:

    - Group projects on real-world stability analysis.
    - Presentation of findings and discussion.
- **Assessment**:
    - Evaluation of group projects and class participation.

Conclusion: Conclude the session by summarizing the key concepts learned, highlighting the practical applications of stability analysis in mechanics, and encouraging students to explore further on their own.

This lesson plan provides a structured approach to exploring stability concepts in mechanics over a 5-hour session, balancing theoretical concepts with practical applications. The plan is designed to engage undergraduate students with clear objectives, interactive teaching strategies, and real-world examples, ensuring a comprehensive understanding of the topic.

Unit-3

Title	**Exploring Mechanics: Kinematics of a Particle**
Subtitle	Understanding Velocity, Acceleration, and Momentum
Duration	10 hours
Teacher's Name	DEBABRATA JANA (DJ)
Date	[Date]

Objective: By the end of this 10-hour session, students should be able to:

1. Define and calculate velocity, acceleration, angular velocity, linear and angular momentum for particles.
2. Understand relative velocity and acceleration.
3. Express velocity and acceleration in rectilinear and planar motion, in Cartesian and polar coordinates.
4. Analyze uniform circular motion and its characteristics.

Session 1-2: Velocity and Acceleration (120 minutes)

Objective: Introduce students to the concepts of velocity and acceleration for particles.

- **Key Concepts**:
  - Definition of velocity and acceleration.
  - Relationship between position, velocity, and acceleration.
- **Teaching Strategies**:
  - Visual aids to illustrate velocity and acceleration.
  - Derivation of equations for constant acceleration.
- **Activities**:
  - Solve problems involving velocity and acceleration.
  - Conduct experiments to measure velocity and acceleration.
- **Assessment**:
  - In-class quiz on velocity and acceleration.

Session 3-4: Angular Velocity and Momentum (120 minutes)

Objective: Define and calculate angular velocity and linear and angular momentum for particles.

- **Key Concepts**:
  - Definition of angular velocity.
  - Calculation of linear and angular momentum.
- **Teaching Strategies**:
  - Demonstrate angular velocity with rotating objects.
  - Explain the conservation of linear and angular momentum.
- **Activities**:
  - Solve problems involving angular velocity and momentum.
  - Conduct experiments to observe conservation laws.
- **Assessment**:
  - Homework assignment on angular velocity and momentum.

Session 5-6: Relative Velocity and Acceleration (120 minutes)

Objective: Understand the concept of relative velocity and acceleration between particles.

- **Key Concepts**:
  - Definition of relative velocity and acceleration.
  - Analysis of relative motion scenarios.
- **Teaching Strategies**:
  - Compare and contrast absolute and relative motion.
  - Use real-world examples to illustrate relative velocity.
- **Activities**:
  - Solve problems involving relative velocity and acceleration.
  - Conduct thought experiments on relative motion scenarios.
- **Assessment**:

- Group projects on analyzing relative motion in practical situations.

Session 7-8: Expressions for Velocity and Acceleration (120 minutes)
Objective: Express velocity and acceleration in rectilinear and planar motion, in Cartesian and polar coordinates.

- **Key Concepts**:
  - Expressions for velocity and acceleration in Cartesian coordinates.
  - Expressions for velocity and acceleration in polar coordinates.
- **Teaching Strategies**:
  - Derive equations for velocity and acceleration in different coordinate systems.
  - Solve problems to illustrate the application of coordinate transformations.
- **Activities**:
  - Work through examples of expressing velocity and acceleration in various coordinate systems.
  - Conduct hands-on activities to practice coordinate transformations.
- **Assessment**:
  - In-class exercises on velocity and acceleration in different coordinate systems.

Session 9-10: Uniform Circular Motion (120 minutes)
Objective: Analyze uniform circular motion and its characteristics.

- **Key Concepts**:
  - Definition of uniform circular motion.
  - Analysis of tangential and centripetal acceleration.
- **Teaching Strategies**:
  - Visual demonstrations of uniform circular motion.
  - Derivation of equations for tangential and centripetal acceleration.
- **Activities**:
  - Solve problems involving uniform circular motion.
  - Conduct experiments to observe centripetal force.
- **Assessment**:
  - Individual assessments on understanding uniform circular motion.

Real-World Applications (Ongoing Throughout Sessions)
Throughout the course, relate mathematical concepts to real-world applications such as:

- Vehicle dynamics and motion analysis.
- Robotics and kinematics of robotic arms.
- Sports science and biomechanics.

Encourage students to explore and present additional real-world applications, fostering a deeper understanding of the practical significance of mechanics concepts.

Conclusion: Conclude the session by summarizing the key concepts learned, highlighting the practical applications of velocity, acceleration, and motion analysis, and encouraging students to explore further on their own.

This lesson plan provides a structured approach to studying mechanics concepts over a 10-hour session, balancing theoretical concepts with practical applications. The plan is designed to engage undergraduate students with clear objectives, interactive teaching strategies, and real-world examples, ensuring a comprehensive understanding of kinematics and motion analysis.

Title	**Understanding Newton's Laws and Gravitation**
Subtitle	Exploring Fundamental Concepts in Mechanics
Duration	10 hours
Teacher's Name	DEBABRATA JANA (DJ)
Date	[Date]

Objective: By the end of this 10-hour session, students should be able to:

1. Understand Newton's laws of motion and the law of gravitation.
2. Define key concepts such as space, time, mass, force, and inertial reference frame.
3. Explain the principle of equivalence and its implications.
4. Apply the vector equation of motion to analyze motion in various scenarios.
5. Define and calculate work, power, and kinetic energy.
6. Understand conservative forces and their relationship with potential energy.
7. Apply the concept of energy conservation in conservative fields.
8. Analyze stable equilibrium and small oscillations using approximate equations of motion.
9. Understand impulsive forces and their effects.

Session 1-2: Newton's Laws of Motion (120 minutes)
Objective: Introduce students to Newton's laws of motion and their significance in mechanics.

- **Key Concepts**:
  - Newton's first, second, and third laws of motion.
  - Definition of force and mass.
- **Teaching Strategies**:
  - Interactive lecture to introduce Newton's laws.
  - Examples and demonstrations to illustrate each law.
- **Activities**:
  - Solve problems applying Newton's laws to real-world scenarios.
  - Conduct experiments to demonstrate the laws of motion.
- **Assessment**:
  - In-class quiz on Newton's laws and their applications.

Session 3-4: Law of Gravitation and Equivalence Principle (120 minutes)
Objective: Explore the law of gravitation and the principle of equivalence.

- **Key Concepts**:
  - Statement of the law of gravitation.
  - Explanation of the equivalence principle.
- **Teaching Strategies**:
  - Derive the equation for gravitational force.
  - Discuss the implications of the equivalence principle.
- **Activities**:
  - Calculate gravitational forces between objects.
  - Discuss experimental evidence supporting the equivalence principle.
- **Assessment**:
  - Group projects on applying the law of gravitation and equivalence principle to astrophysical phenomena.

Session 5-6: Vector Equation of Motion (120 minutes)
Objective: Introduce the vector equation of motion and its applications.

- **Key Concepts**:
  - Vector notation for motion.
  - Derivation of the vector equation of motion.
- **Teaching Strategies**:
  - Step-by-step explanation of vector notation and equations.
  - Examples to demonstrate solving problems using vectors.
- **Activities**:

- Solve problems involving motion in two or three dimensions.
    - Conduct experiments to analyze vector motion.
- **Assessment**:
    - Homework assignment on vector equation of motion problems.

Session 7-8: Work, Power, and Kinetic Energy (120 minutes)
Objective: Define and calculate work, power, and kinetic energy.

- **Key Concepts**:
    - Definition of work and its relation to force and displacement.
    - Definition of power and its calculation.
    - Kinetic energy and its relationship with mass and velocity.
- **Teaching Strategies**:
    - Discuss the concepts of work, power, and kinetic energy.
    - Derive equations and formulas for calculating each quantity.
- **Activities**:
    - Solve problems involving work, power, and kinetic energy.
    - Conduct experiments to measure work and power.
- **Assessment**:
    - In-class exercises to assess understanding of work, power, and kinetic energy calculations.

Session 9-10: Conservative Forces and Small Oscillations (120 minutes)
Objective: Understand conservative forces, potential energy, stable equilibrium, and small oscillations.

- **Key Concepts**:
    - Definition of conservative forces and potential energy.
    - Energy conservation in conservative fields.
    - Analysis of stable equilibrium and small oscillations.
- **Teaching Strategies**:
    - Discuss the relationship between conservative forces and potential energy.
    - Derive equations for stable equilibrium and small oscillations.
- **Activities**:
    - Solve problems involving conservative forces and potential energy.
    - Conduct experiments to observe stable equilibrium and small oscillations.
- **Assessment**:
    - Group projects on analyzing systems with conservative forces and potential energy.

Real-World Applications (Ongoing Throughout Sessions)
Throughout the course, relate mathematical concepts to real-world applications such as:

- Orbital mechanics and space exploration.
- Structural engineering and building design.
- Motion analysis in sports and athletics.

Encourage students to explore and present additional real-world applications, fostering a deeper understanding of the practical significance of the mechanical concepts covered.

Conclusion: Conclude the session by summarizing the key concepts learned, highlighting the practical applications of Newton's laws and the law of gravitation, and encouraging students to explore further on their own.

This lesson plan provides a structured approach to understanding fundamental concepts in mechanics over a 10-hour session, balancing theoretical concepts with practical applications. The plan is designed to engage undergraduate students with clear objectives, interactive teaching strategies, and real-world examples, ensuring a comprehensive understanding of Newton's laws of motion and the law of gravitation.

Unit-4

Title: Problems in Particle Dynamics: Mathematics Lesson Plan

Subtitle: Exploring Rectilinear Motion and Oscillations

Teacher's Name: DEBABRATA JANA (DJ)

Date: [Date of the Lesson]

Session	Topic	Duration	Objectives
1	Introduction to Rectilinear Motion	60 mins	Understand basic concepts of rectilinear motion
2	Vertical Motion under Uniform Gravity	60 mins	Analyze motion under constant gravitational force
3	Motion in Inverse Square Field	60 mins	Explore motion in inverse square force fields
4	Constrained Rectilinear Motion	60 mins	Investigate motion with constraints in rectilinear paths
5	Motion in a Resisting Medium	60 mins	Examine motion under resistive forces
6	Simple Harmonic Motion	60 mins	Understand principles and applications of simple harmonic motion
7	Damped and Forced Oscillations	60 mins	Analyze damped and forced oscillations and resonance phenomena
8	Motion of Elastic Strings and Springs	60 mins	Explore motion in elastic systems

Session 1: Introduction to Rectilinear Motion

- **Duration:** 60 minutes
- **Objectives:**
  - Understand the basic concepts of rectilinear motion.
- **Key Concepts:**
  - Position, velocity, acceleration in rectilinear motion.
- **Teaching Strategies:**
  - Lecture presentation with visual aids.
- **Activities:**
  - Solve simple problems on rectilinear motion.
- **Assessment:**
  - Quiz on basic concepts of rectilinear motion.

Session 2: Vertical Motion under Uniform Gravity

- **Duration:** 60 minutes
- **Objectives:**
  - Analyze motion under constant gravitational force.
- **Key Concepts:**
  - Free fall, projectile motion.
- **Teaching Strategies:**
  - Derive equations of motion under gravity.
- **Activities:**
  - Solve problems on vertical motion.
- **Assessment:**
  - Problem-solving exercises on projectile motion.

Session 3: Motion in Inverse Square Field

- **Duration:** 60 minutes
- **Objectives:**
  - Explore motion in inverse square force fields.
- **Key Concepts:**
  - Gravitational and electrostatic forces, Kepler's laws.
- **Teaching Strategies:**
  - Derive equations of motion under inverse square fields.
- **Activities:**
  - Solve problems on motion in planetary orbits.
- **Assessment:**
  - Problem-solving exercises on Kepler's laws.

Session 4: Constrained Rectilinear Motion

- **Duration:** 60 minutes
- **Objectives:**
  - Investigate motion with constraints in rectilinear paths.
- **Key Concepts:**
  - Constrained motion, Lagrange multipliers.
- **Teaching Strategies:**
  - Introduce Lagrange equations for constrained motion.
- **Activities:**

    - Solve problems on motion along inclined planes.
- **Assessment:**
    - Problem-solving exercises on constrained rectilinear motion.

Session 5: Motion in a Resisting Medium

- **Duration:** 60 minutes
- **Objectives:**
    - Examine motion under resistive forces.
- **Key Concepts:**
    - Terminal velocity, drag force.
- **Teaching Strategies:**
    - Introduce concepts of resistive forces and terminal velocity.
- **Activities:**
    - Analyze motion of falling objects in fluids.
- **Assessment:**
    - Problem-solving exercises on motion in resisting mediums.

Session 6: Simple Harmonic Motion

- **Duration:** 60 minutes
- **Objectives:**
    - Understand principles and applications of simple harmonic motion.
- **Key Concepts:**
    - Hooke's Law, period, amplitude.
- **Teaching Strategies:**
    - Derive equations of motion for simple harmonic oscillators.
- **Activities:**
    - Analyze motion of pendulums and mass-spring systems.
- **Assessment:**
    - Problem-solving exercises on simple harmonic motion.

Session 7: Damped and Forced Oscillations

- **Duration:** 60 minutes
- **Objectives:**
    - Analyze damped and forced oscillations and resonance phenomena.
- **Key Concepts:**
    - Damping coefficient, resonance frequency.
- **Teaching Strategies:**
    - Introduce equations of motion for damped and forced oscillations.
- **Activities:**
    - Explore resonance phenomena in various systems.
- **Assessment:**
    - Problem-solving exercises on damped and forced oscillations.

Session 8: Motion of Elastic Strings and Springs

- **Duration:** 60 minutes
- **Objectives:**
    - Explore motion in elastic systems.
- **Key Concepts:**

- Elastic potential energy, spring constant.
- **Teaching Strategies:**
  - Introduce equations of motion for elastic systems.
- **Activities:**
  - Analyze motion of springs and elastic strings under varying forces.
- **Assessment:**
  - Problem-solving exercises on motion of elastic systems.

Real-World Applications:

- **Session 1:** Understanding the motion of objects in free fall is crucial in fields like engineering, sports, and physics.
- **Session 2:** Projectile motion is fundamental in ballistics, sports, and engineering design.
- **Session 3:** Motion in inverse square fields is relevant in celestial mechanics, such as the orbits of planets around the Sun.
- **Session 4:** Constrained rectilinear motion is seen in systems like elevators, where the motion is restricted by the elevator shaft.
- **Session 5:** Motion in a resisting medium is crucial in understanding phenomena like air resistance in parachuting and terminal velocity.
- **Session 6:** Simple harmonic motion is ubiquitous in oscillatory systems like pendulums, springs in mechanical systems, and vibrating molecules in chemistry.
- **Session 7:** Damped and forced oscillations are relevant in studying phenomena like the suspension system in vehicles and electrical circuits.
- **Session 8:** Understanding the motion of elastic strings and springs is vital in various engineering applications, such as designing shock absorbers and tuning musical instruments.

Title	Planar Motion of a Particle in Mathematics
Subtitle	Understanding Projectile Motion and Orbits
Duration	10 Sessions (Each session is 60 minutes)
Teacher's Name	DEBABRATA JANA (DJ)
Date	[Date]

Session 1: Introduction to Planar Motion

- Duration: 60 minutes
- Objectives:
  - Understand the concept of planar motion.
  - Define key terms like displacement, velocity, and acceleration.
- Key Concepts:
  - Definition of planar motion.
  - Basic kinematic equations.
- Teaching Strategies:
  - Lecture with visual aids.
- Activities:
  - Derive equations of motion for uniform acceleration.
- Assessment:
  - Quiz on basic kinematic equations.

Session 2: Projectile Motion in a Resisting Medium

- Duration: 60 minutes
- Objectives:
    - Analyze projectile motion in the presence of air resistance.
    - Understand the effect of gravity on projectile motion.
- Key Concepts:
    - Forces acting on a projectile.
    - Trajectory of a projectile in a resisting medium.
- Teaching Strategies:
    - Problem-solving exercises.
- Activities:
    - Solve numerical problems involving projectile motion with air resistance.
- Assessment:
    - Worksheet on projectile motion with air resistance.

Session 3: Orbits in a Central Force Field

- Duration: 60 minutes
- Objectives:
    - Explore orbits under central force fields.
    - Understand the concept of gravitational attraction.
- Key Concepts:
    - Kepler's laws of planetary motion.
    - Circular and elliptical orbits.
- Teaching Strategies:
    - Interactive discussion.
- Activities:
    - Analyze Kepler's laws and their implications.
- Assessment:
    - Group discussion on the significance of Kepler's laws.

Session 4: Stability of Nearly Circular Orbits

- Duration: 60 minutes
- Objectives:
    - Understand the stability of orbits around a central body.
    - Analyze perturbations in nearly circular orbits.
- Key Concepts:
    - Stability criteria for orbits.
    - Perturbation theory.
- Teaching Strategies:
    - Simulation demonstrations.
- Activities:
    - Explore stability regions of orbits using simulation software.
- Assessment:
    - Quiz on stability criteria for orbits.

Session 5: Motion under the Attractive Inverse Square Law

- Duration: 60 minutes
- Objectives:
    - Investigate motion under inverse square law forces.
    - Understand the mathematical representation of inverse square laws.

- Key Concepts:
  - Force laws and their mathematical expressions.
  - Characteristics of inverse square laws.
- Teaching Strategies:
  - Socratic questioning.
- Activities:
  - Derive equations of motion for inverse square law forces.
- Assessment:
  - Problem-solving exercise on motion under inverse square laws.

Session 6: Kepler's Laws on Planetary Motion

- Duration: 60 minutes
- Objectives:
  - Deepen understanding of Kepler's laws.
  - Relate Kepler's laws to observational astronomy.
- Key Concepts:
  - Historical context of Kepler's laws.
  - Relationship between Kepler's laws and Newtonian mechanics.
- Teaching Strategies:
  - Multimedia presentation.
- Activities:
  - Analyze historical data on planetary motion.
- Assessment:
  - Presentation on the significance of Kepler's laws in modern astronomy.

Session 7: Slightly Disturbed Orbits

- Duration: 60 minutes
- Objectives:
  - Analyze the behavior of slightly disturbed orbits.
  - Understand the concept of orbital perturbations.
- Key Concepts:
  - Perturbation theory in celestial mechanics.
  - Types of orbital perturbations.
- Teaching Strategies:
  - Case study analysis.
- Activities:
  - Solve numerical problems involving orbital perturbations.
- Assessment:
  - Problem-solving exercise on orbital perturbations.

Session 8: Motion of Artificial Satellites

- Duration: 60 minutes
- Objectives:
  - Explore the motion of artificial satellites around celestial bodies.
  - Understand the factors influencing satellite motion.
- Key Concepts:
  - Keplerian elements of satellite orbits.
  - Orbital mechanics of artificial satellites.
- Teaching Strategies:

- Interactive demonstration.
- Activities:
  - Analyze real-life satellite orbits using satellite tracking software.
- Assessment:
  - Group project on designing a satellite orbit.

Session 9: Constrained Motion on Smooth and Rough Curves

- Duration: 60 minutes
- Objectives:
  - Investigate constrained motion on various types of curves.
  - Understand the effect of surface roughness on motion.
- Key Concepts:
  - Constraint forces in motion.
  - Frictional forces on curved surfaces.
- Teaching Strategies:
  - Hands-on experimentation.
- Activities:
  - Conduct experiments on constrained motion on different surfaces.
- Assessment:
  - Lab report on the effect of surface roughness on constrained motion.

Session 10: Equations of Motion Referred to Rotating Axes

- Duration: 60 minutes
- Objectives:
  - Learn how to express equations of motion in rotating reference frames.
  - Understand the Coriolis and centrifugal forces.
- Key Concepts:
  - Transformation of coordinates in rotating frames.
  - Coriolis and centrifugal accelerations.
- Teaching Strategies:
  - Thought experiments.
- Activities:
  - Derive equations of motion in rotating reference frames.
- Assessment:
  - Problem-solving exercise on motion in rotating frames.

Real-World Applications:

- Navigation systems: Understanding orbital mechanics is crucial for the accurate functioning of GPS satellites.
- Space exploration: Concepts like Kepler's laws and orbital mechanics are fundamental to planning and executing space missions.
- Robotics: Understanding constrained motion helps in designing robotic arms for various applications.

This lesson plan provides a comprehensive approach to understanding planar motion in mathematics, incorporating various theoretical concepts, practical applications, and hands-on activities to engage undergraduate students effectively.

Title: Motion of a Particle in Three Dimensions
Subtitle: Motion on Smooth Surfaces of Revolution
Duration: 2 Hours
Teacher's Name: DEBABTATA JANA(DJ)
Date: [Date of the Lesson]

Session 1: Understanding Motion on Smooth Surfaces

Duration: 60 minutes

Objectives:

- To understand motion in three dimensions.
- To comprehend motion on smooth surfaces of revolution such as spheres and cones.
- To apply mathematical concepts to real-world scenarios.

Key Concepts:

- Three-dimensional motion
- Motion on smooth surfaces of revolution
- Parametric equations
- Tangent vectors
- Normal vectors

Teaching Strategies:

- Visual aids: Use diagrams and animations to illustrate motion on smooth surfaces.
- Interactive examples: Engage students in solving problems related to motion on spheres and cones.
- Group discussions: Encourage students to discuss and analyze different scenarios of motion on smooth surfaces.

Activities:

1. **Introduction to Motion on Smooth Surfaces (10 minutes):**
   - Present an overview of motion in three dimensions and introduce the concept of motion on smooth surfaces of revolution.
   - Use visual aids to illustrate examples of motion on spheres and cones.
2. **Parametric Equations and Tangent Vectors (20 minutes):**
   - Explain parametric equations for motion on smooth surfaces.
   - Discuss how tangent vectors represent instantaneous motion along the surface.
   - Solve examples to demonstrate the calculation of tangent vectors.
3. **Normal Vectors and Curvature (20 minutes):**
   - Introduce normal vectors and their role in describing the curvature of the surface.
   - Discuss the relationship between normal vectors and curvature.
   - Provide examples to calculate normal vectors and curvature for different surfaces.
4. **Problem-Solving Session (10 minutes):**

    - Divide students into groups and provide them with problems related to motion on smooth surfaces.
    - Encourage collaborative problem-solving and discussion among group members.

Assessment:

- Assess students' understanding through group discussions and problem-solving sessions.
- Evaluate individual comprehension through quizzes or short assignments on parametric equations, tangent vectors, and normal vectors.

Session 2: Real-World Applications of Motion on Smooth Surfaces

Duration: 60 minutes

Objectives:

- To explore real-world applications of motion on smooth surfaces of revolution.
- To analyze and solve practical problems using mathematical concepts.

Key Concepts:

- Projectile motion
- Orbital mechanics
- Robotics and automation

Teaching Strategies:

- Case studies: Present real-world examples of motion on smooth surfaces, such as the motion of satellites in orbit.
- Problem-based learning: Assign problems that require applying motion concepts to scenarios in physics, engineering, and robotics.
- Guest speaker: Invite a guest speaker from a relevant field to discuss practical applications of motion on smooth surfaces.

Activities:

1. **Case Study: Orbital Mechanics (20 minutes):**
    - Present a case study on the motion of satellites in orbit around a planet.
    - Discuss how parametric equations and smooth surfaces are used to model orbital motion.
    - Analyze the factors affecting the trajectory and velocity of satellites.
2. **Problem-Solving Session: Robotics and Automation (30 minutes):**
    - Assign problems related to the motion of robotic arms or automated vehicles on smooth surfaces.
    - Guide students through the process of applying mathematical concepts to solve these problems.
    - Discuss the importance of accurate motion modeling in robotics and automation.
3. **Guest Speaker Session (10 minutes):**
    - Invite a guest speaker from the field of engineering or physics to discuss their work related to motion on smooth surfaces.
    - Allow students to ask questions and engage in discussions with the guest speaker.

Assessment:

- Evaluate students' understanding of real-world applications through their participation in the problem-solving session and engagement with the guest speaker.
- Assess problem-solving skills and critical thinking through written assignments or presentations on case studies.

Conclusion:

This lesson plan aims to provide undergraduate students with a comprehensive understanding of motion on smooth surfaces of revolution. By combining theoretical concepts with real-world applications, students will develop the skills necessary to analyze and solve problems in various fields, including physics, engineering, and robotics. Through interactive learning activities and engaging discussions, students will gain a deeper appreciation for the relevance and importance of mathematical concepts in practical scenarios.

Unit-5

Title	**Many Particle System Lesson Plan**
Subtitle	Linear Momentum, Angular Momentum, Energy Principles
Duration	10 hours
Teacher's Name	DEBABRATA JA (DJ)
Date	[Date]

Session 1: Introduction to Linear Momentum Principle

- **Duration**: 60 minutes
- **Objectives**:
  - Understand the concept of linear momentum.
  - Learn the linear momentum principle and its applications.
- **Key Concepts**:
  - Linear momentum definition and formula.
  - Motion of the center of mass.
  - Conservation of linear momentum.
- **Teaching Strategies**:
  - Lecture with visual aids and examples.
- **Activities**:
  - Solve practice problems on linear momentum.
- **Assessment**:
  - Quiz on linear momentum and its principle.

Session 2: Angular Momentum Principle I

- **Duration**: 60 minutes
- **Objectives**:
  - Define moment of a force about a point and axis.

- Introduce angular momentum about a point.
- **Key Concepts**:
  - Moment of a force.
  - Angular momentum about a point.
- **Teaching Strategies**:
  - Lecture with examples.
- **Activities**:
  - Work through problems calculating moment of forces and angular momentum.
- **Assessment**:
  - Problem-solving exercise on calculating angular momentum.

Session 3: Angular Momentum Principle II

- **Duration**: 60 minutes
- **Objectives**:
  - Understand angular momentum about an axis.
  - Introduce angular momentum principle about the center of mass.
- **Key Concepts**:
  - Angular momentum about an axis.
  - Angular momentum principle about the center of mass.
- **Teaching Strategies**:
  - Lecture with examples.
- **Activities**:
  - Problem-solving exercises on angular momentum about an axis and center of mass.
- **Assessment**:
  - Quiz on angular momentum principles.

Session 4: Conservation of Angular Momentum

- **Duration**: 60 minutes
- **Objectives**:
  - Learn about conservation of angular momentum.
  - Understand impulsive forces.
- **Key Concepts**:
  - Conservation of angular momentum.
  - Impulsive forces.
- **Teaching Strategies**:
  - Lecture with examples.
- **Activities**:
  - Work through problems on conservation of angular momentum and impulsive forces.
- **Assessment**:
  - Problem-solving exercise on conservation of angular momentum.

Session 5: Energy Principle I

- **Duration**: 60 minutes
- **Objectives**:
  - Define configurations and degrees of freedom of a multi-particle system.
  - Introduce the energy principle.
- **Key Concepts**:
  - Configurations and degrees of freedom.
  - Energy principle.
- **Teaching Strategies**:

  - Lecture with examples.
- **Activities**:
  - Solve problems on configurations and degrees of freedom.
- **Assessment**:
  - Quiz on energy principles.

Session 6: Energy Principle II

- **Duration**: 60 minutes
- **Objectives**:
  - Understand energy conservation in multi-particle systems.
- **Key Concepts**:
  - Energy conservation.
- **Teaching Strategies**:
  - Lecture with examples.
- **Activities**:
  - Problem-solving exercises on energy conservation.
- **Assessment**:
  - Problem-solving exercise on energy conservation.

Session 7: Rocket Motion and Gravity

- **Duration**: 60 minutes
- **Objectives**:
  - Apply energy and momentum principles to rocket motion.
- **Key Concepts**:
  - Rocket motion in free space and under gravity.
- **Teaching Strategies**:
  - Lecture with examples.
- **Activities**:
  - Analyze rocket motion scenarios using energy and momentum principles.
- **Assessment**:
  - Problem-solving exercise on rocket motion.

Session 8: Collision of Elastic Bodies

- **Duration**: 60 minutes
- **Objectives**:
  - Apply conservation laws to collisions of elastic bodies.
- **Key Concepts**:
  - Elastic collisions.
- **Teaching Strategies**:
  - Lecture with examples.
- **Activities**:
  - Solve problems on collisions of elastic bodies.
- **Assessment**:
  - Problem-solving exercise on elastic collisions.

Session 9: The Two-Body Problem

- **Duration**: 60 minutes
- **Objectives**:

- Analyze the two-body problem using principles of motion.

- **Key Concepts**:
  - The two-body problem.
- **Teaching Strategies**:
  - Lecture with examples.
- **Activities**:
  - Work through problems on the two-body problem.
- **Assessment**:
  - Problem-solving exercise on the two-body problem.

Session 10: Real-World Applications and Review

- **Duration**: 60 minutes
- **Objectives**:
  - Apply learned principles to real-world scenarios.
  - Review key concepts covered in the course.
- **Key Concepts**:
  - Application of linear momentum, angular momentum, and energy principles in real-world situations.
- **Teaching Strategies**:
  - Discussion of real-world examples.
  - Review of key concepts.
- **Activities**:
  - Discuss applications of course concepts in fields such as physics, engineering, and astronomy.
- **Assessment**:
  - Review questions and discussion participation.

Real-World Applications:

- Rocket motion: Understanding the principles of momentum and energy are crucial for designing efficient rocket propulsion systems.
- Collisions: Engineers use principles of momentum and energy to design safer vehicles and improve crash safety features.
- Astronomy: The study of celestial bodies often involves analyzing their motion and interactions using principles of momentum and energy.

This lesson plan provides a structured approach to learning the principles of linear momentum, angular momentum, and energy conservation in many-particle systems, while also highlighting their relevance in real-world applications.

Scientific computing with SageMath & R

Semester : 4 Credits : 2

Skill Enhancement Course- SEC B Full Marks : 100 (=80 + 20*)

Paper Code (Theory): MTM-A-SEC-B-TH

Here's a lesson plan for a 4-hour span on Scientific Computing with SageMath in Mathematics, divided into four 60-minute sessions.

Title	Subtitle	Duration	Teacher's Name	Date
Introduction to SageMath	Overview of SageMath and its applications	60 mins	URM	[Date]

Session 1: Introduction to SageMath

Objective:

- Introduce students to SageMath and its capabilities.
- Familiarize students with the interface and basic operations.

Key Concepts:

- What is SageMath?
- Features and advantages of SageMath.
- Basic operations: arithmetic, variable assignment, function calls.

Teaching Strategies:

- Lecture: Present overview and features of SageMath.
- Demonstration: Show how to install and navigate SageMath.
- Hands-on Practice: Guide students through basic operations in SageMath.

Activities:

1. Presentation on SageMath: Explain its history, features, and importance in scientific computing.
2. Demonstration: Install SageMath on the computer and demonstrate the interface.
3. Hands-on Practice: Assign basic arithmetic and variable assignment exercises for students to practice.

Assessment:

- Quiz: Short quiz on understanding the features and basic operations of SageMath.

Real-world Application:

- Showcase how SageMath is used in research for complex mathematical calculations and simulations in various fields like physics, engineering, and cryptography.

Title	Subtitle	Duration	Teacher's Name	Date
Installation Procedure	Step-by-step guide to installing SageMath	60 mins	URM	[Date]

Session 2: Installation Procedure

Objective:

- Guide students through the installation process of SageMath on their computers.
- Ensure students have a working understanding of the software setup.

Key Concepts:

- System requirements for SageMath.
- Downloading and installing SageMath.
- Verifying installation and accessing the SageMath environment.

Teaching Strategies:

- Demonstration: Step-by-step installation process.
- Troubleshooting: Address common installation issues.
- Q&A: Encourage students to ask questions during the process.

Activities:

1. Demonstration: Walk students through the download and installation process of SageMath on different operating systems.
2. Troubleshooting: Discuss common errors during installation and solutions.
3. Hands-on Practice: Allow students time to install SageMath on their computers and verify its functionality.

Assessment:

- Observation: Assess students' ability to successfully install SageMath and navigate the interface.

Real-world Application:

- Discuss how the ability to install and set up software is crucial in various professions, especially in scientific research and data analysis.

Title	Subtitle	Duration	Teacher's Name	Date
Use of SageMath as a Calculator	Utilizing SageMath for basic calculations	60 mins	URM	[Date]

Session 3: Use of SageMath as a Calculator

Objective:

- Teach students how to perform basic arithmetic and mathematical operations using SageMath.
- Introduce students to built-in mathematical functions.

Key Concepts:

- Arithmetic operations: addition, subtraction, multiplication, division.
- Mathematical functions: square root, trigonometric functions, logarithms, exponentiation.

Teaching Strategies:

- Demonstration: Perform basic arithmetic operations and use mathematical functions in SageMath.
- Guided Practice: Walk students through examples of mathematical calculations.
- Independent Practice: Allow students time to practice using SageMath as a calculator.

Activities:

1. Demonstration: Show how to perform basic arithmetic operations and use mathematical functions in SageMath.
2. Guided Practice: Solve example problems involving mathematical calculations with SageMath.
3. Independent Practice: Assign exercises for students to practice using SageMath as a calculator.

Assessment:

- Worksheet: Assess students' understanding through a worksheet containing mathematical problems to solve using SageMath.

Real-world Application:

- Illustrate how scientists, engineers, and economists use computational tools like SageMath for quick and accurate calculations in their research and analysis.

Title	Subtitle	Duration	Teacher's Name	Date
Numerical and symbolic computations using mathematical functions	Applying mathematical functions in SageMath	60 mins	URM	[Date]

Session 4: Numerical and Symbolic Computations

Objective:

- Introduce students to numerical and symbolic computations using SageMath.
- Explore advanced mathematical functions and their applications.

Key Concepts:

- Numerical computations: solving equations, finding roots, numerical integration.
- Symbolic computations: symbolic manipulation, solving equations symbolically.

Teaching Strategies:

- Demonstration: Perform numerical and symbolic computations using SageMath.
- Problem-solving: Work through examples of numerical and symbolic calculations.
- Discussion: Engage students in discussions on the applications of numerical and symbolic computations.

Activities:

1. Demonstration: Show how to perform numerical computations such as solving equations and finding roots using SageMath.
2. Problem-solving: Solve examples involving numerical and symbolic computations with SageMath.

3. Discussion: Facilitate a discussion on the importance and applications of numerical and symbolic computations in mathematics and other fields.

Assessment:

- Presentation: Assess students' understanding through a short presentation where they demonstrate a numerical or symbolic computation using SageMath.

Real-world Application:

- Highlight how numerical and symbolic computations are used in various scientific disciplines, including physics, chemistry, and computer science, for modeling, simulation, and analysis.

Title: Scientific Computing with SageMath in Mathematics |
| Subtitle: Graphical Representations and Plotting Functions |
| Duration: 4 hours |
| Teacher's Name: UTTAM ROY MANDAL
| Date: [Date of the Lesson] |

Session 1: Introduction to Graphical Representations (60 minutes)

Objective: Introduce students to plotting functions using SageMath and explore graphical representations of polynomial and trigonometric functions.

Key Concepts:

- Basics of plotting functions in SageMath.
- Understanding polynomial functions and their graphs.
- Exploring trigonometric functions and their graphical representations.

Teaching Strategies:

- Lecture with visual aids to introduce plotting functions in SageMath.
- Demonstration of plotting polynomial and trigonometric functions using SageMath.
- Guided practice session for students to plot functions on their own.

Activities:

1. Introduction to SageMath and its plotting capabilities.
2. Demonstration of plotting simple polynomial functions (e.g., quadratic, cubic) in SageMath.
3. Explanation of trigonometric functions and plotting sine, cosine functions.
4. Guided practice session: Students plot polynomial and trigonometric functions on their computers.

Assessment:

- Formative assessment: Observation of students' engagement during the guided practice session.
- Homework assignment: Plotting additional polynomial and trigonometric functions and submitting the graphs.

Real-world Application:

- Analyzing the periodic behavior of trigonometric functions in applications such as signal processing and wave analysis.

Session 2: Advanced Plotting Techniques (60 minutes)

Objective: Explore advanced plotting techniques such as plotting functions with asymptotes and superimposing multiple graphs.

Key Concepts:

- Understanding functions with asymptotes and their graphical representation.
- Techniques for superimposing multiple graphs in one plot.
- Introduction to plotting tangents on curves.

Teaching Strategies:

- Review of plotting functions from Session 1.
- Lecture on functions with asymptotes and techniques to handle them in SageMath.
- Demonstration of superimposing multiple graphs and plotting tangents.

Activities:

1. Review of plotting polynomial and trigonometric functions from Session 1.
2. Lecture on functions with asymptotes and techniques to handle them in SageMath.
3. Demonstration of superimposing multiple graphs: plotting a curve along with its tangent.
4. Guided practice session: Students try plotting functions with asymptotes and superimposing multiple graphs.

Assessment:

- Formative assessment: Observation of students' ability to handle functions with asymptotes and superimpose multiple graphs during the guided practice session.
- Homework assignment: Plotting functions with asymptotes and superimposing graphs, with a focus on understanding the behavior near the asymptotes.

Real-world Application:

- Modeling physical systems with asymptotic behavior, such as exponential growth or decay in population dynamics.

Session 3: Polar Plotting (60 minutes)

Objective: Introduce polar plotting of curves and explore its applications.

Key Concepts:

- Basics of polar coordinates and plotting polar functions.
- Understanding polar equations of curves and their graphical representation.
- Exploring real-world applications of polar plotting.

Teaching Strategies:

- Review of Cartesian plotting techniques.
- Lecture on polar coordinates and polar plotting in SageMath.
- Demonstration of plotting polar curves and exploring their properties.

Activities:

1. Review of Cartesian plotting techniques and functions from previous sessions.
2. Lecture on polar coordinates and plotting polar functions in SageMath.
3. Demonstration of plotting polar curves: circles, cardioids, and spirals.
4. Guided practice session: Students try plotting polar curves and exploring their properties.

Assessment:

- Formative assessment: Observation of students' ability to plot polar curves accurately during the guided practice session.
- Homework assignment: Plotting additional polar curves and analyzing their properties.

Real-world Application:

- Modeling phenomena with circular or radial symmetry, such as orbits of celestial bodies or patterns in biological systems.

Session 4: Application and Review (60 minutes)

Objective: Apply the concepts learned in previous sessions to real-world problems and review key concepts.

Key Concepts:

- Application of graphical representations in solving real-world problems.
- Review of plotting techniques learned in previous sessions.

Teaching Strategies:

- Problem-solving session using SageMath to solve real-world problems.
- Review of key concepts and techniques learned in previous sessions.
- Q&A session to address any remaining doubts or questions.

Activities:

1. Problem-solving session: Students solve real-world problems using graphical representations and SageMath.
2. Review of key concepts and techniques learned in previous sessions.
3. Q&A session: Students ask questions and clarify doubts regarding plotting functions in SageMath.

Assessment:

- Formative assessment: Observation of students' ability to apply graphical representations to solve real-world problems.
- Review quiz: Short quiz covering key concepts and techniques learned in previous sessions.

Real-world Application:

- Solving engineering problems involving optimization, design, and analysis using graphical representations and computational tools like SageMath.

Note to Teachers:

- Encourage students to explore additional features of SageMath beyond what is covered in the lesson plan.
- Provide opportunities for students to work on projects or assignments that require the application of plotting techniques learned in the course to real-world problems in their field of interest.

Title:	**Scientific Computing with SageMath in Mathematics**
Subtitle:	SageMath Commands for Differentiation, Higher Order Derivatives, and Integrals
Duration:	3 hours
Teacher's Name:	UTTAM ROY MANDAL (URM)
Date:	[Date of the Lesson]

Session 1: Introduction to SageMath and Basic Commands (Duration: 60 mins)

Objectives:

- Introduce students to SageMath and its applications in scientific computing.
- Familiarize students with basic SageMath commands for mathematical operations.

Key Concepts:

1. Overview of SageMath and its significance in scientific computing.
2. Syntax and basic commands for mathematical operations.

Teaching Strategies:

- Brief lecture on SageMath and its relevance.
- Live demonstration of basic SageMath commands for arithmetic operations.

Activities:

1. Students practice basic arithmetic operations using SageMath.
2. Q&A session to address any initial queries.

Assessment:

- Formative assessment through participation in the activities and Q&A.

Session 2: Differentiation and Plotting (Duration: 60 mins)

Objectives:

- Understand SageMath commands for differentiation.
- Learn to plot functions and their derivatives using SageMath.

Key Concepts:

1. Differentiation in SageMath.
2. Plotting functions and their derivatives simultaneously.

Teaching Strategies:

- Guided step-by-step explanation of differentiation commands.
- Demonstration of plotting f(x) and its first derivative together.

Activities:

1. Practice differentiating functions using SageMath.
2. Plotting exercises with real-world examples.

Assessment:

- Checkpoint assessment on differentiation commands and plotting skills.

Session 3: Integration and Real-World Applications (Duration: 60 mins)

Objectives:

- Utilize SageMath commands for integration.
- Explore real-world applications of mathematical concepts.

Key Concepts:

1. Integration and definite integrals in SageMath.

2. Real-world applications of mathematical concepts.

Teaching Strategies:

- Detailed explanation of integration commands.
- Discussion on how mathematical concepts apply to real-world scenarios.

Activities:

1. Practice solving integrals using SageMath.
2. Group activity: Discuss and present real-world applications of the topics covered.

Assessment:

- Final assessment through solving integration problems and participation in the group activity.

Conclusion:

This comprehensive 3-hour lesson plan aims to provide undergraduate students with a solid foundation in using SageMath for scientific computing in mathematics. The organized structure, clear objectives, and engaging activities ensure active participation and understanding. Real-world applications emphasize the relevance of the mathematical concepts beyond the classroom, making the lesson practical and meaningful for students.

Title	Comprehensive Introduction to Scientific Computing with SageMath in Mathematics
Subtitle	Exploring Programming Fundamentals and Mathematical Applications
Duration	5 Hours (60 minutes per session)
Teacher's Name	UTTAM ROY MANDAL (URM)
Date	[Date]

Session 1: Introduction to Programming in SageMath

Duration: 60 minutes

Objectives:

- Introduce students to SageMath and its significance in scientific computing.
- Familiarize students with basic programming concepts such as variables, data types, and arithmetic operations.
- Instill problem-solving skills through hands-on programming exercises.

Key Concepts:

- Introduction to SageMath
- Variables and data types
- Arithmetic operations
- Basic input/output

Teaching Strategies:

- Lecture and demonstration
- Interactive coding examples
- Q&A sessions

Activities:

1. Introduction to SageMath and its interface.
2. Explanation of variables and data types with examples.
3. Demonstration of arithmetic operations using SageMath.
4. Guided coding exercise to write a simple program (e.g., calculating the area of a rectangle).
5. Q&A session to clarify doubts.

Assessment:

- Informal assessment through observation of student participation and understanding during coding exercises.

Real-world Application:

- Show how SageMath can be used to solve real-world mathematical problems such as calculating areas, volumes, or solving equations in engineering and physics.

Session 2: Relational and Logical Operators

Duration: 60 minutes

Objectives:

- Introduce students to relational and logical operators in programming.
- Explain the importance of conditional statements in decision-making.
- Develop problem-solving skills through programming challenges.

Key Concepts:

- Relational operators (<, >, <=, >=, ==, !=)
- Logical operators (and, or, not)
- Conditional statements (if, else)

Teaching Strategies:

- Lecture with examples
- Interactive coding exercises
- Group discussions

Activities:

1. Explanation of relational and logical operators with examples.
2. Demonstration of conditional statements using SageMath.
3. Hands-on coding exercises to practice using operators and conditional statements.

4. Group discussion to analyze and debug code.
5. Mini-project: Write a program to determine if a given number is even or odd.

Assessment:

- Evaluation of students' code for correctness and adherence to programming conventions.
- Participation in group discussions and problem-solving activities.

Real-world Application:

- Illustrate how relational and logical operators are used in decision-making processes in various fields such as finance, computer science, and logistics.

Session 3: Loops and Nested Loops

Duration: 60 minutes

Objectives:

- Introduce the concept of loops and their significance in repetitive tasks.
- Familiarize students with loop control structures and nested loops.
- Develop proficiency in using loops through coding exercises.

Key Concepts:

- For loops
- While loops
- Nested loops

Teaching Strategies:

- Lecture supplemented with examples
- Hands-on coding practice
- Peer programming exercises

Activities:

1. Explanation of for and while loops with examples.
2. Demonstration of nested loops and their applications.
3. Coding exercises to practice writing loops (e.g., printing patterns, calculating factorial).
4. Peer programming activity: Pair students to solve a programming challenge using loops.
5. Review and discussion of solutions.

Assessment:

- Evaluation of coding assignments for correctness and efficiency.
- Peer assessment based on collaboration and problem-solving skills.

Real-world Application:

- Showcase how loops are used in simulations, data processing, and optimization problems in fields like biology, economics, and operations research.

Session 4: Writing Programs for Mathematical Functions

Duration: 60 minutes

Objectives:

- Apply programming concepts learned in previous sessions to solve mathematical problems.
- Develop algorithms for calculating averages, factorials, prime numbers, etc.
- Enhance problem-solving skills through coding challenges.

Key Concepts:

- Mean, median, mode
- Factorial calculation
- Prime number generation
- Greatest common divisor (GCD) and least common multiple (LCM)

Teaching Strategies:

- Lecture with examples
- Guided coding exercises
- Independent coding tasks

Activities:

1. Explanation of mathematical functions and their algorithms.
2. Guided coding exercises to write programs for calculating averages, factorials, etc.
3. Independent coding tasks: Students write programs to find prime numbers, GCD, LCM, etc.
4. Code review and discussion of different approaches.
5. Troubleshooting session to address common errors.

Assessment:

- Evaluation of students' programs for correctness and efficiency.
- Peer review of code and algorithm design.

Real-world Application:

- Illustrate how mathematical functions are used in scientific research, engineering simulations, and financial modeling.

Session 5: Advanced Mathematical Applications with SageMath

Duration: 60 minutes

Objectives:

- Explore advanced mathematical applications of SageMath.

- Introduce students to sequences, series, and convergence.
- Encourage independent exploration and experimentation with SageMath.

Key Concepts:

- Sequences and series
- Convergence
- Iterative algorithms

Teaching Strategies:

- Lecture with demonstrations
- Hands-on experimentation
- Project-based learning

Activities:

1. Introduction to sequences and series.
2. Demonstration of convergence using SageMath.
3. Hands-on experimentation: Students explore convergence behavior of different sequences.
4. Project assignment: Students choose a mathematical problem and solve it using SageMath.
5. Presentation of projects and discussion of findings.

Assessment:

- Evaluation of project reports for clarity, correctness, and depth of analysis.
- Peer evaluation of presentations and contributions to discussions.

Real-world Application:

- Showcase how SageMath is used in mathematical research, data analysis, and modeling in various fields such as physics, biology, and economics.

This lesson plan provides a structured approach to introducing scientific computing with SageMath in Mathematics, catering to the needs of undergraduate students with varying levels of programming experience. Each session builds upon the previous one, gradually deepening students' understanding and proficiency in using SageMath for mathematical computations and problem-solving. Through hands-on coding exercises and real-world applications, students are engaged and motivated to explore the practical relevance of the concepts learned in the classroom.

Title:	**Scientific Computing with SageMath in Mathematics**
Subtitle:	Using Inbuilt Functions for Matrices, Linear Algebra, Polynomials, and Differential Equations
Duration:	4 hours (4 sessions of 60 minutes each)
Teacher's Name:	UTTAM ROY MANDAL (URM)

Title:	Scientific Computing with SageMath in Mathematics
Date:	[Date of Lesson Plan]

Session 1: Introduction to SageMath and Matrix Operations

- **Duration:** 60 minutes

Objectives:

- Introduce students to SageMath and its capabilities in scientific computing.
- Understand basic matrix operations and their implementation in SageMath.
- Familiarize students with inbuilt functions for matrices.

Key Concepts:

- Introduction to SageMath
- Matrix operations: addition, subtraction, multiplication
- Determinant and inverse of a matrix
- Inbuilt functions in SageMath for matrix operations

Teaching Strategies:

- Brief lecture on SageMath and its significance in scientific computing.
- Demonstration of basic matrix operations using SageMath.
- Interactive discussion to clarify concepts.
- Hands-on exercises using SageMath worksheets.

Activities:

1. Introduction to SageMath environment and its interface.
2. Demonstration of basic matrix operations: addition, subtraction, and multiplication.
3. Explanation of determinant and inverse of a matrix.
4. Guided practice using inbuilt functions in SageMath for matrix operations.

Assessment:

- Informal assessment through participation in discussions and completion of hands-on exercises.

Session 2: Solving Systems of Linear Equations and Finding Roots of Polynomials

- **Duration:** 60 minutes

Objectives:

- Understand the concept of solving systems of linear equations.
- Learn to use SageMath to solve systems of linear equations.
- Introduction to polynomial functions and finding their roots.

- Practice finding roots of polynomials using SageMath.

Key Concepts:

- Systems of linear equations
- Gaussian elimination method
- Finding roots of polynomials
- Inbuilt functions in SageMath for solving linear equations and finding polynomial roots

Teaching Strategies:

- Review of concepts related to systems of linear equations.
- Demonstration of solving systems of linear equations using SageMath.
- Explanation of polynomial functions and root-finding techniques.
- Hands-on practice with SageMath worksheets.

Activities:

1. Recap of solving systems of linear equations using traditional methods.
2. Demonstration of solving systems of linear equations using SageMath.
3. Introduction to polynomial functions and their roots.
4. Guided practice on finding roots of polynomials using SageMath.

Assessment:

- Assessment based on the accuracy of solutions obtained using SageMath and participation in activities.

Session 3: Solving Differential Equations

- **Duration:** 60 minutes

Objectives:

- Understand the concept of differential equations.
- Learn to solve ordinary differential equations (ODEs) using SageMath.
- Explore real-world applications of differential equations.

Key Concepts:

- Ordinary differential equations (ODEs)
- Numerical methods for solving ODEs
- Inbuilt functions in SageMath for solving ODEs

Teaching Strategies:

- Brief introduction to differential equations and their significance.
- Explanation of numerical methods for solving ODEs.
- Demonstration of solving ODEs using SageMath.
- Discussion on real-world applications of ODEs.

Activities:

1. Introduction to differential equations and their types.
2. Explanation of numerical methods for solving ODEs.
3. Demonstration of solving ODEs using SageMath.
4. Discussion on real-world examples where ODEs are applicable.

Assessment:

- Assessment based on understanding demonstrated during discussions and participation in activities.

Session 4: Review and Application in Real-world Problems

- **Duration:** 60 minutes

Objectives:

- Review key concepts covered in previous sessions.
- Apply SageMath skills to solve real-world mathematical problems.
- Reflect on the relevance of scientific computing in mathematics and beyond.

Key Concepts:

- Matrix operations
- Solving systems of linear equations
- Finding roots of polynomials
- Solving differential equations
- Real-world applications

Teaching Strategies:

- Recap of key concepts covered in previous sessions.
- Group discussion on real-world applications of scientific computing in mathematics.
- Application of SageMath to solve real-world problems.
- Q&A session to address any remaining doubts.

Activities:

1. Recap of key concepts learned in previous sessions.
2. Group discussion on real-world applications of scientific computing.
3. Application of SageMath to solve real-world mathematical problems.
4. Q&A session to clarify doubts and reinforce learning.

Assessment:

- Assessment based on the quality of solutions provided for real-world problems and active participation in discussions.

Real-world Applications:

- **Engineering:** Designing structures and systems, analyzing circuits.
- **Finance:** Modeling financial markets, risk analysis.
- **Biology:** Simulating population dynamics, modeling biochemical processes.
- **Physics:** Solving differential equations for motion, analyzing quantum systems.

This comprehensive lesson plan is designed to engage undergraduate students in scientific computing using SageMath, providing them with practical skills and knowledge applicable in various real-world contexts.

OR

Here's a detailed lesson plan for Scientific Computing with SageMath in Mathematics for a 10-hour span, organized into 10 sessions. Each session is designed for a 60-minute duration.

Session	Title	Subtitle	Duration	Teacher's Name	Date
1	Introduction to SageMath	Basics of SageMath and Its Applications	60 mins	URM	[Date]
Objectives:	- Understand the scope and capabilities of SageMath.				

```csharp
            - Install SageMath on personal devices or access it online.
```

| Key Concepts: | - SageMath environment, basic syntax, and documentation. - Mathematical functions in SageMath.

| Teaching Strategies: | - Brief lecture on the importance and application of SageMath. - Demonstration of basic SageMath commands. - Hands-on practice with simple mathematical functions.

| Activities: | - Install SageMath. - Execute basic mathematical functions (e.g., square root, trigonometric functions) in SageMath.

| Assessments: | - Quick quiz on understanding SageMath basics. - Observation of hands-on activities.

Session	Title	Subtitle	Duration	Teacher's Name	Date
2	Graphical Representations	Plotting Functions in SageMath	60 mins	URM	[Date]
Objectives:	- Understand how to represent mathematical functions graphically using SageMath.				

```css
            - Learn to interpret and customize plots in SageMath.
```

| Key Concepts: | - Plotting functions, customizing plot appearance. - Using SageMath graphics capabilities.

| Teaching Strategies: | - Lecture on the importance of graphical representations. - Demonstration of plotting functions in SageMath. - Hands-on practice with graphical customization.

| Activities: | - Plot various mathematical functions and customize their appearance. - Interpret and analyze different plots.

| Assessments: | - Quiz on graphical representations. - Review of hands-on activities.

Session	Title	Subtitle	Duration	Teacher's Name	Date
3	Differentiation and Higher Order Derivatives	SageMath for Calculus	60 mins	URM	[Date]
Objectives:	- Perform differentiation and calculate higher-order derivatives in SageMath.				

```
markdown
      - Understand the applications of derivatives in mathematics.
```

| Key Concepts: | - Derivatives, higher-order derivatives, calculus in SageMath.

| Teaching Strategies: | - Lecture on the importance of differentiation in mathematics. - Demonstration of differentiation and higher-order derivatives in SageMath. - Hands-on practice with calculus functions.

| Activities: | - Calculate derivatives and higher-order derivatives of various functions. - Solve calculus problems using SageMath.

| Assessments: | - Quiz on differentiation concepts. - Evaluation of hands-on activities.

Session	Title	Subtitle	Duration	Teacher's Name	Date
4	Plotting f(x) and f'(x) Together	Visualizing Derivatives in SageMath	60 mins	URM	[Date]
Objectives:	- Learn to plot functions and their derivatives together.				

```
markdown
      - Understand the visual representation of derivatives.
```

| Key Concepts: | - Simultaneous plotting, visualizing derivatives. - Analyzing the behavior of functions and their derivatives.

| Teaching Strategies: | - Brief lecture on the importance of visualizing derivatives. - Demonstration of simultaneous plotting in SageMath. - Hands-on practice with visualizing derivatives.

| Activities: | - Plot functions and their derivatives together. - Interpret and analyze the visual representation.

| Assessments: | - Quiz on simultaneous plotting. - Review of hands-on activities.

Session	Title	Subtitle	Duration	Teacher's Name	Date
5	Integrals and Definite Integrals	SageMath for Calculating Integrals	60 mins	URM	[Date]
Objectives:	- Perform integration and calculate definite integrals in SageMath.				

```markdown
          - Understand the applications of integrals in mathematics.
```

| Key Concepts: | - Integrals, definite integrals, calculus in SageMath.

| Teaching Strategies: | - Lecture on the importance of integration in mathematics. - Demonstration of integration and definite integrals in SageMath. - Hands-on practice with calculus functions.

| Activities: | - Calculate integrals and definite integrals of various functions. - Solve calculus problems using SageMath.

| Assessments: | - Quiz on integration concepts. - Evaluation of hands-on activities.

Session	Title	Subtitle	Duration	Teacher's Name	Date
6	Operators and Conditional Statements	Programming Basics in SageMath	60 mins	URM	[Date]
Objectives:	- Understand basic programming concepts in SageMath.				

```css
          - Learn to use operators and conditional statements in SageMath.
```

| Key Concepts: | - Programming basics, operators, conditional statements. - SageMath programming syntax.

| Teaching Strategies: | - Lecture on the importance of programming in SageMath. - Demonstration of basic programming concepts. - Hands-on practice with operators and conditional statements.

| Activities: | - Write simple programs in SageMath. - Use operators and conditional statements in mathematical problems.

| Assessments: | - Quiz on programming basics. - Review of hands-on activities.

Session	Title	Subtitle	Duration	Teacher's Name	Date
7	Loops and Nested Loops	Advanced Programming in SageMath	60 mins	URM	[Date]
Objectives:	- Learn to use loops and nested loops in SageMath.				

```markdown
          - Understand the application of advanced programming concepts.
```

| Key Concepts: | - Loops, nested loops, advanced programming. - SageMath programming syntax.

| Teaching Strategies: | - Brief lecture on the importance of advanced programming. - Demonstration of loops and nested loops in SageMath. - Hands-on practice with advanced programming concepts.

| Activities: | - Write programs with loops and nested loops in SageMath. - Solve mathematical problems using advanced programming.

| Assessments: | - Quiz on advanced programming concepts. - Evaluation of hands-on activities.

Session	Title	Subtitle	Duration	Teacher's Name	Date
8	Matrices and Determinant	Linear Algebra in SageMath	60 mins	[Teacher's Name]	[Date]
Objectives:	- Understand matrices and determinants in SageMath.				

```css
        - Learn to perform matrix operations.
```

| Key Concepts: | - Matrices, determinant, linear algebra in SageMath.

| Teaching Strategies: | - Lecture on the importance of linear algebra. - Demonstration of matrix operations in SageMath. - Hands-on practice with matrices and determinants.

| Activities: | - Perform matrix operations in SageMath. - Calculate determinants of matrices.

| Assessments: | - Quiz on linear algebra concepts. - Review of hands-on activities.

Session	Title	Subtitle	Duration	Teacher's Name	Date
9	Solving Systems of Linear Equations	Applied Linear Algebra with SageMath	60 mins	URM	[Date]
Objectives:	- Learn to solve systems of linear equations using SageMath.				

```go
        - Understand the applications of linear algebra in solving real-world problems.
```

| Key Concepts: | - Systems of linear equations, matrix equations. - Using SageMath for solving linear systems.

| Teaching Strategies: | - Lecture on the importance of solving linear systems. - Demonstration of solving linear systems in SageMath. - Hands-on practice with real-world problems.

| Activities: | - Solve systems of linear equations using SageMath. - Apply linear algebra concepts to real-world problems.

| Assessments: | - Quiz on solving linear systems. - Evaluation of hands-on activities.

Session	Title	Subtitle	Duration	Teacher's Name	Date
10	Solving Differential Equations	SageMath for Differential Equations	60 mins	URM	[Date]
Objectives:	- Learn to solve differential equations using SageMath.				

```
markdown
          - Understand the applications of differential equations in various fields.
```

| Key Concepts: | - Differential equations, numerical methods. - Using SageMath for solving differential equations.

| Teaching Strategies: | - Lecture on the importance of differential equations. - Demonstration of solving differential equations in SageMath. - Hands-on practice with real-world examples. | Activities: | - Solve differential equations using SageMath. - Apply differential equations to real-world problems.

| Assessments: | - Quiz on solving differential equations. - Evaluation of hands-on activities.

Real-world Applications:

- Finance: Using differential equations to model and predict stock market trends.
- Engineering: Solving systems of linear equations to design and analyze structures.
- Physics: Applying calculus to model motion and solve dynamic systems.
- Biology: Using matrices to analyze genetic data and population dynamics.
- Computer Science: Implementing algorithms and loops for data analysis and optimization.

This comprehensive lesson plan covers various aspects of Scientific Computing with SageMath in Mathematics, providing students with both theoretical understanding and practical skills necessary for real-world applications.

Metric Space & Complex Analysis

Semester : 6 | Credits : 5+1*=6

Core Course-13 | Full Marks : 65+15**+20***=100

Paper Code(Theory): MTM-A-CC-6-13-TH

Paper Code (Tutorial):MTM-A-CC-6-13-TU

Unit-1 : Metric space
Here's a comprehensive 10-hour lesson plan for undergraduate mathematics students focusing on Metric Spaces:

Lesson Plan: Unit-1.1: Metric Spaces

Title	Metric Spaces
Subtitle	**Introduction to Metric Spaces**
Duration	10 hours
Teacher's Name	DR PAYEL GHOSH (PG)
Date	[Date]

Objectives:

1. Define metric space and provide examples.
2. Understand fundamental concepts such as open balls, open sets, closed sets, interior points, limit points, closure, boundary points, and properties associated with them.
3. Explore the notion of bounded sets and diameters.
4. Learn about distances between sets and properties of subspaces within metric spaces.

Materials Needed:

- Whiteboard and markers
- Projector and slides
- Printed handouts with definitions and examples
- Textbook or online resources for supplementary reading
- Worksheets and practice problems

Day 1-2: Introduction to Metric Spaces (2 hours)

1. **Introduction to Metric Spaces**:
    - Define metric space and explain its significance in mathematics.
    - Present examples of metric spaces such as Euclidean space, discrete metric space, and metric spaces derived from norms.
2. **Basic Definitions**:
    - Define metrics and metric properties (non-negativity, symmetry, triangle inequality).
    - Discuss the concept of open balls and open sets.
3. **Activity**:
    - Work through examples of open balls and open sets in different metric spaces.
4. **Assessment**:
    - Q&A session to check understanding of definitions.
    - Assign exercises related to open balls and open sets for homework.

Day 3-4: Sets and Operations in Metric Spaces (2 hours)

1. **Closed Sets**:
    - Define closed sets and their relationship with open sets.

2. **Interior Points and Interior of a Set**:
    - Introduce interior points and interior of a set.
    - Discuss the characterization of interior points in terms of open sets.
3. **Limit Points and Closure of a Set**:
    - Define limit points and closure of a set.
    - Discuss closure in terms of convergent sequences.
4. **Activity**:
    - Work through examples illustrating the concepts of closed sets, interior points, limit points, and closures.
5. **Assessment**:
    - Problem-solving session on identifying interior points, limit points, and closures.
    - Assign exercises for practice.

Day 5-6: Boundary Points and Bounded Sets (2 hours)

1. **Boundary Points and Boundary of a Set**:
    - Define boundary points and boundary of a set.
    - Discuss the relationship between boundary points, closures, and interiors.
2. **Bounded Sets and Diameter**:
    - Introduce bounded sets and diameter as a measure of size.
    - Discuss properties of bounded sets and diameters.
3. **Activity**:
    - Work through examples involving bounded sets, diameters, and boundary points.
4. **Assessment**:
    - Quiz on the definitions and properties covered.
    - Assign problems for further exploration.

Day 7-8: Advanced Concepts and Applications (2 hours)

1. **Distance Between Two Sets**:
    - Define the distance between two sets and discuss its properties.
2. **Subspace of a Metric Space**:
    - Define subspaces within a metric space and explore their properties.
3. **Applications**:
    - Discuss applications of metric spaces in analysis, topology, and other areas of mathematics.
4. **Activity**:
    - Solve problems related to distances between sets and properties of subspaces.
5. **Assessment**:
    - Group discussion on real-world applications of metric spaces.
    - Assign a project or research assignment on a specific application of metric spaces.

Day 9-10: Review and Evaluation (2 hours)

1. **Review**:
    - Recap key concepts and definitions covered throughout the week.
    - Address any remaining questions or areas of confusion.
2. **Evaluation**:
    - Conduct a comprehensive assessment, such as a test or project presentation, covering all aspects of metric spaces.
3. **Feedback**:
    - Provide feedback on student performance and understanding.
    - Encourage students to reflect on their learning and identify areas for improvement.
4. **Closure**:

- Conclude the lesson with a summary of the importance of metric spaces and their relevance in mathematics.

Additional Materials:

- Online resources for further reading and exploration.
- Supplementary exercises and problems for additional practice.
- Interactive simulations or demonstrations illustrating concepts in metric spaces.

This comprehensive lesson plan aims to provide a thorough understanding of metric spaces while promoting engagement and active learning among undergraduate mathematics students. It incorporates various teaching strategies, including lectures, activities, assessments, and real-world applications, to cater to different learning styles and ensure coherence and depth in learning.

Here's a comprehensive 10-hour lesson plan for undergraduate mathematics students focusing on the specified topics within Metric Spaces:

Lesson Plan: Unit- 1.2: Convergence and Completeness in Metric Spaces

Title	**Metric Spaces**
Subtitle	**Convergence and Completeness in Metric Spaces**
Duration	10 hours
Teacher's Name	DR PAYEL GHOSH (PG)
Date	[Date]

Objectives:

1. Understand the concepts of convergent sequences and Cauchy sequences in metric spaces.
2. Explore the relationship between convergent sequences and Cauchy sequences, including the properties of boundedness and completeness.
3. Introduce Cantor's intersection theorem and its implications for completeness.
4. Discuss the completeness of the real numbers as a metric space compared to the rational numbers.

Materials Needed:

- Whiteboard and markers
- Projector and slides
- Printed handouts with definitions and examples
- Textbook or online resources for supplementary reading
- Worksheets and practice problems

Day 1-2: Convergent Sequences (2 hours)

1. **Introduction to Convergence**:
    - Define convergent sequences in metric spaces.
    - Explain the concept of limit points and convergence criteria.
2. **Cauchy Sequences**:
    - Introduce Cauchy sequences and their significance in metric spaces.
    - Discuss the relationship between convergence and Cauchy sequences.
3. **Activity**:
    - Work through examples of convergent sequences and Cauchy sequences in various metric spaces.
4. **Assessment**:
    - Q&A session to check understanding of convergence and Cauchy sequences.
    - Assign exercises related to identifying convergent and Cauchy sequences.

Day 3-4: Boundedness and Completeness (2 hours)

1. **Bounded Sequences**:
    - Discuss the properties of bounded sequences and their relationship with convergence.
    - Explore examples illustrating bounded and unbounded sequences.
2. **Completeness**:
    - Define completeness in metric spaces and its importance.
    - Discuss the relationship between completeness and convergence.
3. **Activity**:
    - Work through examples demonstrating boundedness, completeness, and convergence.
4. **Assessment**:
    - Problem-solving session on proving boundedness and completeness properties.
    - Assign problems for practice.

Day 5-6: Cantor's Intersection Theorem (2 hours)

1. **Introduction to Cantor's Theorem**:
    - Present Cantor's intersection theorem and its significance in metric spaces.
    - Discuss the conditions under which the theorem applies.
2. **Proof of Cantor's Theorem**:
    - Outline the proof of Cantor's intersection theorem using nested intervals.
3. **Application**:
    - Explore applications of Cantor's theorem in analysis and topology.
4. **Activity**:
    - Work through examples demonstrating the application of Cantor's theorem.

Day 7-8: Completeness of Real and Rational Numbers (2 hours)

1. **Real Numbers as Complete**:
    - Discuss the completeness of the real numbers as a metric space.
    - Explain why every Cauchy sequence in the real numbers converges.
2. **Rational Numbers as Incomplete**:
    - Contrast the completeness of the real numbers with the incompleteness of the rational numbers.
    - Provide examples illustrating the incompleteness of the rational numbers.
3. **Activity**:
    - Work through proofs and examples demonstrating the completeness of the real numbers and the incompleteness of the rational numbers.

Day 9-10: Review and Evaluation (2 hours)

1. **Review**:
    - Recap key concepts and definitions covered throughout the week.
    - Address any remaining questions or areas of confusion.
2. **Evaluation**:
    - Conduct a comprehensive assessment, such as a test or project presentation, covering all aspects of convergence and completeness.
3. **Feedback**:
    - Provide feedback on student performance and understanding.
    - Encourage students to reflect on their learning and identify areas for improvement.
4. **Closure**:
    - Conclude the lesson with a summary of the importance of convergence and completeness in metric spaces.

Additional Materials:

- Online resources for further reading and exploration.
- Supplementary exercises and problems for additional practice.
- Interactive simulations or demonstrations illustrating concepts in convergence and completeness.

This comprehensive lesson plan aims to provide a thorough understanding of convergence and completeness in metric spaces while promoting engagement and active learning among undergraduate mathematics students. It incorporates various teaching strategies, including lectures, activities, assessments, and real-world applications, to cater to different learning styles and ensure coherence and depth in learning.

Here's a detailed 10-hour lesson plan focusing on the topic of Metric Spaces, **covering Continuous Mappings, Uniform Continuity, Compactness, and related theorems:**

Lesson Plan: Metric Spaces - Unit 1.3

Title	**Metric Spaces**
Subtitle	**Continuous Mappings, Uniform Continuity, Compactness, and related theorems**
Duration	10 hours
Teacher's Name	DR PAYEL GHOSH (PG)
Date	[Date]

Objectives:

1. Define continuous mappings and understand the sequential criterion of continuity.
2. Explore the concept of uniform continuity and its significance.
3. Introduce compactness and sequential compactness in metric spaces.
4. Understand the Heine-Borel theorem in $\mathbb{R}$ and its implications.
5. Discuss the finite intersection property and its relationship with compact sets.
6. Explore properties of continuous functions on compact sets.

Materials Needed:

- Whiteboard and markers
- Projector and slides
- Printed handouts with definitions, theorems, and examples
- Textbook or online resources for supplementary reading
- Worksheets and practice problems
- Calculators (optional)

Day 1-2: Introduction to Continuous Mappings (2 hours)

1. **Definition of Continuous Mappings**:
    - Define continuous mappings between metric spaces.
    - Explain the intuitive notion of continuity and its formal definition.
2. **Sequential Criterion of Continuity**:
    - Introduce the sequential criterion of continuity.
    - Discuss its equivalence to the epsilon-delta definition of continuity.
3. **Activity**:
    - Work through examples demonstrating continuous and discontinuous mappings using both definitions.
4. **Assessment**:
    - Q&A session to check understanding of continuity.
    - Assign exercises related to continuity for homework.

Day 3-4: Uniform Continuity (2 hours)

1. **Introduction to Uniform Continuity**:
    - Define uniform continuity and its differences from pointwise continuity.
2. **Properties and Examples**:
    - Discuss properties of uniformly continuous functions.
    - Provide examples illustrating uniform continuity.
3. **Activity**:
    - Work through examples demonstrating uniform continuity and contrast it with pointwise continuity.
4. **Assessment**:
    - Problem-solving session on identifying uniformly continuous functions.
    - Assign exercises for practice.

Day 5-6: Compactness (2 hours)

1. **Definition of Compactness**:

   - Define compact sets in metric spaces.
   - Discuss the notion of "finite subcover" and its importance.
2. **Sequential Compactness**:
   - Introduce sequential compactness and its relationship with compactness.
3. **Activity**:
   - Work through examples demonstrating compact and sequentially compact sets.
4. **Assessment**:
   - Quiz on the definitions and properties of compactness.
   - Assign problems for further exploration.

Day 7-8: Heine-Borel Theorem in R (2 hours)

1. **Statement and Proof**:
   - Present the Heine-Borel theorem in $\mathbb{R}$ and its proof.
   - Discuss the implications of the theorem for compact sets in $\mathbb{R}$.
2. **Applications**:
   - Explore applications of the Heine-Borel theorem in real analysis.
3. **Activity**:
   - Work through examples applying the Heine-Borel theorem to prove compactness.
4. **Assessment**:
   - Problem-solving session on using the Heine-Borel theorem.
   - Assign exercises related to the theorem for homework.

Day 9-10: Continuous Functions on Compact Sets (2 hours)

1. **Continuous Functions on Compact Sets**:
   - Discuss the relationship between continuity and compactness.
   - Introduce the concept of the finite intersection property.
2. **Properties and Examples**:
   - Explore properties of continuous functions on compact sets.
   - Provide examples illustrating these properties.
3. **Activity**:
   - Work through examples demonstrating the behavior of continuous functions on compact sets.
4. **Assessment**:
   - Group discussion on the implications of continuity on compact sets.
   - Assign a project or research assignment on a specific application of compactness.

Additional Materials:

- Online resources for further reading and exploration.
- Supplementary exercises and problems for additional practice.
- Interactive simulations or demonstrations illustrating concepts in compactness.

This lesson plan aims to provide a comprehensive understanding of continuous mappings, uniform continuity, compactness, and related theorems, while promoting engagement and active learning among undergraduate mathematics students. It incorporates various teaching strategies, including lectures, activities, assessments, and real-world applications, to cater to different learning styles and ensure coherence and depth in learning.

Here's a detailed 10-hour lesson plan for undergraduate mathematics students focusing on the concepts of connectedness in metric spaces and the application of contraction mappings and the Banach Fixed Point Theorem to ordinary differential equations:

Lesson Plan: Unit 1.4: Connectedness and Banach Fixed Point Theorem

Title	**Metric Spaces**
Subtitle	**Continuous Mappings, Uniform Continuity, Compactness, and related theorems**
Duration	10 hours
Teacher's Name	DR PAYEL GHOSH (PG)
Date	[Date]

Objectives:

1. Understand the concept of connectedness in metric spaces and its importance.
2. Explore examples of connected metric spaces and connected subsets of the real and complex numbers.
3. Introduce contraction mappings and their properties.
4. Learn the Banach Fixed Point Theorem and its application to solving ordinary differential equations.
5. Apply the theorem to practical problems in mathematics and science.

Materials Needed:

- Whiteboard and markers
- Projector and slides
- Printed handouts with definitions and examples
- Textbook or online resources for supplementary reading
- Worksheets and practice problems
- Examples of ordinary differential equations for application exercises

Day 1-2: Introduction to Connectedness (2 hours)

1. **Introduction to Connectedness**:
    - Define connectedness in metric spaces and discuss its intuitive meaning.
    - Explain the importance of connected spaces in mathematics and real-world applications.
2. **Examples of Connected Metric Spaces**:
    - Present examples of connected metric spaces, such as intervals in the real line and connected subsets of Euclidean spaces.
3. **Connected Subsets of Real and Complex Numbers**:
    - Discuss connected subsets of R and C and their properties.
    - Work through examples illustrating connected and disconnected subsets.
4. **Activity**:
    - Group discussion on the properties of connected subsets and their significance.
    - Work through exercises to identify connected and disconnected subsets in various spaces.

Day 3-4: Contraction Mappings (2 hours)

1. **Introduction to Contraction Mappings**:
   - Define contraction mappings and discuss their properties, including the contraction constant.
2. **Banach Fixed Point Theorem**:
   - Present the statement of the Banach Fixed Point Theorem and its significance.
   - Discuss the conditions under which the theorem applies.
3. **Application to Ordinary Differential Equations**:
   - Explain how contraction mappings and the Banach Fixed Point Theorem can be applied to solving ordinary differential equations.
4. **Activity**:
   - Solve examples of ordinary differential equations using contraction mappings and the Banach Fixed Point Theorem.
   - Work through exercises to reinforce understanding and application.

Day 5-6-7-8: Practical Applications (4 hours)

1. **Application Exercises**:
   - Provide practical exercises involving the application of contraction mappings and the Banach Fixed Point Theorem to various problems in mathematics and science.
   - Examples may include applications in population dynamics, physics, economics, and engineering.
2. **Group Projects**:
   - Assign group projects where students can explore and present real-world applications of contraction mappings and the Banach Fixed Point Theorem.
   - Encourage creativity and critical thinking in applying theoretical concepts to practical problems.

Day 9-10: Review and Evaluation (2 hours)

1. **Review**:
   - Recap key concepts, definitions, and theorems covered throughout the week.
   - Address any remaining questions or areas of confusion.
2. **Evaluation**:
   - Conduct a comprehensive assessment, such as a test or project presentation, covering all aspects of connectedness, contraction mappings, and the Banach Fixed Point Theorem.
   - Assess understanding of both theoretical concepts and their practical applications.
3. **Feedback**:
   - Provide feedback on student performance and understanding.
   - Encourage students to reflect on their learning and identify areas for improvement.
4. **Closure**:
   - Conclude the lesson with a summary of the importance of connectedness and the practical implications of contraction mappings and the Banach Fixed Point Theorem in mathematics and science.

Additional Materials:

- Online resources for further reading and exploration.
- Supplementary exercises and problems for additional practice.
- Real-world data sets or scenarios for application exercises.

This comprehensive lesson plan aims to provide a thorough understanding of connectedness in metric spaces and the application of contraction mappings and the Banach Fixed Point Theorem. It incorporates various teaching strategies, including lectures, activities, group projects, and practical applications, to cater to different learning styles and ensure coherence and depth in learning.

Unit-2 : Complex analysis

Unit-2.1:

Here's a comprehensive 5-hour lesson plan for undergraduate mathematics students focusing on the topic of Stereographic Projection, Regions in the Complex Plane, Limits Involving the Point at Infinity, and Continuity of Functions of a Complex Variable:

Lesson Plan: Stereographic Projection and Complex Analysis

Title	Complex analysis
Subtitle	**Stereographic Projection and Complex Analysis**
Duration	5 hours
Teacher's Name	DR PAYEL GHOSH (PG)
Date	[Date]

Objectives:

1. Understand the concept of stereographic projection and its application in mapping the complex plane to the sphere.
2. Explore regions in the complex plane and their representations under stereographic projection.
3. Learn about limits involving the point at infinity and their significance in complex analysis.
4. Study the continuity of functions of a complex variable and its relation to limits.

Materials Needed:

- Whiteboard and markers
- Projector and slides
- Printed handouts with definitions and examples
- Textbook or online resources for supplementary reading
- Worksheets and practice problems
- Graph paper or software for plotting complex functions

Lesson 1: Introduction to Stereographic Projection (1 hour)

1. **Introduction to Stereographic Projection**:
    - Define stereographic projection and explain its use in mapping the complex plane to the sphere.
2. **Mapping Regions in the Complex Plane**:

- Illustrate how regions in the complex plane are mapped to regions on the sphere under stereographic projection.

3. **Examples**:
    - Work through examples of mapping simple regions, such as circles and lines, onto the sphere.
4. **Activity**:
    - Plotting exercises using graph paper or software to visualize the stereographic projection of complex regions.

Lesson 2-3: Limits and Continuity (2 hours)

1. **Limits Involving the Point at Infinity**:
    - Discuss limits involving the point at infinity in the context of complex analysis.
    - Explain how to evaluate limits of complex functions using stereographic projection.
2. **Continuity of Functions of Complex Variable**:
    - Define continuity of functions of a complex variable and discuss its importance.
    - Introduce the concept of limit points and their relation to continuity.
3. **Examples and Exercises**:
    - Work through examples of evaluating limits involving the point at infinity.
    - Discuss continuity of complex functions and identify continuous and discontinuous points.

Lesson 4-5: Applications and Practice (2 hours)

1. **Application Exercises**:
    - Provide practical exercises involving stereographic projection, limits, and continuity of complex functions.
    - Examples may include finding limits of complex functions at various points, determining regions of continuity, and analyzing discontinuities.
2. **Group Activities**:
    - Assign group activities where students explore real-world applications of stereographic projection and complex analysis.
    - Encourage students to present their findings and discuss the significance of their results.
3. **Problem-Solving Session**:
    - Facilitate a problem-solving session where students can work on challenging problems related to the topics covered.
    - Provide guidance and assistance as needed.

Assessment:

- Formative assessment through class participation and discussions.
- Assignments and quizzes to assess understanding of concepts and techniques.
- Project or presentation on a specific application of stereographic projection and complex analysis.

Additional Materials:

- Online resources for further reading and exploration.
- Supplementary exercises and problems for additional practice.
- Software or applets for interactive visualization of complex functions and their mappings.

This comprehensive lesson plan aims to provide a thorough understanding of stereographic projection, regions in the complex plane, limits involving the point at infinity, and continuity of functions of a complex variable. It incorporates various teaching strategies, including lectures, activities, group work, and problem-solving sessions, to cater to different learning styles and ensure coherence and depth in learning.

Unit-2.2:

Here's a detailed 10-hour lesson plan for undergraduate mathematics students focusing on derivatives, analytic functions, and Mobius transformations in metric spaces:

Lesson Plan: Derivatives, Analytic Functions, and Mobius Transformations

Title	**Complex analysis**
Subtitle	**Derivatives, Analytic Functions, and Mobius Transformations**
Duration	10 hours
Teacher's Name	DR PAYEL GHOSH (PG)
Date	[Date]

Objectives:

1. Understand the concept of derivatives in the context of complex analysis.
2. Learn differentiation formulas and the Cauchy-Riemann equations.
3. Explore sufficient conditions for differentiability and analyticity.
4. Study analytic functions and their properties, including exponential, logarithmic, trigonometric, and hyperbolic functions.
5. Introduce Mobius transformations and their applications.

Materials Needed:

- Whiteboard and markers
- Projector and slides
- Printed handouts with definitions and examples
- Textbook or online resources for supplementary reading
- Worksheets and practice problems
- Complex plane models or visual aids for Mobius transformations

Day 1-2-3-4: Derivatives and Differentiation (4 hours)

1. **Introduction to Derivatives**:
    - Define derivatives in the context of complex analysis and compare them to real derivatives.
    - Discuss the geometric interpretation of derivatives in the complex plane.
2. **Differentiation Formulas**:
    - Present differentiation formulas for complex functions, including power rule, product rule, quotient rule, and chain rule.
3. **Cauchy-Riemann Equations**:
    - Introduce the Cauchy-Riemann equations and explain their importance in determining differentiability.

4. **Sufficient Conditions for Differentiability**:
   - Discuss sufficient conditions for a function to be differentiable, including the existence of partial derivatives and satisfaction of Cauchy-Riemann equations.
5. **Activity**:
   - Work through examples applying differentiation formulas and verifying differentiability using the Cauchy-Riemann equations.
   - Solve practice problems to reinforce understanding.

Day 5-6-7-8: Analytic Functions and Special Functions (4 hours)

1. **Analytic Functions**:
   - Define analytic functions and discuss their properties, including being differentiable everywhere in their domain.
2. **Special Functions**:
   - Introduce exponential, logarithmic, trigonometric, and hyperbolic functions in the complex plane.
   - Discuss their definitions, properties, and graphical representations.
3. **Applications**:
   - Explore applications of analytic functions in physics, engineering, and other fields.
   - Discuss how special functions arise naturally in various mathematical contexts.
4. **Activity**:
   - Work through examples involving analytic functions and special functions.
   - Solve problems applying differentiation and properties of special functions.

Day 9-10: Mobius Transformations (2 hours)

1. **Introduction to Mobius Transformations**:
   - Define Mobius transformations as transformations of the complex plane of the form $f(z)=cz+d/az+b$, where $ad-bc \neq 0$.
   - Discuss the geometric interpretation of Mobius transformations and their properties.
2. **Applications of Mobius Transformations**:
   - Explore applications of Mobius transformations in geometry, computer graphics, and conformal mapping.
3. **Visualization**:
   - Use complex plane models or visual aids to illustrate the effects of Mobius transformations on different regions of the complex plane.
4. **Activity**:
   - Work through examples of Mobius transformations and their applications.
   - Provide opportunities for students to experiment with Mobius transformations and observe their properties.

Additional Materials:

- Online resources for further reading and exploration.
- Interactive software or applets for visualizing complex functions and Mobius transformations.
- Supplementary exercises and problems for additional practice.

This comprehensive lesson plan aims to provide a thorough understanding of derivatives, analytic functions, and Mobius transformations in metric spaces. It incorporates various teaching strategies, including lectures, activities, and applications, to cater to different learning styles and ensure coherence and depth in learning.

Unit-2.3:

Here's a comprehensive 10-hour lesson plan for undergraduate mathematics students focusing on Power Series, Cauchy-Hadamard Theorem, determination of radius of convergence, and related concepts:

Lesson Plan: Power Series and Convergence

Title	Complex analysis
Subtitle	**Power Series and Convergence**
Duration	10 hours
Teacher's Name	DR PAYEL GHOSH (PG)
Date	[Date]

Objectives:

1. Understand the concept of power series and its representation of analytic functions.
2. Learn the Cauchy-Hadamard theorem and its application in determining the radius of convergence of a power series.
3. Explore the concepts of uniform and absolute convergence of power series.
4. Understand the uniqueness of power series representation for analytic functions.

Materials Needed:

- Whiteboard and markers
- Projector and slides
- Printed handouts with definitions and examples
- Textbook or online resources for supplementary reading
- Worksheets and practice problems
- Calculators or computers for numerical calculations

Day 1-2-3-4: Introduction to Power Series (4 hours)

1. **Introduction to Power Series**:
    - Define power series and its representation as an infinite sum of terms involving powers of a variable.
    - Discuss the concept of convergence and divergence of power series.
2. **Radius of Convergence**:
    - Introduce the concept of the radius of convergence and its significance.
    - State and discuss the Cauchy-Hadamard theorem for determining the radius of convergence.
3. **Determining Radius of Convergence**:
    - Work through examples illustrating the application of the Cauchy-Hadamard theorem to find the radius of convergence of power series.
    - Discuss different techniques for finding the radius of convergence, including ratio test and root test.
4. **Activity**:
    - Solve practice problems involving determination of the radius of convergence for various power series.

- Discuss the importance of the radius of convergence in determining the domain of convergence of power series.

Day 5-6-7-8: Convergence of Power Series (4 hours)

1. **Uniform and Absolute Convergence**:
   - Define uniform and absolute convergence of power series.
   - Discuss the relationships between uniform convergence, absolute convergence, and pointwise convergence.
2. **Analytic Functions and Power Series**:
   - Explain how power series can represent analytic functions within their radius of convergence.
   - Discuss the concept of analytic continuation and its relevance to power series representation.
3. **Uniqueness of Power Series**:
   - Present the theorem stating the uniqueness of power series representation for analytic functions.
   - Discuss the conditions under which two power series can represent the same analytic function.
4. **Activity**:
   - Work through examples illustrating uniform and absolute convergence of power series.
   - Explore applications of power series representation in approximating functions and solving differential equations.

Day 9-10: Review and Evaluation (2 hours)

1. **Review**:
   - Recap key concepts, definitions, and theorems covered throughout the week.
   - Address any remaining questions or areas of confusion.
2. **Evaluation**:
   - Conduct a comprehensive assessment, such as a test or problem-solving session, covering all aspects of power series and convergence.
   - Assess understanding of theoretical concepts and their practical applications.
3. **Feedback**:
   - Provide feedback on student performance and understanding.
   - Encourage students to reflect on their learning and identify areas for improvement.
4. **Closure**:
   - Conclude the lesson with a summary of the key takeaways from the unit on power series and convergence.
   - Emphasize the importance of these concepts in various areas of mathematics and their applications in real-world problems.

Additional Materials:

- Online resources for further reading and exploration.
- Supplementary exercises and problems for additional practice.
- Software or programming tools for numerical analysis and visualization of power series.

This comprehensive lesson plan aims to provide a thorough understanding of power series, convergence, and related concepts, including the Cauchy-Hadamard theorem and the representation of analytic functions. It incorporates various teaching strategies, including lectures, examples, activities, and assessments, to cater to different learning styles and ensure coherence and depth in learning.

Unit-2.4:

Here's a detailed 10-hour lesson plan for undergraduate mathematics students focusing on the topic of Contours, Complex Integration along a Contour, and related theorems:

Lesson Plan: Contours and Complex Integration

Title	**Complex analysis**
Subtitle	**Contours and Complex Integration**
Duration	10 hours
Teacher's Name	DR PAYEL GHOSH (PG)
Date	[Date]

Objectives:

1. Understand the concept of contours and their significance in complex analysis.
2. Learn how to perform complex integration along a contour.
3. Explore examples of contour integrals and upper bounds for their moduli.
4. Introduce the Cauchy-Goursat theorem (statement only) and its consequences.
5. Learn the Cauchy integral formula and its applications.

Materials Needed:

- Whiteboard and markers
- Projector and slides
- Printed handouts with definitions and examples
- Textbook or online resources for supplementary reading
- Worksheets and practice problems
- Examples of contour integrals for application exercises

Day 1-2: Introduction to Contours (2 hours)

1. **Introduction to Contours**:
    - Define contours in the complex plane and discuss their geometric interpretations.
    - Explain the significance of contours in complex analysis and their role in complex integration.
2. **Complex Integration along a Contour**:
    - Introduce the concept of complex integration along a contour and the notation used.
    - Discuss the linearity and properties of contour integrals.
3. **Activity**:
    - Work through examples of simple contour integrals to illustrate the concept.
    - Practice evaluating contour integrals using basic techniques.

Day 3-4: Upper Bounds for Contour Integrals (2 hours)

1. **Upper Bounds for Moduli of Contour Integrals**:

- Explain techniques for estimating the modulus of contour integrals.
- Discuss the Cauchy-Schwarz inequality and its application to contour integrals.

2. **Examples and Applications**:
   - Work through examples of contour integrals with known upper bounds for their moduli.
   - Discuss the implications of upper bounds in evaluating complex integrals.
3. **Activity**:
   - Solve problems involving the estimation of contour integrals and their moduli.
   - Explore applications of upper bounds in evaluating complex integrals.

Day 5-6-7-8: Cauchy-Goursat Theorem and Cauchy Integral Formula (4 hours)

1. **Cauchy-Goursat Theorem (Statement Only)**:
   - Introduce the Cauchy-Goursat theorem and its significance in complex analysis.
   - State the theorem and discuss its assumptions and consequences.
2. **Cauchy Integral Formula**:
   - Present the Cauchy integral formula for analytic functions and its derivation.
   - Discuss the implications of the formula for contour integrals.
3. **Examples and Applications**:
   - Work through examples illustrating the application of the Cauchy integral formula to evaluate contour integrals.
   - Discuss the connection between analyticity and contour integration.

Day 9-10: Review and Evaluation (2 hours)

1. **Review**:
   - Recap key concepts, definitions, and theorems covered throughout the week.
   - Address any remaining questions or areas of confusion.
2. **Evaluation**:
   - Conduct a comprehensive assessment, such as a test or problem-solving session, covering all aspects of contour integration, upper bounds, and related theorems.
   - Assess understanding of both theoretical concepts and their practical applications.
3. **Feedback**:
   - Provide feedback on student performance and understanding.
   - Encourage students to reflect on their learning and identify areas for improvement.
4. **Closure**:
   - Conclude the lesson with a summary of the key concepts learned and their relevance in complex analysis.

Additional Materials:

- Online resources for further reading and exploration.
- Supplementary exercises and problems for additional practice.
- Complex functions and contour plots for visualization.

This comprehensive lesson plan aims to provide a thorough understanding of contours, complex integration, and related theorems in complex analysis. It incorporates various teaching strategies, including lectures, activities, examples, and applications, to cater to different learning styles and ensure coherence and depth in learning.

Numerical Methods

Semester : 6 Credits : 4

Core Course-14 Full Marks : 50+20**=70

Paper Code(Theory): MTM-A-CC-6-14-TH

Unit-1:

Title	Numerical Methods
Subtitle	Fundamental of Numerical Method
Duration	5 hours
Teacher's Name	UTTAM ROY MANDAL(URM)
Date	[Date]

Here's a comprehensive 5-hour lesson plan in tabular format for undergraduate mathematics students focusing on Numerical Methods:

Time	Topic	Objectives	Instructional Activities	Assessment	Materials Needed
1 hour	Representation of Real Numbers	- Understand how real numbers are represented in computers	- Lecture on the representation of real numbers	Q&A session to check understanding	Whiteboard and markers
					Projector and slides
					Printed handouts
					Examples of floating point numbers
					Examples of fixed point numbers
					Computer for demonstrations
1 hour	Sources of Errors, Rounding of Numbers, Significant Digits	- Understand sources of errors in numerical computations	- Discuss sources of errors in numerical computations	Formative assessment through class participation	Whiteboard and markers

Time	Topic	Objectives	Instructional Activities	Assessment	Materials Needed
		- Learn about rounding of numbers and significant digits	- Explain rounding of numbers and significant digits		Projector and slides
		- Understand error propagation in machine arithmetic operations	- Work through examples illustrating error propagation in arithmetic operations		Printed handouts
			- Engage students in discussions on practical examples of errors and their impact		Examples of numerical algorithms
1 hour	Numerical Algorithms - Stability and Convergence	- Understand the concepts of stability and convergence in numerical algorithms	- Define stability and convergence in numerical algorithms	Summative assessment through problem-solving exercises	Whiteboard and markers
			- Discuss the importance of stability and convergence for numerical methods		Projector and slides
			- Work through examples of stable and unstable algorithms		Printed handouts
					Examples of numerical algorithms
					Computer for demonstrations
1 hour	Application and Practice	- Apply concepts learned in solving numerical problems	- Provide practice problems related to representation of real numbers, error analysis, and algorithms	Formative assessment through problem-solving exercises	Printed handouts
		- Reinforce understanding through practical exercises	- Encourage students to work individually or in groups on the provided problems		Examples of numerical problems
			- Monitor and provide assistance as needed		Computer for simulations
					Whiteboard and markers
					Projector and slides

This lesson plan provides a structured approach to teaching Numerical Methods, covering topics such as representation of real numbers, sources of errors, numerical algorithms, stability, and convergence. It includes a variety of instructional activities to engage students, such as lectures, discussions, problem-solving exercises, and practical applications. Assessment methods include formative assessments through class participation and summative assessments through problem-solving exercises. The materials needed include whiteboards and markers, projectors and slides, printed handouts, examples of numerical algorithms, examples of numerical problems, and a computer for demonstrations and simulations.

Unit-2:

Title	**Numerical Methods**
Subtitle	Aproximation, Interpolation, Central Interpolation
Duration	15 hours
Teacher's Name	UTTAM ROY MANDAL(URM)
Date	[Date]

Here's a comprehensive 15-hour lesson plan for undergraduate mathematics students focusing on Numerical Methods:

Time Slot	Topic	Objectives	Instructional Activities	Assessment
Hour 1	Introduction to Approximation	- Define approximation and its significance	- Lecture on approximation concepts and classes of approximating functions	Q&A session to check understanding
Hour 2	Polynomial Approximation	- Understand polynomial approximation	- Introduce polynomial approximation techniques	Problem-solving exercises
Hour 3	Weierstrass Polynomial Approximation	- Understand the statement of the Weierstrass polynomial approximation theorem	- Present the Weierstrass polynomial approximation theorem	Quiz on the theorem
Hour 4	Introduction to Interpolation	- Define interpolation and its importance	- Lecture on interpolation methods, focusing on Lagrange and Newton's methods	Discussion on advantages and limitations of interpolation methods
Hour 5	Lagrange Interpolation	- Understand Lagrange interpolation	- Explain Lagrange interpolation formula and demonstrate its application	Problem-solving exercises
Hour 6	Newton's Interpolation	- Understand Newton's interpolation	- Introduce Newton's interpolation formula and demonstrate its application	Problem-solving exercises
Hour	Error Bounds in	- Understand error	- Discuss error bounds in	Problem-solving

Time Slot	Topic	Objectives	Instructional Activities	Assessment
7	Interpolation	bounds in interpolation	interpolation methods and techniques for estimating errors	exercises
Hour 8	Finite Difference Operators	- Understand finite difference operators	- Lecture on finite difference operators and their applications in numerical methods	Problem-solving exercises
Hour 9	Newton (Gregory) Forward Interpolation	- Understand Newton (Gregory) forward interpolation	- Present Newton forward interpolation formula and demonstrate its application	Problem-solving exercises
Hour 10	Newton (Gregory) Backward Interpolation	- Understand Newton (Gregory) backward interpolation	- Present Newton backward interpolation formula and demonstrate its application	Problem-solving exercises
Hour 11	Central Interpolation	- Understand central interpolation techniques	- Lecture on Stirling's and Bessel's formulas for central interpolation and discuss different interpolation zones	Problem-solving exercises
Hour 12	Error Estimation in Central Interpolation	- Understand error estimation in central interpolation	- Discuss techniques for error estimation in central interpolation methods	Problem-solving exercises
Hour 13	Hermite Interpolation	- Understand Hermite interpolation	- Introduce Hermite interpolation and demonstrate its application in numerical methods	Problem-solving exercises
Hour 14	Application Exercises	- Apply approximation and interpolation techniques to solve practical problems	- Assign application exercises and projects involving approximation and interpolation methods	Evaluation of application exercises
Hour 15	Review and Evaluation	- Review key concepts and techniques covered throughout the lesson plan	- Conduct a comprehensive assessment, such as a test or problem-solving session, covering all aspects of numerical methods	Feedback on student performance and understanding

Materials Needed:

- Whiteboard and markers
- Projector and slides
- Printed handouts with definitions and examples
- Textbook or online resources for supplementary reading
- Worksheets and practice problems
- Computational software for numerical calculations and visualization (e.g., MATLAB, Python with NumPy)

This comprehensive lesson plan aims to provide a thorough understanding of approximation and interpolation techniques in numerical methods. It incorporates various teaching strategies, including lectures, demonstrations, problem-solving exercises, and application exercises, to cater to different learning styles and ensure coherence and depth in learning.

Unit-3

Title	Numerical Methods
Subtitle	Numerical Differentiation and Numerical Integration
Duration	10 hours
Teacher's Name	UTTAM ROY MANDAL(URM)
Date	[Date]

Here's a tabular plan for a comprehensive 10-hour lesson focusing on Numerical Methods for undergraduate mathematics students:

Lesson	Objectives	Instructional Activities	Assessment Methods	Materials Needed
Numerical Differentiation 3 hours	1. Understand methods based on interpolations for numerical differentiation. 2. Learn methods based on finite differences for numerical differentiation.	1. Introduction to numerical differentiation methods based on interpolations. Discuss concepts and principles. 2. Explain numerical differentiation methods based on finite differences, including forward, backward, and central differences. 3. Work through examples illustrating each method. 4. Practice exercises individually or in groups.	- Q&A session to check understanding. - Assign homework problems for assessment.	Whiteboard, markers, projector, printed handouts
Numerical Integration: Newton-Cotes Formulas 3 hours	1. Understand Newton-Cotes formulas for numerical integration. 2. Learn the Trapezoidal rule. 3. Learn Simpson's 1/3rd rule. 4. Learn Simpson's 3/8th rule.	1. Introduction to Newton-Cotes formulas and their significance. 2. Explain the Trapezoidal rule and its derivation. 3. Discuss Simpson's 1/3rd rule and Simpson's 3/8th rule. 4. Work through examples illustrating the application of each rule.	- Problem-solving session on examples. - Assign practice problems for assessment.	Whiteboard, markers, projector, printed handouts, examples of integration problems
Numerical Integration: Advanced	1. Learn advanced numerical integration methods: Weddle's rule,	1. Explain advanced integration methods: Weddle's rule, Boole's rule,	- Group activity to solve integration problems. -	Whiteboard, markers, projector,

Lesson	Objectives	Instructional Activities	Assessment Methods	Materials Needed
Methods 3 hours	Boole's rule, midpoint rule. 2. Understand composite integration methods: composite Trapezoidal rule, composite Simpson's 1/3rd rule, composite Weddle's rule. 3. Learn Gaussian quadrature formula.	and midpoint rule. 2. Discuss composite integration methods and their advantages. 3. Present Gaussian quadrature formula and its application. 4. Work through examples illustrating each method.	Assessment through quizzes on methods and their applications.	printed handouts, examples of integration problems
Review and Applications 1 hour	1. Review key concepts and methods covered in numerical differentiation and integration. 2. Explore practical applications of numerical methods in real-world problems.	1. Recap key concepts and methods through a review session. 2. Discuss real-world applications of numerical methods in various fields such as physics, engineering, and finance. 3. Work on application exercises individually or in groups.	- Problem-solving session on application exercises. - Peer evaluation of solutions.	Whiteboard, markers, projector, printed handouts, real-world application examples

This plan offers a structured approach to teaching Numerical Methods, covering both differentiation and integration techniques. It includes clear objectives, instructional activities, assessment methods, and materials needed to facilitate student learning effectively. Through a combination of lectures, examples, practice exercises, and real-world applications, students will gain a comprehensive understanding of the topic while engaging with diverse teaching strategies to accommodate different learning styles.

Unit-4:

Here's a tabular plan for a comprehensive 10-hour lesson on Numerical Methods focusing on Transcendental and Polynomial Equations, as well as the Numerical Solution of Systems of Nonlinear Equations:

Lesson Plan: Numerical Methods			
Unit: Transcendental and Polynomial Equations			
Duration: 10 hours		Teacher:UTTAM ROY MANDAL(URM)	
Objectives	**Instructional Activities**	**Assessment Methods**	**Materials Needed**
1. Introduction to Numerical Methods for Equations			
- Understand the need for numerical methods in solving equations	- Lecture on the importance of numerical methods in solving transcendental and polynomial equations.	- Q&A session to check understanding.	Whiteboard, markers
2. Bisection Method			
- Understand the concept of	- Explain the bisection method	- Problem-solving session	Textbook,

Objectives	Instructional Activities	Assessment Methods	Materials Needed
the bisection method and its convergence properties	algorithm and its application through examples.	with exercises on bisection method problems.	handouts
3. Secant Method			
- Learn the concept and application of the secant method	- Present the secant method algorithm and compare it with the bisection method.	- Group activity: solve problems using the secant method.	Projector, slides
4. Regula-Falsi Method			
- Introduce the regula-falsi method and its advantages over the bisection method	- Discuss the regula-falsi method algorithm and its convergence properties.	- Class discussion on the merits and limitations of the regula-falsi method.	Handouts, calculator
5. Fixed-Point Iteration			
- Understand the fixed-point iteration method and its application	- Explain the fixed-point iteration algorithm and its connection to finding roots.	- Peer evaluation: solve problems using fixed-point iteration and provide feedback.	Whiteboard, markers
6. Newton-Raphson Method			
- Learn about the Newton-Raphson method and its superior convergence properties	- Derive the Newton-Raphson method algorithm and discuss its convergence criteria.	- Individual assessment: solve problems using Newton-Raphson method.	Textbook, calculator
7. Modified Newton-Raphson Method for Multiple Roots			
- Understand the limitations of Newton-Raphson for multiple roots and learn the modified method	- Explain the modified Newton-Raphson method algorithm and its advantages.	- Problem-solving session with examples of multiple roots.	Projector, slides
8. Complex Roots of Algebraic Equations			
- Learn how to apply Newton-Raphson method for complex roots	- Discuss the approach to finding complex roots using Newton-Raphson method.	- Assessment: solve problems involving complex roots.	Handouts, calculator
9. Numerical Solution of Systems of Nonlinear Equations			
- Understand the extension of numerical methods to systems of equations	- Present the Newton's method for systems of nonlinear equations and its algorithm.	- Group activity: solve systems of nonlinear equations using Newton's method.	Whiteboard, markers
10. Convergence Analysis			
- Understand the conditions, order, and rate of convergence of numerical methods	- Lecture on convergence analysis, discussing conditions, order, and rate of convergence of the methods covered.	- Quiz on convergence properties and analysis.	Textbook, handouts

This structured lesson plan covers a range of numerical methods for solving transcendental and polynomial equations, as well as systems of nonlinear equations. It incorporates various instructional activities and assessment methods to promote engagement and understanding among undergraduate mathematics students.

Unit-5

Here's a comprehensive 10-hour lesson plan for undergraduate mathematics students focusing on the topic of Numerical Methods: **System of Linear Algebraic Equations**:

Teacher:UTTAM ROY MANDAL(URM)

Lesson Title	**Objectives**	**Instructional Activities**	**Assessment**	**Materials Needed**
Introduction to Linear Algebraic Equations 1hour	- Understand the concept of linear algebraic equations. - Recognize the importance of numerical methods for solving such equations.	- Overview of linear algebraic equations and their significance. - Discuss the limitations of analytical methods for solving large systems. - Introduce the need for numerical methods.	- Q&A session to gauge understanding. - Assign a small exercise on identifying linear algebraic equations in real-world scenarios.	Whiteboard, markers, projector.
Direct Methods: Gaussian Elimination and Gauss-Jordan Methods 2 hours	- Understand the concepts and algorithms of Gaussian elimination and Gauss-Jordan methods. - Learn pivoting strategies to avoid numerical instability.	- Explain the step-by-step procedure of Gaussian elimination and Gauss-Jordan methods. - Discuss the need for pivoting and different strategies. - Work through examples demonstrating the application of each method.	- Solve practice problems on Gaussian elimination and Gauss-Jordan methods. - Evaluate student performance during the activity.	Whiteboard, markers, printed handouts.
Iterative Methods: Gauss-Jacobi and Gauss-Seidel Methods 2 hours	- Understand the iterative nature of Gauss-Jacobi and Gauss-Seidel methods. - Analyze the convergence properties of these methods.	- Introduce the iterative process of Gauss-Jacobi and Gauss-Seidel methods. - Discuss the convergence criteria and analysis for each method. - Work through examples illustrating the iterative process and convergence analysis.	- Conduct a discussion on the convergence properties of iterative methods. - Assign practice problems for further reinforcement.	Whiteboard, markers, projector.
LU Decomposition Method (Crout's LU Decomposition) 2 hours	- Learn the LU decomposition method and its algorithm. - Understand Crout's method for LU decomposition.	- Explain the concept of LU decomposition and its significance. - Present the algorithm for Crout's LU decomposition method. - Work through examples demonstrating the decomposition process.	- Assess student understanding through problem-solving exercises. - Evaluate the accuracy of LU decomposition solutions.	Whiteboard, markers, printed handouts.

Lesson Title	Objectives	Instructional Activities	Assessment	Materials Needed
Matrix Inversion: Gaussian Elimination and LU Decomposition 2 hours	- Understand the techniques for matrix inversion using Gaussian elimination and LU decomposition. - Learn the operational counts involved in each method.	- Discuss the procedure for matrix inversion using Gaussian elimination and LU decomposition. - Present the computational complexity analysis for both methods. - Work through examples illustrating the matrix inversion process.	- Assess student proficiency through problem-solving exercises on matrix inversion. - Evaluate the computational efficiency of each method.	Whiteboard, markers, printed handouts.
Algebraic Eigenvalue Problem: Power Method 1 hour	- Learn the power method for computing dominant eigenvalues. - Understand its applications and limitations.	- Introduce the power method algorithm for computing dominant eigenvalues. - Discuss the convergence criteria and limitations of the power method. - Work through examples demonstrating the application of the power method.	- Assess student understanding through problem-solving exercises on eigenvalue computation. - Evaluate the accuracy and efficiency of the power method solutions.	Whiteboard, markers, printed handouts.

This lesson plan provides a structured approach to cover various aspects of numerical methods for solving systems of linear algebraic equations, including both direct and iterative methods, LU decomposition, matrix inversion, and the power method for eigenvalue computation. It incorporates a mix of lectures, discussions, examples, and problem-solving exercises to cater to different learning styles and ensure depth of understanding.

Unit-6

Here's a comprehensive 5-hour lesson plan in tabular format for undergraduate mathematics students focusing on numerical methods for **ordinary differential equations**:

Teacher:UTTAM ROY MANDAL(URM)

Time	Topic	Objectives	Instructional Activities	Assessment
0:00 - 1:00	Introduction to Numerical Methods for ODEs	- Understand the importance of numerical methods in solving ODEs - Introduce single-step difference equation methods - Discuss the concept of error and convergence	- Lecture on the significance of numerical methods in ODEs - Explain single-step difference equation methods and error analysis - Present examples illustrating convergence	Q&A session to assess understanding Homework assignment on error analysis
1:00 - 2:00	Method of Successive Approximations (Picard)	- Learn the concept of successive approximations for solving ODEs - Understand the iterative	- Explain the method of successive approximations using Picard's method - Derive the iterative formula for Picard's method -	Problem-solving session on Picard's method Mini-quiz on the iterative process

Time	Topic	Objectives	Instructional Activities	Assessment
		process of Picard's method	Work through examples demonstrating the application of Picard's method	
2:00 - 3:00	Euler's Method	- Understand the basics of Euler's method - Learn the iterative process for approximating solutions of ODEs using Euler's method	- Introduce Euler's method and its derivation - Discuss the limitations and stability issues of Euler's method - Work through examples applying Euler's method to simple ODEs	Group activity: Implement Euler's method in MATLAB/Python and compare results
3:00 - 4:00	Modified Euler Method and Runge-Kutta Methods	- Introduce improved methods for approximating solutions of ODEs - Understand the principles behind the Modified Euler method and Runge-Kutta methods	- Explain the Modified Euler method and its advantages over Euler's method - Introduce the concepts of Runge-Kutta methods of orders two and four - Work through examples applying these methods to ODEs	Peer evaluation: Compare the accuracy and efficiency of Euler's method, Modified Euler method, and Runge-Kutta methods
4:00 - 5:00	Error Analysis and Conclusion	- Review error analysis and convergence of numerical methods - Summarize the key concepts covered in the lesson	- Recap error analysis techniques for numerical methods - Discuss the importance of choosing appropriate step sizes and methods for different ODEs - Conclude the lesson with a summary of the methods discussed and their applications	Quiz on error analysis techniques Feedback session on the lesson and learning experience

Materials Needed:

- Lecture slides or whiteboard and markers
- Textbooks or handouts with theoretical concepts and examples
- Computational software such as MATLAB or Python for numerical simulations
- Worksheets or practice problems for hands-on activities and assessments

This lesson plan provides a structured approach to teaching numerical methods for ordinary differential equations, covering theoretical concepts, practical applications, and hands-on activities to enhance understanding and engagement among undergraduate mathematics students.

Numerical Methods Lab

Semester : 6 Credits : 2

Core Course-14 Practical Full Marks : 30

Paper Code(Practical): MTM-A-CC-6-14-P

Practical-1 &2

Here's a comprehensive 4-hour lesson plan for undergraduate mathematics students focusing on Numerical Methods Lab practicals using C:

Teacher:UTTAM ROY MANDAL(URM)

Time	**Activity**	**Objective**	**Assessment**	**Materials Needed**
0:00 - 0:30	Introduction to Numerical Methods Lab	- Understand the importance of numerical methods	- Q&A session to check understanding	Whiteboard, markers
		in solving mathematical problems.		
0:30 - 1:00	Explanation of Practical 1	- Understand the problem statement and approach	- Problem-solving session	Projector, slides
	Calculate the sum 1/1+ 1/2+ 1/3+ · · · + 1/N	to solve it.		
1:00 - 2:00	Practical Session 1	- Implement the algorithm in C language.	- Observation of code implementation	Computers, C compiler
2:00 - 2:30	Break	- Relax and refresh before the next session.	- Observation of engagement	Snacks, drinks
2:30 - 3:00	Explanation of Practical 2	- Understand the problem statement and approach	- Problem-solving session	Projector, slides
	Enter 100 integers into an array and sort them	to solve it.		
	in an ascending order.			
3:00 - 4:00	Practical Session 2	- Implement the sorting algorithm in C language.	- Observation of code implementation	Computers, C compiler

Objectives:

1. To introduce students to the importance of numerical methods in solving mathematical problems.
2. To provide hands-on experience in implementing algorithms using C language.
3. To enhance problem-solving skills through practical applications of numerical methods.
4. To reinforce the understanding of concepts such as sorting algorithms.

Instructional Activities:

- Introduction to Numerical Methods Lab.
- Explanation of practical problem statements.
- Practical sessions for implementing algorithms.
- Break for relaxation and refreshment.

Assessment Methods:

- Q&A session to check understanding of numerical methods.
- Observation of code implementation during practical sessions.
- Problem-solving sessions to assess comprehension and coding skills.

Materials Needed:

- Whiteboard and markers for introductory session.
- Projector and slides for explaining practical problem statements.
- Computers with C compiler for practical coding sessions.
- Snacks and drinks for the break.

This lesson plan aims to engage undergraduate mathematics students in hands-on learning experiences with numerical methods using C programming. Through practical sessions and problem-solving activities, students will gain a deeper understanding of the concepts and enhance their coding skills.

Practical 3:

Solution of transcendental and algebraic equations by
i) Bisection method
ii) Newton Raphson method (Simple root, multiple roots, complex roots).
iii) Secant method.
iv) Regula Falsi method.

Here's a comprehensive 6-hour lesson plan in tabular form for undergraduate mathematics students focusing on Numerical Methods Lab:

Teacher:UTTAM ROY MANDAL(URM)

Time	**Topic**	**Objectives**	**Instructional Activities**	**Assessment Methods**	**Materials Needed**
1 hr	Introduction to Numerical Methods	- Understand the importance of numerical methods in solving mathematical problems	- Lecture on the significance of numerical methods	Q&A session	Whiteboard, markers
		- Introduce the concept of solving equations numerically using iterative methods			
1 hr	Bisection Method	- Learn the bisection method for finding roots of equations	- Explanation of the bisection method	Problem-solving exercises	Computers with C compiler, IDE

Time	Topic	Objectives	Instructional Activities	Assessment Methods	Materials Needed
		- Understand the algorithm and its convergence properties	- Work through examples of solving equations using the bisection method	Instructor observation	
		- Practice implementing the method in C			
1 hr	Newton-Raphson Method	- Understand the Newton-Raphson method for finding roots of equations	- Lecture on the Newton-Raphson method and its derivation	Problem-solving exercises	Computers with C compiler, IDE
		- Learn how to handle simple roots, multiple roots, and complex roots	- Work through examples of solving equations using the Newton-Raphson method	Instructor observation	
		- Implement the method in C			
1 hr	Secant Method	- Learn the secant method for finding roots of equations	- Explanation of the secant method and comparison with the bisection and Newton-Raphson methods	Problem-solving exercises	Computers with C compiler, IDE
		- Understand the algorithm and its convergence properties	- Work through examples of solving equations using the secant method	Instructor observation	
		- Practice implementing the method in C			
1 hr	Regula Falsi Method	- Learn the regula falsi method for finding roots of equations	- Explanation of the regula falsi method and comparison with other methods	Problem-solving exercises	Computers with C compiler, IDE
		- Understand the algorithm and its convergence properties	- Work through examples of solving equations using the regula falsi method	Instructor observation	
		- Implement the method in C			
1 hr	Practical Implementation	- Apply the learned methods to solve a variety of transcendental and algebraic equations	- Provide a set of equations for students to solve using the methods learned	Evaluation of solutions	Computers with C compiler, IDE, Equations
		- Debug and refine implementations as needed			

Time	Topic	Objectives	Instructional Activities	Assessment Methods	Materials Needed
		- Discuss challenges and strategies for improving numerical solutions			

This lesson plan provides a structured approach for teaching undergraduate mathematics students various numerical methods for solving transcendental and algebraic equations using C programming language. It incorporates clear objectives, instructional activities, assessment methods, and materials needed for effective learning. The plan aims to promote engagement and understanding among students while emphasizing practical application and conceptual understanding of the chosen topic.

Practical 4:
Solution of system of linear equations
i) LU decomposition method
ii) Gaussian elimination method
iii) Gauss-Jacobi method
iv) Gauss-Seidel method

Here's a comprehensive 8-hour lesson plan in tabular format for undergraduate mathematics students focusing on numerical methods using C:

Teacher:UTTAM ROY MANDAL(URM)

Time	Activity	Objective	Materials Needed	Assessment Methods
1 hour	Introduction to Numerical Methods and C Programming	- Introduce the importance of numerical methods in solving mathematical problems	Whiteboard, markers	Class participation, Q&A session
		- Provide an overview of the C programming language and its application in numerical methods	Projector, slides	
		- Discuss the significance of solving systems of linear equations using numerical methods		
2 hours	Solving Linear Systems using LU Decomposition Method	- Understand the LU decomposition method for solving systems of linear equations	Computers with C compiler	Observation of code implementation
		- Implement LU decomposition algorithm in C	Textbooks or online resources	Assessment of code correctness and efficiency
		- Discuss the advantages and limitations of LU decomposition method		
2 hours	Solving Linear Systems using Gaussian Elimination	- Understand the Gaussian elimination method for solving systems of linear equations	Computers with C compiler	Observation of code implementation

Time	Activity	Objective	Materials Needed	Assessment Methods
	Method	- Implement Gaussian elimination algorithm in C	Textbooks or online resources	Assessment of code correctness and efficiency
		- Compare the performance of LU decomposition and Gaussian elimination methods		
2 hours	Solving Linear Systems using Gauss-Jacobi Method	- Understand the Gauss-Jacobi method for solving systems of linear equations	Computers with C compiler	Observation of code implementation
		- Implement Gauss-Jacobi algorithm in C	Textbooks or online resources	Assessment of code correctness and efficiency
		- Discuss the convergence criteria and convergence rate of the Gauss-Jacobi method		
2 hours	Solving Linear Systems using Gauss-Seidel Method	- Understand the Gauss-Seidel method for solving systems of linear equations	Computers with C compiler	Observation of code implementation
		- Implement Gauss-Seidel algorithm in C	Textbooks or online resources	Assessment of code correctness and efficiency
		- Discuss the advantages and limitations of Gauss-Seidel method		

This lesson plan provides a structured approach to teaching numerical methods for solving systems of linear equations using C programming. It includes clear objectives, instructional activities, assessment methods, and materials needed for each segment of the lesson. The plan aims to engage students through hands-on coding exercises, discussions, and comparisons of different numerical methods while promoting a deeper understanding of the underlying mathematical concepts.

Practical-5. Interpolation
i) Lagrange Interpolation
ii) Newton’s forward, backward and divided difference interpolations

Below is a tabular plan for a 4-hour Numerical Methods Lab session focusing on **Interpolation** using C programming:

Teacher:UTTAM ROY MANDAL(URM)

Time	Activity	Objectives	Materials Needed	Assessment Methods
0:00 - 0:30	Introduction to Interpolation	- Understand the concept of interpolation	Whiteboard, markers	Q&A session to gauge understanding
		- Learn about the importance of		

Time	Activity	Objectives	Materials Needed	Assessment Methods
		interpolation in numerical methods		
		- Introduce the types of interpolation methods (Lagrange, Newton's forward, backward, and divided difference)		
0:30 - 1:00	Coding Session: Lagrange Interpolation	- Implement the Lagrange interpolation algorithm in C	Computers with C compilers	Review of code and functionality
		- Understand the algorithmic steps involved in Lagrange interpolation		
		- Discuss the complexity and limitations of Lagrange interpolation		
1:00 - 1:30	Coding Session: Newton's Forward and Backward Interpolations	- Implement Newton's forward and backward interpolation algorithms in C	Computers with C compilers	Review of code and functionality
		- Compare and contrast Newton's forward and backward interpolations		
		- Discuss the advantages and disadvantages of these methods		
1:30 - 2:00	Break	- Allow students to rest and recharge		
2:00 - 2:30	Coding Session: Newton's Divided Difference Interpolation	- Implement Newton's divided difference interpolation algorithm in C	Computers with C compilers	Review of code and functionality
		- Understand the concept of divided differences and its application in interpolation		
		- Discuss the computational efficiency of Newton's divided difference interpolation		
2:30 - 3:00	Practical Application Exercise	- Provide students with datasets and ask them to apply interpolation methods to approximate missing data points	Datasets	Evaluation of results and accuracy
		- Encourage students to analyze and compare the performance of different interpolation methods		
3:00 - 3:30	Discussion and Conclusion	- Facilitate a discussion on the practical applications of interpolation methods in real-world scenarios	Whiteboard, markers	Participation and contribution to discussion assessed
		- Summarize key concepts learned during the lab session		

Time	Activity	Objectives	Materials Needed	Assessment Methods
		- Provide guidance on further exploration and practice with interpolation techniques		

Objectives:

1. Understand the concept and importance of interpolation.
2. Learn about different interpolation methods, including Lagrange and Newton's methods.
3. Gain practical experience in implementing interpolation algorithms using C programming.
4. Apply interpolation methods to real-world datasets and evaluate their performance.

Instructional Activities:

- Introduction to interpolation and different interpolation methods.
- Coding sessions to implement Lagrange, Newton's forward, backward, and divided difference interpolations in C.
- Practical application exercise where students apply interpolation methods to real-world datasets.
- Discussion on the practical applications and limitations of interpolation methods.

Assessment Methods:

- Q&A sessions to gauge understanding of concepts.
- Review of code and functionality during coding sessions.
- Evaluation of results and accuracy in the practical application exercise.
- Assessment of participation and contribution to discussions.

Materials Needed:

- Whiteboard and markers for explanations and discussions.
- Computers with C compilers for coding sessions.
- Datasets for practical application exercise.

This comprehensive lab session aims to provide students with both theoretical knowledge and practical experience in interpolation techniques using C programming. It emphasizes hands-on learning, critical thinking, and analysis of results to ensure a deeper understanding of the topic.

Practical 6. Numerical Integration
i) Trapezoidal Rule
ii) Simpson’s one third rule
iii) Weddle’s Rule
iv) Gauss Quadrature

Here's a tabular plan for an 8-hour Numerical Methods Lab focusing on Numerical Integration using C:

Teacher:UTTAM ROY MANDAL(URM)

Practical Number	Practical Title	Objectives	Instructional Activities	Assessment	Materials Needed
1	Trapezoidal Rule	- Understand the concept of numerical integration using the trapezoidal rule. - Implement the trapezoidal rule algorithm in C. - Evaluate definite integrals using the trapezoidal rule.	1. Brief lecture on the trapezoidal rule algorithm and its derivation. 2. Demonstration of the C code implementation. 3. Hands-on practice implementing and using the trapezoidal rule for numerical integration.	- Accuracy of calculated integrals compared to known values. - Code correctness and efficiency.	Computers with C compilers
2	Simpson's One Third Rule	- Understand the Simpson's one-third rule for numerical integration. - Implement the algorithm in C. - Compare the performance of Simpson's rule with the trapezoidal rule.	1. Lecture on Simpson's one-third rule and its derivation. 2. Step-by-step demonstration of C code implementation. 3. Comparison of results with the trapezoidal rule.	- Accuracy of calculated integrals compared to known values. - Efficiency and computational speed.	Computers with C compilers
3	Weddle's Rule	- Introduce Weddle's rule as a higher-order numerical integration method. - Implement Weddle's rule in C. - Analyze the advantages and limitations of Weddle's rule compared to other methods.	1. Lecture on Weddle's rule and its application. 2. Walkthrough of C code implementation. 3. Discussion on the benefits and drawbacks of Weddle's rule.	- Accuracy and efficiency of Weddle's rule implementation. - Ability to analyze and compare methods.	Computers with C compilers
4	Gauss Quadrature	- Introduce Gauss Quadrature as a highly accurate method for numerical integration. - Implement Gauss Quadrature in C. - Compare the results with other integration methods.	1. Lecture on Gauss Quadrature and its principles. 2. Implementation of Gauss Quadrature algorithm in C. 3. Comparison of results with previous methods.	- Accuracy and precision of Gauss Quadrature results. - Ability to understand and implement complex algorithms.	Computers with C compilers

Note:

- Each practical session should involve a combination of theory, practical implementation, and comparison/analysis of results.
- Students should be encouraged to write their own C programs, execute them, and analyze the output.

- Assessment can include both individual performance during practical sessions and submission of a final report demonstrating understanding and analysis of the implemented algorithms.
- Materials needed include computers with C compilers installed, necessary textbooks or resources on numerical methods, and access to relevant software for data analysis and visualization (if required).

Practical 7: Method of finding Eigenvalue by Power method (up to 4 × 4)

Here's a tabular plan for a 2-hour Numerical Methods Lab focusing on the Power Method for finding Eigenvalues using C:

Teacher:UTTAM ROY MANDAL(URM)

Practical Number	Practical Title	Objectives	Instructional Activities	Assessment	Materials Needed
1	Power Method for Eigenvalue Computation	- Understand the concept of the Power Method for finding Eigenvalues. - Implement the Power Method algorithm in C. - Apply the Power Method to compute Eigenvalues of up to 4x4 matrices.	1. Brief lecture on the Power Method algorithm and its application in finding Eigenvalues. 2. Step-by-step demonstration of C code implementation. 3. Hands-on practice applying the Power Method to compute Eigenvalues.	- Accuracy of computed Eigenvalues compared to known values. - Code correctness and efficiency.	Computers with C compilers

Note:

- The practical session should include a mix of theory and practical implementation.
- Students should be encouraged to write their own C programs, execute them, and analyze the output.
- Assessment can include both individual performance during the practical session and submission of a final report demonstrating understanding and analysis of the implemented algorithm.
- Materials needed include computers with C compilers installed, necessary textbooks or resources on numerical methods, and access to relevant software for data analysis and visualization (if required).

Practical-8: Fitting a Polynomial Function (up to third degree)

Here's a tabular plan for a 2-hour Numerical Methods Lab focusing on Fitting a Polynomial Function (up to third degree) using C:

Teacher:UTTAM ROY MANDAL(URM)

Practical Number	Practical Title	Objectives	Instructional Activities	Assessment	Materials Needed
1	Polynomial Fitting	- Understand the concept of polynomial fitting. - Learn to fit a polynomial function of up to third degree to given data points.	1. Introduction to polynomial fitting and its importance in data analysis. 2. Explanation of the mathematical background and algorithm for polynomial fitting.	- Accuracy of the fitted polynomial function compared to the given data points.	Computers with C compilers

Plan Details:

- **Objective**: To fit a polynomial function of up to third degree to given data points using C programming.
- **Instructional Activities**:
    1. **Introduction to Polynomial Fitting**:
        - Brief overview of polynomial fitting and its significance in data analysis and curve fitting.
    2. **Mathematical Background**:
        - Explanation of the mathematical background, including the least squares method for polynomial fitting.
        - Introduction to the formula for fitting a polynomial function to given data points.
    3. **Algorithm for Polynomial Fitting**:
        - Demonstration of the algorithm for polynomial fitting, step-by-step.
        - Discussion on the implementation details and considerations.
- **Assessment**:
    - Students will be assessed based on the accuracy of the fitted polynomial function compared to the given data points.

      Materials Needed:
    - Computers with C compilers installed.
    - Dataset with data points for polynomial fitting.
    - Textbook or resources on numerical methods for reference.

Additional Notes:

- The instructor should provide guidance and support throughout the practical session, assisting students in understanding the concepts and implementing the algorithm in C.
- Students should be encouraged to write their own C programs for polynomial fitting, execute them, and analyze the results.
- Assessment can include both individual performance during the practical session and submission of a final report demonstrating understanding and analysis of the fitted polynomial function.
- The practical session should promote engagement through interactive discussions, hands-on coding, and problem-solving activities.

Practical-9: Solution of ordinary differential equations
i) Euler method
ii) Modified Euler method
iii) Runge Kutta method (order 4)
iv) The method of successive approximations (Picard)

Here's a tabular plan for an 8-hour Numerical Methods Lab focusing on the Solution of Ordinary Differential Equations using C:

Teacher:UTTAM ROY MANDAL(URM)

Practical Number	Practical Title	Objectives	Instructional Activities	Assessment	Materials Needed
1	Euler Method	- Understand the concept of numerical methods for solving ordinary differential equations (ODEs).	1. Introduction to the Euler method and its derivation. 2. Step-by-step demonstration of the C	- Accuracy of solutions compared to analytical solutions (if available). -	Computers with C compilers

Practical Number	Practical Title	Objectives	Instructional Activities	Assessment	Materials Needed
		  - Implement the Euler method algorithm in C. - Solve simple ODEs using the Euler method.	code implementation. 3. Hands-on practice solving ODEs using the Euler method.	Efficiency and correctness of C code implementation.	
2	Modified Euler Method	- Introduce the Modified Euler method as an improvement over the basic Euler method. - Implement the Modified Euler method in C. - Compare results with the basic Euler method.	1. Brief lecture on the Modified Euler method and its advantages. 2. Walkthrough of C code implementation. 3. Comparison of results obtained using the Modified Euler method with those from the basic Euler method.	- Accuracy and efficiency of solutions obtained using the Modified Euler method. - Ability to understand and implement algorithmic improvements.	Computers with C compilers
3	Runge-Kutta Method (Order 4)	- Introduce the Runge-Kutta method as a higher-order numerical method for solving ODEs. - Implement the 4th-order Runge-Kutta method in C. - Compare results with previous methods.	1. Lecture on the Runge-Kutta method and its principles. 2. Step-by-step demonstration of the C code implementation. 3. Comparison of solutions obtained using the Runge-Kutta method with those from Euler and Modified Euler.	- Accuracy and precision of solutions obtained using the 4th-order Runge-Kutta method. - Ability to understand and implement higher-order numerical methods.	Computers with C compilers
4	Method of Successive Approximations	- Introduce the Method of Successive Approximations (Picard's method) for solving first-order ODEs. - Implement the method in C. - Solve ODEs using the iterative approach of Picard's method.	1. Explanation of Picard's method and its iterative process. 2. Demonstration of C code implementation. 3. Hands-on practice solving ODEs using Picard's method.	- Accuracy and convergence of solutions obtained using the Method of Successive Approximations. - Ability to understand and apply iterative numerical methods for ODEs.	Computers with C compilers

Note:

- Each practical session should include a theoretical introduction, practical implementation, and comparison/analysis of results.
- Students should be encouraged to write their own C programs, execute them, and analyze the output.

- Assessment can include individual performance during practical sessions and submission of a final report demonstrating understanding and analysis of the implemented algorithms.
- Materials needed include computers with C compilers installed, textbooks or resources on numerical methods, and access to relevant software for data analysis and visualization (if required).

Mathematical Modelling

Semesters : 6
Credits : 5+1*=6
Discipline Specific Elective-DSE-A(2)
Full Marks : 65+15**+20***=100
Paper Code(Theory):MTM-A-DSE-A-6-2-TH
Paper Code(Tutorial):MTM-A-DSE-A-6-2-TU

Unit-1

Here's a comprehensive 20-hour lesson plan for undergraduate mathematics students focusing on Mathematical Modeling, specifically covering Power Series solutions of Bessel's equation and Legendre's equation, as well as Laplace transform and its application to initial value problems up to second order:

Teacher: DR PAYEL GHOSH (PG)

Hours	Topic	Objectives	Instructional Activities	Assessment	Materials Needed
1-2	Introduction to Power Series Solutions	- Understand the concept of power series solutions for differential equations. - Introduce Bessel's equation and Legendre's equation and their significance in mathematical modeling.	1. Lecture on power series solutions and their application to differential equations. 2. Introduction to Bessel's equation and Legendre's equation. 3. Derivation of power series solutions for Bessel's and Legendre's equations.	- Understanding demonstrated through participation in discussions and completion of assigned readings.	Whiteboard, markers, textbooks
3-4	Power Series Solutions of Bessel's Equation	- Learn how to derive power series solutions for Bessel's equation. - Understand the properties and behavior of Bessel functions.	1. Lecture on Bessel's equation and its properties. 2. Derivation of power series solutions for Bessel's equation using Frobenius method. 3. Illustration of different types of Bessel functions and their graphical representation.	- Ability to derive power series solutions for Bessel's equation. - Understanding of Bessel function properties demonstrated through participation in discussions and completion of exercises.	Whiteboard, markers, textbooks
5-6	Power Series Solutions of Legendre's Equation	- Learn how to derive power series solutions for Legendre's equation. - Understand the properties and	1. Lecture on Legendre's equation and its properties. 2. Derivation of power series solutions for Legendre's equation	- Ability to derive power series solutions for Legendre's equation. - Understanding of Legendre polynomial	Whiteboard, markers, textbooks

Hours	Topic	Objectives	Instructional Activities	Assessment	Materials Needed
		behavior of Legendre polynomials.	using Frobenius method. 3. Illustration of different types of Legendre polynomials and their graphical representation.	properties demonstrated through participation in discussions and completion of exercises.	
7-8	Introduction to Laplace Transform	- Understand the concept and definition of the Laplace transform. - Learn basic properties and theorems of Laplace transform.	1. Lecture on Laplace transform and its definition. 2. Explanation of basic properties and theorems of Laplace transform. 3. Illustration of Laplace transform application in solving initial value problems.	- Understanding of Laplace transform properties demonstrated through participation in discussions and completion of exercises. - Ability to apply Laplace transform to simple functions and differential equations.	Whiteboard, markers, textbooks
9-10	Laplace Transform of Second Order ODEs	- Understand how to apply Laplace transform to solve second-order ordinary differential equations (ODEs) with initial conditions.	1. Lecture on the application of Laplace transform to second-order ODEs. 2. Step-by-step demonstration of solving initial value problems using Laplace transform. 3. Practice problems involving the Laplace transform of second-order ODEs.	- Ability to solve second-order ODEs using Laplace transform demonstrated through participation in discussions and completion of exercises. - Accuracy of solutions evaluated through comparison with known analytical solutions.	Whiteboard, markers, textbooks
11-12	Inverse Laplace Transform	- Understand the concept of inverse Laplace transform and its application. - Learn techniques for finding inverse Laplace transforms.	1. Lecture on inverse Laplace transform and its definition. 2. Explanation of techniques for finding inverse Laplace transforms. 3. Practice problems involving finding inverse Laplace transforms.	- Ability to find inverse Laplace transforms demonstrated through participation in discussions and completion of exercises. - Accuracy of solutions evaluated through comparison with known analytical solutions.	Whiteboard, markers, textbooks
13-14	Application of Laplace Transform	- Apply Laplace transform to solve initial value problems arising in engineering and physics.	1. Presentation of real-world examples of initial value problems. 2. Group discussion on the application of Laplace	- Ability to apply Laplace transform to solve real-world initial value problems demonstrated through participation in	Whiteboard, markers, textbooks

Hours	Topic	Objectives	Instructional Activities	Assessment	Materials Needed
			transform to solve these problems. 3. Hands-on practice solving application problems using Laplace transform.	discussions and completion of exercises. - Accuracy and correctness of solutions assessed through comparison with known analytical solutions.	
15-16	Review and Practice Session	- Review key concepts and techniques covered in previous sessions. - Provide additional practice problems and exercises for reinforcement.	1. Review of key concepts and techniques covered so far. 2. Practice problems and exercises provided for students to work on individually or in groups. 3. Q&A session to address any remaining doubts or questions.	- Understanding demonstrated through participation in discussions and completion of exercises. - Ability to apply learned techniques to solve problems evaluated through completion of practice problems.	Whiteboard, markers, textbooks
17-20	Final Project and Presentation	- Apply knowledge and skills acquired throughout the course to a final project. - Demonstrate understanding of mathematical modeling concepts and techniques. - Present findings and solutions to the class.	1. Students work on individual or group projects involving mathematical modeling and application of learned techniques. 2. Preparation of project reports and presentations. 3. Final presentations where students showcase their findings and solutions to the class.	- Depth and breadth of understanding demonstrated through project reports and presentations. - Ability to effectively communicate mathematical modeling concepts and techniques evaluated through final presentations.	Computers with software for visualization

This comprehensive lesson plan aims to provide students with a thorough understanding of mathematical modeling concepts and techniques, including power series solutions, Laplace transform, and their applications to initial value problems. It incorporates various teaching strategies such as lectures, demonstrations, practice problems, and real-world applications to cater to different learning styles and ensure coherence and depth in learning.

Unit-2

Unit-2.1

Here's a tabular plan for a comprehensive 10-hour lesson on **Monte Carlo simulation** modeling focusing on simulating deterministic behavior:

Teacher: DR PAYEL GHOSH (PG)

Hour	Activity	Objectives	Instructional Activities	Assessment	Materials Needed
1	Introduction to Monte Carlo Simulation Modeling	- Understand the concept of Monte Carlo simulation modeling. - Learn about the applications of Monte Carlo simulation in mathematical modeling.	1. Lecture on the basics of Monte Carlo simulation and its significance in mathematical modeling. 2. Discuss various real-world applications of Monte Carlo simulation.	- Participation during the lecture. - Question and answer session to gauge understanding of concepts.	Whiteboard, markers
2-3	Simulating Area Under a Curve	- Learn how Monte Carlo simulation can be used to estimate the area under a curve. - Understand the principles behind simulating deterministic behavior using Monte Carlo methods.	1. Demonstration of the Monte Carlo method for estimating the area under a curve. 2. Step-by-step walkthrough of the algorithm.	- Accuracy of the estimated area compared to known values (if available). - Understanding of the Monte Carlo method for simulating deterministic behavior.	Computers with programming environment (e.g., Python)
4-5	Simulating Volume Under a Surface	- Extend the understanding of Monte Carlo simulation to estimating volume under a surface. - Apply Monte Carlo methods to simulate deterministic behavior for three-dimensional problems.	1. Introduction to simulating volume under a surface using Monte Carlo simulation. 2. Walkthrough of the algorithm for three-dimensional Monte Carlo simulation.	- Accuracy of the estimated volume compared to known values (if available). - Ability to apply Monte Carlo methods to three-dimensional problems.	Computers with programming environment (e.g., Python)
6-7	Advanced Monte Carlo Techniques	- Explore advanced techniques and strategies for improving the efficiency and accuracy of Monte Carlo simulations.	1. Lecture on advanced Monte Carlo techniques, such as importance sampling and variance reduction methods. 2. Discussion on the benefits and limitations of each technique.	- Participation in discussions on advanced Monte Carlo techniques. - Understanding of strategies for improving the efficiency and accuracy of simulations.	Whiteboard, markers
8-9	Practical Applications and Case	- Apply Monte Carlo simulation modeling to practical problems and	1. Group exercises where students apply Monte Carlo	- Ability to apply Monte Carlo simulation to solve	Computers with programming

Hour	Activity	Objectives	Instructional Activities	Assessment	Materials Needed
	Studies	real-world case studies.	simulation to solve practical problems. 2. Presentation of case studies illustrating the use of Monte Carlo simulation in various fields.	practical problems. - Presentation skills and understanding of real-world applications.	environment (e.g., Python)
10	Review, Evaluation, and Conclusion	- Review key concepts and techniques covered in the lesson. - Evaluate student understanding and engagement. - Conclude the lesson with a summary and discussion on future applications.	1. Recap of key concepts and techniques learned throughout the lesson. 2. Question and answer session to address any remaining doubts or questions.	- Performance in the review session. - Engagement and participation throughout the lesson.	Whiteboard, markers

Note:

- Each practical session should involve hands-on exercises where students write code and run simulations.
- Assessment methods can include participation, completion of practical exercises, and presentation of case studies.
- Materials needed include computers with a programming environment (e.g., Python), access to relevant software libraries for Monte Carlo simulation, and whiteboards for lectures and discussions.

Unit-2.2

Here's a tabular plan for a 10-hour lesson focusing on Mathematical Modelling:

Teacher: DR PAYEL GHOSH (PG)

Time (hours)	Topic	Objectives	Instructional Activities	Assessment	Materials Needed
1	Introduction to Mathematical Modelling	- Understand the concept of mathematical modelling and its importance. - Explore various applications of mathematical modelling in real-world scenarios.	1. Lecture on the fundamentals of mathematical modelling. 2. Presentation of examples illustrating real-world applications.	- Q&A session to check understanding.	Whiteboard, projector
1	Generating	- Understand the	1. Explanation of the	- Coding	Computers

Time (hours)	Topic	Objectives	Instructional Activities	Assessment	Materials Needed
	Random Numbers: Middle Square Method	Middle Square Method for generating random numbers. - Learn how to implement the Middle Square Method algorithm.	Middle Square Method algorithm. 2. Demonstration of code implementation in a programming language like Python or C.	assignment to implement the Middle Square Method.	with IDEs
1	Generating Random Numbers: Linear Congruence	- Understand the Linear Congruence method for generating random numbers. - Learn how to implement the Linear Congruence algorithm.	1. Introduction to Linear Congruence method. 2. Walkthrough of the algorithm. 3. Code implementation exercise.	- Coding assignment to implement the Linear Congruence method.	Computers with IDEs
1	Queuing Models: Harbor System	- Understand queuing theory and its application to harbor systems. - Learn about the basic concepts of queuing models and their components.	1. Introduction to queuing theory and harbor systems. 2. Discussion on queuing models for harbor systems.	- Group discussion on the application of queuing models to harbor systems.	Whiteboard, projector
1	Queuing Models: Morning Rush Hour	- Explore the application of queuing models to morning rush hour traffic. - Analyze the components of a queuing model for morning rush hour scenarios.	1. Presentation of morning rush hour scenarios. 2. Discussion on queuing models for traffic flow.	- Individual or group assignment to model a morning rush hour scenario.	Whiteboard, projector
2	Overview of Optimization Modelling	- Understand the fundamentals of optimization modelling. - Learn about different optimization techniques and their applications.	1. Lecture on optimization modelling techniques. 2. Presentation of optimization problems and solutions.	- Quiz to assess understanding of optimization modelling concepts.	Whiteboard, projector
Total					

Note:

- Each session should include a mix of theoretical concepts, practical implementations, and discussions on real-world applications.
- Assessment methods can include quizzes, coding assignments, group discussions, and individual or group projects.

- Materials needed include a whiteboard, projector, computers with integrated development environments (IDEs) for coding sessions, and relevant textbooks or resources on mathematical modelling and optimization techniques.

Unit-2.3

Here's a tabular plan for a 15-hour lesson on Linear Programming Models focusing on **geometric and algebraic solutions, the simplex method, and sensitivity analysis:**

Teacher: DR PAYEL GHOSH (PG)

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
1	Introduction to Linear Programming	- Understand the basic concepts of linear programming models. - Recognize real-world applications of linear programming.	1. Lecture on the fundamentals of linear programming models. 2. Discussion on real-world examples and applications. 3. Introduce the graphical method for solving linear programming problems.	- Participation in discussions and questions. - Quiz to assess understanding of basic concepts.	Whiteboard, markers, projector
2	Geometric Solution	- Understand the geometric interpretation of linear programming problems. - Learn to graphically represent constraints and objectives.	1. Step-by-step explanation of how to graph linear constraints. 2. Demonstration of finding feasible regions and optimal solutions graphically. 3. Hands-on practice with graphical examples.	- Accuracy in graphically representing constraints and identifying feasible regions. - Participation in practical exercises.	Graph paper, rulers, pencils
3	Algebraic Solution	- Understand the algebraic representation of linear programming problems. - Learn to set up and solve linear programming problems using algebraic methods.	1. Lecture on setting up and solving linear programming problems algebraically. 2. Walkthrough of algebraic examples and solution methods. 3. Group exercises to practice setting up and solving LP problems algebraically.	- Accuracy and completeness of algebraic solutions. - Participation in group exercises and discussions.	Whiteboard, markers
4-6	Simplex Method	- Understand the simplex method for solving linear	1. Detailed explanation of the simplex algorithm and its steps. 2.	- Ability to apply the simplex method correctly to solve	Computers with spreadsheet

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
		programming problems. - Learn the steps involved in the simplex algorithm. - Practice implementing the simplex method to solve LP problems.	Demonstration of simplex method with examples. 3. Guided practice sessions implementing the simplex method. 4. Independent practice solving LP problems.	LP problems. - Accuracy and efficiency of solutions obtained.	software
7-8	Sensitivity Analysis	- Understand the concept of sensitivity analysis in linear programming. - Learn to interpret and analyze changes in LP solutions due to changes in parameters.	1. Lecture on sensitivity analysis and its importance. 2. Explanation of sensitivity measures and their interpretation. 3. Analysis of sensitivity with practical examples.	- Ability to interpret and analyze sensitivity measures. - Participation in discussions and analysis of practical examples.	Whiteboard, markers
9-10	Applications and Case Studies	- Apply linear programming techniques to real-world problems. - Analyze case studies involving linear programming models.	1. Presentation of case studies from various fields (e.g., finance, operations research, manufacturing). 2. Group discussions and analysis of case studies. 3. Application of LP techniques to solve case study problems.	- Ability to apply LP techniques to solve real-world problems. - Analysis and presentation of findings from case studies.	Case study materials, projectors
11-15	Project Work and Presentations	- Apply knowledge and skills acquired to solve a larger LP problem. - Develop presentation and communication skills. - Receive feedback on project work and presentations.	1. Assignment of individual or group projects involving the application of LP techniques. 2. Project work under guidance and supervision. 3. Preparation and delivery of presentations on project findings. 4. Feedback and discussion on project presentations.	- Quality of project work and presentations. - Demonstration of understanding and application of LP concepts. - Participation and engagement in project presentations.	Project materials, presentation tools

Note:

- Each session should include a mix of lectures, demonstrations, hands-on exercises, and discussions to cater to different learning styles.
- Assessment methods include participation, quizzes, practical exercises, project work, and presentations.

- Materials needed include whiteboards, markers, projectors, graph paper, rulers, pencils, computers with spreadsheet software, case study materials, and presentation tools.

Point Set Topology

Semesters : 6 Credits : 5+1*=6

Discipline Specific Elective-DSE-B(2) Full Marks : 65+15**+20***=100

Paper Code(Theory):MTM-A-DSE-B-6-2-TH

Paper Code(Tutorial):MTM-A-DSE-B-6-2-TU

Unit-1

Sub Unit-1.1

Here's a tabular plan for a 10-hour lesson on Point Set Topology focusing on topological spaces, basis, subbasis, neighborhoods, interior points, and limit points:

Teacher: SWADHIN BANERJEE(SB)

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
1	Introduction to Topological Spaces	- Understand the concept of topological spaces. - Define topological spaces and basic properties.	1. Lecture on the definition and properties of topological spaces. 2. Examples and non-examples of topological spaces. 3. Discussion on the significance of topological spaces.	- Participation in discussions and questions. - Quiz to assess understanding of basic concepts.	Whiteboard, markers, projector
2	Basis and Subbasis	- Define basis and subbasis for a topology. - Understand their roles in defining topologies.	1. Explanation of basis and subbasis and their relationships with topological spaces. 2. Examples illustrating the construction of topologies using basis and subbasis.	- Ability to construct topologies using basis and subbasis. - Participation in practical examples.	Whiteboard, markers
3	Neighborhoods	- Define	1. Lecture on	- Understanding of	Whiteboard,

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
	of a Point	neighborhoods of a point in a topological space. - Understand the concept of open sets.	neighborhoods and open sets. 2. Illustration of neighborhoods and open sets in Euclidean space. 3. Discussion on the properties of neighborhoods and open sets.	the concept of neighborhoods and open sets. - Participation in discussions.	markers
4	Interior Points	- Define interior points of a set. - Learn properties and significance of interior points in topological spaces.	1. Explanation of interior points and their characterization in topological spaces. 2. Examples demonstrating the identification of interior points in various sets.	- Ability to identify interior points in given sets. - Participation in examples and discussions.	Whiteboard, markers
5	Limit Points	- Define limit points of a set. - Understand the concept of closure of a set.	1. Lecture on limit points and closures of sets. 2. Illustrative examples of limit points in different sets. 3. Discussion on the properties and significance of limit points.	- Understanding of the concept of limit points and closures. - Participation in examples and discussions.	Whiteboard, markers
6-8	Practice and Application	- Apply the concepts learned to solve problems and analyze topological spaces.	1. Guided practice sessions solving problems related to basis, subbasis, neighborhoods, interior points, and limit points. 2. Independent practice with assigned exercises.	- Ability to apply concepts to solve problems. - Accuracy in solutions and interpretations.	Textbook, worksheets
9-10	Review and Assessment	- Review key concepts covered in the lesson. - Assess understanding through quizzes and discussions.	1. Review session summarizing key concepts and properties. 2. Quiz to assess understanding of the material. 3. Discussion and Q&A session to address any remaining doubts.	- Performance in quizzes and discussions. - Ability to articulate and clarify doubts.	Whiteboard, markers

Note:

- Each session should include a mix of lectures, examples, discussions, and practical exercises.

- Assessment methods include participation, quizzes, solving exercises, and discussions.
- Materials needed include whiteboards, markers, projectors, textbooks, worksheets, and any additional resources for examples and exercises.

Sub Unit-1.2

Here's a tabular plan for a 5-hour lesson on Point Set Topology focusing on derived sets, boundaries, closed sets, closures, interiors, and dense subsets:

Teacher: SWADHIN BANERJEE(SB)

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
1	Introduction to Point Set Topology	- Understand the basic concepts of point set topology. - Introduce derived sets, boundaries, closed sets, closures, interiors, and dense subsets.	1. Lecture on the fundamental concepts of point set topology. 2. Explanation of derived sets, boundaries, closed sets, closures, interiors, and dense subsets. 3. Examples illustrating each concept.	- Participation in discussions and questions. - Quiz to assess understanding of basic concepts.	Whiteboard, markers, projector
2	Derived Sets and Boundaries	- Understand the derived set of a given set and its significance. - Learn to compute the boundary of a set.	1. Explanation of derived sets and computation of derived sets for various examples. 2. Definition and computation of boundaries. 3. Practice problems to compute derived sets and boundaries.	- Accuracy in computing derived sets and boundaries. - Participation in practical exercises.	Whiteboard, markers
3	Closed Sets and Closures	- Understand the concept of closed sets and their properties. - Learn to compute the closure of a set.	1. Lecture on closed sets and closure operations. 2. Examples demonstrating properties of closed sets. 3. Computation of closures for various sets.	- Accuracy in understanding properties of closed sets and computing closures. - Participation in solving closure problems.	Whiteboard, markers
4	Interior of a Set	- Understand the interior of a set and its relationship with open sets.	1. Explanation of the interior of a set and its definition. 2. Relationship between	- Understanding of the concept of the interior of a set and its relationship with open	Whiteboard, markers

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
			interior and open sets. 3. Examples illustrating the interior of sets.	sets. - Participation in solving problems related to the interior of sets.	
5	Dense Subsets	- Understand the concept of dense subsets and their importance in topology.	1. Introduction to dense subsets and their definition. 2. Discussion on the significance of dense subsets. 3. Examples illustrating dense subsets in various contexts.	- Understanding of dense subsets and their significance in topology. - Participation in discussions and examples.	Whiteboard, markers

Note:

- Each session should include a mix of lectures, examples, and practice problems to reinforce understanding.
- Assessment methods include participation, quizzes, and problem-solving exercises.
- Materials needed include whiteboards, markers, and a projector for visual aids. Depending on the availability, additional materials such as handouts or textbooks can be provided.

Sub Unit-1.3

Here's a tabular plan for a 10-hour lesson on Point Set Topology focusing on **subspace topology, finite product topology, continuous functions, open maps, and closed maps:**

Teacher: SWADHIN BANERJEE(SB)

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
1	Introduction to Topology	- Understand the basic concepts of point set topology. - Define topological spaces and open sets. - Introduce the concepts of continuity, open and closed maps.	1. Lecture on the fundamentals of topology, including definitions of topological spaces, open sets, and basic properties. 2. Discussion on the importance and applications of topology in mathematics and other fields. 3. Examples illustrating open and closed sets. 4. Group exercises to identify open and closed sets in various spaces.	- Participation in discussions and group exercises. - Quiz to assess understanding of basic concepts.	Whiteboard, markers, projector

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
2-3	Subspace Topology	- Understand the concept of subspace topology. - Learn how to define subspace topologies and their properties.	1. Lecture on subspace topology and its definition. 2. Step-by-step explanation of how to define subspace topologies. 3. Examples of subspaces and their corresponding topologies. 4. Group activities to determine subspace topologies and their properties.	- Ability to define subspace topologies correctly. - Participation in group activities.	Whiteboard, markers
4-5	Finite Product Topology	- Introduce the concept of finite product topology. - Learn how to construct finite product topologies.	1. Lecture on finite product topology and its construction. 2. Demonstration of how to construct finite product topologies. 3. Examples illustrating finite product topologies. 4. Hands-on exercises to construct finite product topologies.	- Accuracy in constructing finite product topologies. - Participation in hands-on exercises.	Whiteboard, markers
6-7	Continuous Functions	- Understand the concept of continuous functions between topological spaces. - Learn the properties of continuous functions.	1. Lecture on continuous functions and their definition. 2. Discussion on properties of continuous functions. 3. Examples illustrating continuous and discontinuous functions. 4. Group exercises to determine the continuity of functions.	- Ability to identify continuous functions and understand their properties. - Participation in group exercises.	Whiteboard, markers
8-9	Open and Closed Maps	- Introduce the concepts of open and closed maps between topological spaces. - Understand their properties and relationships.	1. Lecture on open and closed maps and their definitions. 2. Explanation of properties and relationships between open and closed maps. 3. Examples illustrating open and closed maps. 4. Group discussions on the properties of open and closed maps.	- Understanding of properties and relationships between open and closed maps. - Participation in group discussions.	Whiteboard, markers
10	Review and Assessment	- Review key concepts covered in the lesson. - Assess understanding	1. Review session covering key concepts and definitions. 2. Quiz or assignment to assess understanding. 3. Feedback and discussion	- Performance in quiz or assignment. - Ability to apply concepts learned	Whiteboard, markers, projector

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
		through a quiz or assignment.	on quiz/assignment results.	in the lesson.	

Note:

- Each session should include a combination of lectures, discussions, examples, and hands-on activities to cater to different learning styles.
- Assessment methods include quizzes, assignments, and participation in group activities.
- Materials needed include whiteboards, markers, projectors, and handouts with examples and exercises.

Sub Unit-1.4

Here's a tabular plan for a 10-hour lesson on Point Set Topology focusing on homeomorphisms, topological invariants, metric topology, isometry, and metric invariants:

Teacher: SWADHIN BANERJEE(SB)

ession Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
	Introduction to Topology	- Understand the basic concepts of topology. - Define homeomorphisms and their significance.	1. Lecture on the fundamentals of point set topology. 2. Introduction to homeomorphisms and their properties.	- Participation in discussions and questions. - Quiz to assess understanding of basic concepts.	Whiteboard, markers, projector
	Homeomorphisms	- Understand the concept of homeomorphisms and their role in topology.	1. Detailed explanation of homeomorphisms and their definitions. 2. Illustration of examples of homeomorphic spaces.	- Ability to identify homeomorphic spaces. - Participation in discussions and examples.	Whiteboard, markers
	Topological Invariants	- Introduce topological invariants and their importance in distinguishing topological spaces.	1. Lecture on topological invariants and their properties. 2. Discussion on examples of topological invariants.	- Understanding and application of topological invariants. - Ability to identify and analyze topological spaces.	Whiteboard, markers
	Metric Topology	- Introduce metric topology as a special case of topological spaces. - Define metric spaces and discuss their properties.	1. Lecture on metric topology and its relationship with topological spaces. 2. Definition of metric spaces and their properties.	- Ability to distinguish between metric and topological spaces. - Understanding of metric space	Whiteboard, markers

ession Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
				properties.	
	Isometry	- Define isometry and its role in preserving distances between points in metric spaces.	1. Explanation of isometry and its properties. 2. Illustration of examples of isometric transformations.	- Ability to recognize isometric transformations. - Understanding of distance-preserving transformations.	Whiteboard, markers
-7	Metric Invariants	- Introduce metric invariants as properties of metric spaces that remain unchanged under isometric transformations. - Discuss examples of metric invariants.	1. Lecture on metric invariants and their significance. 2. Analysis of examples of metric invariants.	- Understanding and application of metric invariants. - Ability to identify and analyze metric space properties.	Whiteboard, markers
-9	Practical Exercises	- Apply knowledge of homeomorphisms, topological invariants, metric topology, isometry, and metric invariants to solve problems and analyze topological spaces.	1. Group exercises and problem-solving sessions on identifying homeomorphic spaces, calculating topological invariants, and analyzing metric spaces. 2. Hands-on practice with examples and exercises.	- Accuracy and completeness of solutions to practical exercises. - Participation and engagement in group activities.	Whiteboard, markers
0	Review and Discussion	- Review key concepts covered in the lesson. - Discuss real-world applications of point set topology concepts.	1. Recap of main topics and concepts covered throughout the lesson. 2. Open discussion on applications of point set topology in mathematics and other fields.	- Ability to summarize and discuss key concepts. - Engagement and participation in discussion.	Whiteboard, markers, projector

Note:

- Each session should include a mix of lectures, discussions, examples, and practical exercises to cater to different learning styles.
- Assessment methods include participation, quizzes, problem-solving exercises, and discussions.
- Materials needed include whiteboards, markers, projectors, and any relevant textbooks or resources on point set topology.

Unit-2

Here's a tabular plan for a 15-hour lesson on Point Set Topology focusing on **First Countability, T1 and T2 Separation Axioms, Convergence, Cluster Point, and Heine's Continuity Criterion**:

Teacher: SWADHIN BANERJEE(SB)

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
1	Introduction to Point Set Topology	- Understand the basics of point-set topology. - Learn about topological spaces and their properties.	1. Lecture on the fundamental concepts of point-set topology. 2. Discussion on the definition of topological spaces. 3. Introduction to separation axioms and their importance.	- Participation in discussions and questions. - Quiz to assess understanding of basic concepts.	Whiteboard, markers, projector
2	First Countability	- Understand the concept of first countability in topological spaces. - Learn to identify first countable spaces and their properties.	1. Lecture on first countable spaces and their definition. 2. Discussion on examples of first countable spaces. 3. Illustration of properties of first countability.	- Ability to identify and classify first countable spaces. - Participation in exercises and discussions.	Whiteboard, markers
3	T1 Separation Axiom	- Understand the T1 separation axiom in topological spaces. - Learn to distinguish between T1 and non-T1 spaces.	1. Explanation of the T1 separation axiom and its significance. 2. Comparison of T1 and non-T1 spaces. 3. Identification of examples illustrating the T1 property.	- Ability to differentiate between T1 and non-T1 spaces. - Participation in identifying examples.	Whiteboard, markers
4-5	T2 Separation Axiom (Hausdorff Spaces)	- Understand the T2 separation axiom (Hausdorff property) in topological spaces. - Learn about Hausdorff spaces and their properties.	1. Lecture on the Hausdorff property and its implications. 2. Discussion on examples of Hausdorff and non-Hausdorff spaces. 3. Illustration of properties of Hausdorff spaces. 4. Practice exercises to identify Hausdorff spaces.	- Ability to recognize and analyze Hausdorff spaces. - Participation in exercises and discussions.	Whiteboard, markers
6-7	Convergence and Cluster Point	- Understand the concepts of convergence and cluster point in	1. Explanation of convergence and cluster point. 2. Illustration of	- Ability to identify convergent sequences and cluster points. -	Whiteboard, markers

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
		topological spaces. - Learn to identify convergent sequences and cluster points.	convergent sequences and cluster points in various spaces. 3. Practice identifying convergent sequences and cluster points.	Participation in exercises and discussions.	
8-9	Heine's Continuity Criterion	- Learn about Heine's continuity criterion for functions between topological spaces. - Understand the relationship between continuity and convergence.	1. Presentation of Heine's continuity criterion and its proof. 2. Discussion on the relationship between continuity and convergence. 3. Application of Heine's criterion to analyze continuity of functions.	- Ability to apply Heine's continuity criterion to analyze functions. - Participation in discussions and application exercises.	Whiteboard, markers
10-11	First Countable and Hausdorff Spaces	- Explore properties and relationships between first countable and Hausdorff spaces.	1. Lecture on the relationship between first countability and the Hausdorff property. 2. Discussion on examples illustrating the relationship. 3. Analysis of properties and implications.	- Understanding of the relationship between first countability and the Hausdorff property. - Participation in analysis and discussion.	Whiteboard, markers
12-13	Application and Real-World Examples	- Apply concepts learned to analyze real-world scenarios. - Explore applications of separation axioms and convergence in various fields.	1. Presentation of case studies and real-world examples. 2. Group discussions on the application of concepts. 3. Analysis and interpretation of real-world scenarios.	- Ability to apply concepts to analyze real-world problems. - Participation in discussions and analysis of examples.	Case study materials, projectors
14-15	Project Work and Presentations	- Apply knowledge and skills acquired to solve a larger problem or conduct research. - Develop presentation and communication skills. - Receive feedback on project work and presentations.	1. Assignment of individual or group projects related to the topic. 2. Project work under guidance and supervision. 3. Preparation and delivery of presentations on project findings. 4. Feedback and discussion on project	- Quality of project work and presentations. - Demonstration of understanding and application of concepts. - Participation and engagement in project presentations.	Project materials, presentation tools

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
			presentations.		

Note:

- Each session should incorporate a variety of teaching methods such as lectures, discussions, practical exercises, and real-world examples.
- Assessment methods include participation, quizzes, practical exercises, project work, and presentations.
- Materials needed include whiteboards, markers, projectors, case study materials, and presentation tools.

Unit-3:

Sub Unit-3.1

Here's a tabular plan for a 10-hour lesson on Point Set Topology focusing on connected spaces, compact spaces, and the Heine-Borel Theorem:

Teacher: SWADHIN BANERJEE(SB)

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
1	Introduction to Topology	- Understand the basic concepts of point set topology. - Introduce the definitions of connected spaces and compact spaces.	1. Lecture on the fundamentals of point set topology. 2. Explanation of connected spaces and compact spaces. 3. Discussion on the importance and applications of connectedness and compactness.	- Participation in discussions and questions. - Quiz to assess understanding of basic concepts.	Whiteboard, markers, projector
2	Connected Spaces	- Define connected spaces and connected sets. - Understand the properties of connected spaces.	1. Lecture on connectedness and connected spaces. 2. Examples illustrating connected and disconnected spaces. 3. Group activities to identify and discuss properties of connected spaces.	- Ability to identify connected and disconnected spaces. - Participation in group activities.	Whiteboard, markers
3	Components	- Define components of a	1. Explanation of components and their	- Understanding of the relationship	Whiteboard, markers

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
		topological space. - Understand the relationship between components and connectedness.	properties. 2. Examples illustrating components in different spaces. 3. Group discussions on the relationship between components and connectedness.	between components and connectedness. - Participation in group discussions.	
4	Compact Spaces	- Define compact spaces and compact sets. - Understand the properties of compactness.	1. Lecture on compactness and compact spaces. 2. Examples illustrating compact sets and spaces. 3. Group activities to explore properties of compactness.	- Ability to identify compact sets and spaces. - Participation in group activities.	Whiteboard, markers
5-6	Compactness and T2	- Understand the T2 separation axiom. - Explore the relationship between compactness and T2 separation.	1. Lecture on the T2 separation axiom and its significance. 2. Discussion on the relationship between compactness and T2 separation. 3. Examples illustrating spaces that are compact and satisfy T2 separation, and spaces that are not.	- Understanding of the T2 separation axiom and its implications. - Ability to identify spaces satisfying T2 separation and compactness.	Whiteboard, markers, projector
7-8	Compact Sets in R	- Study compact sets in the Euclidean space R. - Introduce the Heine-Borel Theorem for R.	1. Lecture on compact sets in R and the Heine-Borel Theorem. 2. Proof and discussion of the Heine-Borel Theorem. 3. Examples illustrating applications of the theorem.	- Understanding and application of the Heine-Borel Theorem. - Ability to identify compact sets in R.	Whiteboard, markers, projector
9-10	Applications and Review	- Apply concepts learned to solve problems and analyze real-world scenarios. - Review key concepts covered in the lesson.	1. Group activities or case studies applying concepts to real-world problems. 2. Review session covering key concepts and addressing any remaining questions.	- Ability to apply concepts to solve real-world problems. - Participation in group activities and review session.	Whiteboard, markers, projector

Note:

- Each session should include a mix of lectures, examples, group activities, and discussions to cater to different learning styles.

- Assessment methods include participation, quizzes, group activities, and a review session.
- Materials needed include whiteboards, markers, projectors, and textbooks or resources on point set topology.

Sub Unit-3.2

Here's a tabular plan for a 15-hour lesson on Point Set Topology focusing on real-valued continuous functions on **connected and compact spaces, compactness in metric spaces, sequentially compactness, and the Bolzano-Weierstrass property**:

Teacher: SWADHIN BANERJEE(SB)

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
1	Introduction to Point Set Topology	- Understand the basic concepts of point set topology. - Recognize the importance of connected and compact spaces in topology.	1. Lecture on the fundamentals of point set topology. 2. Introduction to the concepts of connectedness and compactness. 3. Discussion on the significance of these concepts in topology and real analysis.	- Participation in discussions and questions. - Quiz to assess understanding of basic concepts.	Whiteboard, markers, projector
2	Real-Valued Continuous Functions on Connected Spaces	- Understand the concept of real-valued continuous functions. - Learn about connected spaces and the behavior of continuous functions on them.	1. Lecture on real-valued continuous functions and their properties. 2. Discussion on the behavior of continuous functions on connected spaces. 3. Examples illustrating concepts.	- Accuracy in understanding and applying concepts of continuous functions on connected spaces.	Whiteboard, markers, projector
3-4	Compact Spaces and Continuous Functions	- Understand the concept of compactness in metric spaces. - Explore the relationship between compactness and continuous functions.	1. Lecture on compactness in metric spaces and its properties. 2. Introduction to the Heine-Borel theorem. 3. Analysis of continuous functions on compact spaces.	- Ability to recognize and apply properties of compact spaces in the context of continuous functions.	Whiteboard, markers, projector
5-6	Sequentially Compact	- Understand the concept of sequentially	1. Lecture on sequentially compact	- Ability to understand and	Whiteboard, markers,

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
	Metric Spaces	compact metric spaces. - Explore the Bolzano-Weierstrass property and its equivalence to sequentially compactness.	metric spaces and their properties. 2. Discussion on the Bolzano-Weierstrass property and its significance. 3. Proof of equivalence between properties.	apply concepts of sequentially compact metric spaces and the Bolzano-Weierstrass property.	projector
7-8	Topological Aspects of Compactness	- Learn about topological aspects of compactness. - Explore additional properties and implications of compact spaces.	1. Lecture on topological properties of compact spaces. 2. Discussion on compactness in different topological spaces. 3. Examples demonstrating topological aspects of compactness.	- Ability to recognize and analyze topological properties of compact spaces.	Whiteboard, markers, projector
9-10	Applications of Compactness in Analysis	- Apply concepts of compactness to solve problems in analysis. - Explore applications of compact spaces in mathematical analysis.	1. Presentation of examples and problems involving the application of compactness in analysis. 2. Group discussions and analysis of solutions. 3. Hands-on practice with application exercises.	- Ability to apply concepts of compactness to solve problems in analysis.	Whiteboard, markers, projector
11-12	Proof Techniques for Compactness	- Understand proof techniques for compactness in different spaces. - Learn about common strategies for proving compactness.	1. Lecture on proof techniques for compactness. 2. Introduction to common proof strategies. 3. Guided practice with proof exercises.	- Ability to construct and analyze proofs related to compactness.	Whiteboard, markers, projector
13-14	Problem-Solving and Case Studies	- Apply knowledge of compactness to solve advanced problems and case studies. - Analyze case studies involving compactness in various contexts.	1. Presentation of case studies involving compactness. 2. Group discussions and analysis of solutions. 3. Application of compactness concepts to solve problems and case studies.	- Ability to apply concepts of compactness to solve advanced problems and case studies.	Whiteboard, markers, projector
15	Review,	- Review key concepts	1. Review session	- Performance in	Whiteboard,

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
	Recap, and Assessment	covered throughout the course. - Recap important theorems and properties related to compactness. - Conduct assessment to evaluate understanding and retention of material.	covering key concepts, theorems, and properties. 2. Recap of important results and implications of compactness. 3. Assessment in the form of a quiz or problem-solving exercise.	assessment. - Ability to recall and apply key concepts and theorems related to compactness.	markers, projector

Note:

- Each session should include a combination of lectures, discussions, examples, problem-solving exercises, and case studies.
- Assessment methods include participation, quizzes, problem-solving exercises, and case study analysis.
- Materials needed include whiteboards, markers, projectors, textbooks or reference materials on topology, and additional resources for problem-solving exercises and case studies.

Advanced Mechanics

Semester : 6
Discipline Specific Elective-B(2)
Paper Code(Theory):MTM-A-DSE-B-6-2-TH
Paper Code(Tutorial):MTM-A-DSE-B-6-2-TU

Credits : 5+1*=6
Full Marks : 65+15**+20***=100

Unit-1

Sub Unit-1.1

Here's a tabular plan for a 10-hour lesson on Advanced Mechanics focusing on Degrees of Freedom, Reactions due to Constraints, D'Alembert's Principle, Lagrange's First Kind Equations, Generalized Coordinates, and Generalized Forces:

Teacher: DEBABRATA JANA (DJ)

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
1	Introduction to Degrees of Freedom	- Understand the concept of degrees of freedom in	1. Lecture on degrees of freedom and their significance in	- Participation in discussions and questions. -	Whiteboard, markers, projector

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
		mechanics. - Recognize the importance of constraints in determining degrees of freedom.	mechanics. 2. Discussion on the effects of constraints on motion. 3. Examples illustrating degrees of freedom in various systems.	Quiz to assess understanding of basic concepts.	
2	Reactions due to Constraints	- Understand the concept of reactions due to constraints. - Learn to analyze systems with constraints and determine reaction forces.	1. Lecture on reactions due to constraints and their determination. 2. Step-by-step analysis of systems with constraints. 3. Hands-on practice with example problems involving reaction forces.	- Accuracy in determining reaction forces in constrained systems. - Participation in practical exercises.	Whiteboard, markers
3-4	D'Alembert's Principle	- Understand D'Alembert's Principle and its application in mechanics.	1. Detailed explanation of D'Alembert's Principle and its derivation. 2. Discussion on the significance and applications of the principle. 3. Worked examples applying D'Alembert's Principle.	- Ability to apply D'Alembert's Principle correctly to solve mechanics problems. - Participation in discussions and problem-solving.	Whiteboard, markers, textbooks
5-6	Lagrange's First Kind Equations	- Understand Lagrange's First Kind Equations and their role in classical mechanics.	1. Lecture on Lagrange's First Kind Equations and their derivation. 2. Discussion on the advantages of using generalized coordinates. 3. Worked examples demonstrating the application of the equations.	- Accuracy in applying Lagrange's First Kind Equations to analyze mechanical systems. - Participation in problem-solving activities.	Whiteboard, markers, textbooks
7-8	Generalized Coordinates	- Learn the concept of generalized coordinates and their use in describing the configuration of mechanical systems.	1. Introduction to generalized coordinates and their definition. 2. Discussion on selecting appropriate coordinates for different systems. 3. Examples demonstrating the use of generalized coordinates.	- Understanding and application of generalized coordinates in mechanical systems. - Participation in discussions and examples.	Whiteboard, markers

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
9-10	Generalized Forces	- Understand the concept of generalized forces and their relation to generalized coordinates.	1. Lecture on generalized forces and their relationship to generalized coordinates. 2. Worked examples illustrating the calculation of generalized forces. 3. Discussion on real-world applications.	- Accuracy in calculating generalized forces and relating them to generalized coordinates. - Participation in discussions and examples.	Whiteboard, markers, textbooks

Real-World Applications:

- Analysis of mechanical systems in engineering, such as robotic arms, vehicles, and machinery.
- Dynamics of celestial bodies in astrophysics and space exploration.
- Study of molecular dynamics in chemistry and biology, such as protein folding and molecular interactions.

Note:

- Each session should include a mix of lectures, discussions, worked examples, and problem-solving activities.
- Assessment methods include participation, quizzes, problem-solving exercises, and application of concepts to real-world scenarios.
- Materials needed include whiteboards, markers, textbooks or reference materials on advanced mechanics, and additional resources for problem-solving exercises.

Sub Unit-1.2

Here's a tabular plan for a 10-hour lesson on Advanced Mechanics focusing on **Lagrangian mechanics, second kind Lagrange's equations of motion, cyclic coordinates, velocity-dependent potential, the principle of energy, and Rayleigh's dissipation function:**

Teacher: DEBABRATA JANA (DJ)

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
1	Introduction to Lagrangian Mechanics	- Understand the fundamentals of Lagrangian mechanics. - Introduce the concept of generalized coordinates and Lagrange's equations of motion.	1. Lecture on the principles of Lagrangian mechanics and the concept of generalized coordinates. 2. Derivation of Lagrange's equations of motion (second kind). 3. Examples illustrating the use of Lagrange's equations.	- Participation in discussions and questions. - Quiz to assess understanding of basic concepts.	Whiteboard, markers, projector
2-3	Lagrange's	- Learn to apply	1. Step-by-step explanation	- Accuracy and	Whiteboard,

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
	Equations of Motion	Lagrange's equations to solve problems in classical mechanics. - Understand the significance of Lagrange's equations in mechanics.	of Lagrange's equations and their derivation. 2. Guided practice sessions solving problems using Lagrange's equations. 3. Hands-on exercises applying Lagrange's equations to various systems and scenarios.	efficiency in solving problems using Lagrange's equations.	markers, textbooks
4	Cyclic Coordinates	- Understand the concept of cyclic coordinates and their significance in Lagrangian mechanics. - Learn to identify cyclic coordinates and exploit their properties to simplify problems.	1. Lecture on cyclic coordinates and their properties. 2. Discussion on identifying cyclic coordinates in different systems. 3. Examples demonstrating the use of cyclic coordinates to simplify Lagrangian problems.	- Ability to identify and apply cyclic coordinates to simplify Lagrangian problems.	Whiteboard, markers, textbooks
5-6	Velocity-Dependent Potential	- Introduce the concept of velocity-dependent potentials in Lagrangian mechanics. - Learn to handle systems with velocity-dependent potentials.	1. Lecture on velocity-dependent potentials and their effects on Lagrangian dynamics. 2. Derivation of Lagrange's equations with velocity-dependent potentials. 3. Examples demonstrating the application of Lagrange's equations to systems with velocity-dependent potentials.	- Accuracy in understanding and applying Lagrange's equations with velocity-dependent potentials.	Whiteboard, markers, textbooks
7-8	Principle of Energy	- Understand the principle of energy and its significance in Lagrangian mechanics. - Learn to derive and apply the principle of energy in solving mechanical problems.	1. Lecture on the principle of energy in Lagrangian mechanics. 2. Derivation of the principle of energy from Lagrange's equations. 3. Examples illustrating the application of the principle of energy to mechanical systems.	- Ability to derive and apply the principle of energy in Lagrangian mechanics.	Whiteboard, markers, textbooks
9-10	Rayleigh's Dissipation Function	- Introduce Rayleigh's dissipation function as a tool for analyzing dissipative systems. - Learn to incorporate	1. Lecture on Rayleigh's dissipation function and its role in Lagrangian mechanics. 2. Discussion on modeling dissipative systems using	- Ability to understand and apply Rayleigh's dissipation function to model dissipative	Whiteboard, markers, textbooks

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
		dissipative effects into Lagrangian mechanics using Rayleigh’s dissipation function.	Rayleigh’s dissipation function. 3. Examples demonstrating the incorporation of Rayleigh’s dissipation function into Lagrangian dynamics.	systems.	

Real-World Applications:

- Designing mechanical systems with complex dynamics, such as robots or spacecraft.
- Analyzing the behavior of systems subject to friction or other dissipative forces, like a car braking system or a swinging pendulum.
- Understanding the stability of structures under various loads and environmental conditions, such as bridges or buildings.

This comprehensive lesson plan aims to provide students with a thorough understanding of advanced mechanics concepts, emphasizing both theoretical understanding and practical application. It incorporates diverse teaching strategies, including lectures, guided practice, hands-on exercises, and real-world applications, to cater to different learning styles and ensure engagement and depth of understanding.

Unit-2

Sub Unit-2.1:

Here's a tabular plan for a 10-hour lesson on Advanced Mechanics focusing on **Action Integral, Hamilton’s Principle, Lagrange’s Equations, Hamilton’s Principle for non-holonomic systems, symmetry properties, conservation laws, and real-world applications:**

Teacher: DEBABRATA JANA (DJ)

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
1	Introduction to Action Integral and Hamilton’s Principle	- Understand the concepts of action integral and Hamilton’s principle. - Recognize the importance of variational methods in mechanics.	1. Lecture on the concept of action integral and its significance. 2. Explanation of Hamilton’s principle and its application in mechanics. 3. Discussion on the role of variational methods in advanced mechanics.	- Participation in discussions and questions. - Quiz to assess understanding of basic concepts.	Whiteboard, markers, projector
2	Lagrange’s Equations by	- Learn the derivation and	1. Lecture on Lagrange’s equations and their	- Accuracy in deriving	Whiteboard, markers,

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
	Variational Methods	application of Lagrange’s equations using variational methods. - Understand the advantages of Lagrangian mechanics over Newtonian mechanics.	derivation using variational methods. 2. Walkthrough of examples illustrating the use of Lagrange’s equations. 3. Hands-on practice with deriving Lagrange’s equations for simple mechanical systems.	Lagrange’s equations. - Ability to apply Lagrange’s equations to solve mechanical problems.	textbooks, paper
3-4	Hamilton’s Principle for Non-Holonomic Systems	- Understand the extension of Hamilton’s principle to non-holonomic systems. - Learn the application of Hamilton’s principle to solve mechanical problems with constraints.	1. Lecture on Hamilton’s principle for non-holonomic systems. 2. Discussion on the treatment of constraints in Hamiltonian mechanics. 3. Examples and demonstrations of solving problems involving non-holonomic systems using Hamilton’s principle.	- Ability to apply Hamilton’s principle to solve mechanical problems with constraints. - Accuracy in understanding and interpreting solutions.	Whiteboard, markers, textbooks, paper
5-6	Symmetry Properties and Conservation Laws	- Understand the relationship between symmetry properties and conservation laws in mechanics. - Learn how to derive and apply conservation laws using Noether’s theorem.	1. Lecture on symmetry properties, conservation laws, and Noether’s theorem. 2. Discussion on the connection between symmetries and conservation laws. 3. Derivation of conservation laws using Noether’s theorem. 4. Examples and applications of conservation laws in mechanics.	- Ability to identify and exploit symmetry properties to derive conservation laws. - Accuracy in applying conservation laws to analyze mechanical systems.	Whiteboard, markers, textbooks, paper
7-8	Real-World Applications	- Apply concepts learned to analyze real-world mechanical systems. - Understand the practical relevance of advanced mechanics in engineering and science.	1. Presentation of case studies and real-world examples involving the application of Lagrangian and Hamiltonian mechanics. 2. Group discussions on the analysis of mechanical systems in various fields. 3. Hands-on practice with solving problems and analyzing	- Ability to apply advanced mechanics concepts to solve real-world problems. - Analysis and presentation of findings from case studies.	Case study materials, projectors

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
			case studies.		
9-10	Review, Recap, and Assessment	- Review key concepts covered throughout the course. - Recap important theorems, principles, and their applications. - Conduct assessment to evaluate understanding and retention of material.	1. Review session covering key concepts, theorems, and principles. 2. Recap of important results and their applications. 3. Assessment in the form of a quiz, problem-solving exercise, or project. 4. Feedback and discussion on assessment results.	- Performance in assessment. - Ability to recall and apply key concepts and principles in advanced mechanics.	Whiteboard, markers, textbooks, paper

Note:

- Each session should include a combination of lectures, discussions, examples, problem-solving exercises, and real-world applications to cater to different learning styles.
- Assessment methods include participation, quizzes, problem-solving exercises, projects, and case study analysis.
- Materials needed include whiteboards, markers, projectors, textbooks, paper, and additional resources for problem-solving exercises and case studies.
    - **Sub Unit-2.2:**

Here's a tabular plan for a 10-hour lesson on Advanced Mechanics focusing on **Noether’s theorem, canonically conjugate coordinates and momenta, Legendre transformation, Routhian approach, and Hamiltonian:**

Teacher: DEBABRATA JANA (DJ)

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
1	Introduction to Advanced Mechanics and Noether’s Theorem	- Understand the importance of advanced mechanics in physics. - Introduce Noether’s theorem and its significance in classical mechanics.	1. Lecture on the foundations of advanced mechanics and its relevance in physics. 2. Explanation of Noether’s theorem and its applications. 3. Discussion on the physical implications of Noether’s theorem.	- Participation in discussions and questions. - Quiz to assess understanding of basic concepts.	Whiteboard, markers, projector
2-3	Canonically Conjugate Coordinates and Momenta	- Understand the concept of canonically conjugate coordinates and	1. Lecture on canonically conjugate coordinates and momenta. 2. Demonstration of	- Ability to identify and analyze canonically conjugate coordinates and	Whiteboard, markers

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
		momenta. - Explore their relationship in phase space.	examples illustrating the concept. 3. Group exercises to practice identifying and working with conjugate variables.	momenta. - Participation in group exercises.	
4-5	Legendre Transformation	- Learn about the Legendre transformation and its role in mechanics.	1. Lecture on the Legendre transformation and its applications. 2. Step-by-step demonstration of the transformation process. 3. Guided practice with problems involving Legendre transformations.	- Accuracy and understanding of Legendre transformations. - Ability to apply Legendre transformations to solve problems.	Whiteboard, markers, textbooks
6-7	Routhian Approach	- Introduce the Routhian approach to mechanics and its advantages.	1. Lecture on the Routhian approach and its principles. 2. Discussion on the advantages of using Routhian mechanics. 3. Examples illustrating the application of the Routhian approach.	- Ability to understand and apply the Routhian approach to mechanics problems. - Participation in discussions and analysis.	Whiteboard, markers, textbooks
8-9	Hamiltonian Mechanics	- Understand the concept of Hamiltonian mechanics and its relation to Lagrangian mechanics.	1. Lecture on Hamiltonian mechanics and its derivation from Lagrangian mechanics. 2. Explanation of Hamilton's equations. 3. Examples demonstrating the use of Hamiltonian mechanics.	- Understanding and application of Hamiltonian mechanics concepts. - Participation in problem-solving exercises.	Whiteboard, markers, textbooks
10	Real-World Applications and Review	- Apply concepts learned to real-world examples and scenarios. - Review key concepts covered throughout the course.	1. Presentation of real-world applications of advanced mechanics concepts. 2. Group discussions on the relevance and implications of these concepts. 3. Review session covering key concepts.	- Ability to apply advanced mechanics concepts to real-world situations. - Performance in review session.	Whiteboard, markers, textbooks

Note:

- Each session should include a mix of lectures, demonstrations, group discussions, and problem-solving exercises.
- Real-world applications should be emphasized throughout the course to demonstrate the practical relevance of advanced mechanics concepts.
- Assessment methods include participation, quizzes, problem-solving exercises, and review sessions.
- Materials needed include whiteboards, markers, projectors, textbooks, and additional resources for problem-solving exercises and real-world applications.

Unit-3

Here's a tabular plan for a 15-hour lesson on Advanced Mechanics focusing on Hamilton's equations from the variational principle, the Poincaré-Cartan integral invariant, the principle of stationary action, and Fermat's principle, along with real-world applications:

Teacher: DEBABRATA JANA (DJ)

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
1	Introduction to Variational Principles	- Understand the concept of variational principles in mechanics. - Recognize the importance of Hamilton's principle and the principle of stationary action.	1. Lecture on the historical development of variational principles in mechanics. 2. Explanation of Hamilton's principle and its significance. 3. Discussion on the principle of stationary action.	- Participation in discussions and questions. - Quiz to assess understanding of basic concepts.	Whiteboard, markers, projector
2-3	Hamilton's Equations from Variational Principle	- Derive Hamilton's equations from the variational principle. - Understand the significance of Hamilton's equations in classical mechanics.	1. Step-by-step derivation of Hamilton's equations from the principle of stationary action. 2. Explanation of the significance of Hamilton's equations in classical mechanics. 3. Examples illustrating the application of Hamilton's equations.	- Accuracy in understanding and applying Hamilton's equations.	Whiteboard, markers, textbooks

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
4-5	Poincaré-Cartan Integral Invariant	- Understand the concept of Poincaré-Cartan integral invariants. - Learn about their application in classical mechanics.	1. Lecture on the Poincaré-Cartan integral invariant and its properties. 2. Explanation of their application in classical mechanics. 3. Analysis of examples demonstrating the use of Poincaré-Cartan integral invariants.	- Ability to apply Poincaré-Cartan integral invariants to solve problems in mechanics.	Whiteboard, markers, textbooks
6-7	Principle of Stationary Action	- Understand the principle of stationary action and its relationship to Hamilton's principle. - Learn how to apply the principle of stationary action in mechanics.	1. Lecture on the principle of stationary action and its connection to Hamilton's principle. 2. Discussion on the physical interpretation of stationary action. 3. Examples demonstrating the application of the principle of stationary action.	- Accuracy and completeness of solutions obtained using the principle of stationary action.	Whiteboard, markers, textbooks
8-9	Fermat's Principle	- Understand Fermat's principle and its application in optics and classical mechanics. - Learn about the physical interpretation of Fermat's principle.	1. Lecture on Fermat's principle and its historical significance. 2. Explanation of the physical interpretation of Fermat's principle. 3. Examples illustrating the application of Fermat's principle in optics and classical mechanics.	- Ability to apply Fermat's principle to solve problems in optics and classical mechanics.	Whiteboard, markers, textbooks
10-11	Real-World Applications	- Apply principles learned to solve real-world problems in mechanics and optics. - Analyze case studies involving the application of variational principles.	1. Presentation of case studies involving the application of variational principles in mechanics and optics. 2. Group discussions and analysis of solutions. 3. Application of variational principles to solve problems and	- Ability to apply principles learned to solve real-world problems.	Whiteboard, markers, textbooks

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
			case studies.		
12-13	Advanced Topics and Case Studies	- Explore advanced topics related to variational principles in mechanics. - Analyze case studies involving complex applications of variational principles.	1. Lecture on advanced topics such as action-angle variables or Hamilton-Jacobi theory. 2. Presentation of case studies involving complex applications of variational principles. 3. Group discussions and analysis of solutions.	- Ability to understand and apply advanced concepts in mechanics.	Whiteboard, markers, textbooks
14-15	Project Work and Presentations	- Apply knowledge and skills acquired to solve a larger problem or case study. - Develop presentation and communication skills. - Receive feedback on project work and presentations.	1. Assignment of individual or group projects involving the application of variational principles. 2. Project work under guidance and supervision. 3. Preparation and delivery of presentations on project findings. 4. Feedback and discussion on project presentations.	- Quality of project work and presentations. - Demonstration of understanding and application of variational principles. - Participation and engagement in project presentations.	Project materials, presentation tools

Note:

- Each session should include a mix of lectures, discussions, examples, problem-solving exercises, and case studies.
- Assessment methods include participation, quizzes, problem-solving exercises, project work, and presentations.
- Materials needed include whiteboards, markers, projectors, textbooks or reference materials on advanced mechanics, and additional resources for problem-solving exercises and case studies.

Unit-4

Sub Unit-4.1

Here's a tabular plan for a 10-hour lesson on Advanced Mechanics focusing on Canonical Transformations, Generating Functions, Poisson Brackets, Equations of Motion, and Action-Angle Variables, along with real-world applications:

Teacher: DEBABRATA JANA (DJ)

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
1	Introduction to Canonical Transformations	- Understand the concept of canonical transformations and their importance in classical mechanics. - Learn about the preservation of Hamiltonian dynamics under canonical transformations.	1. Lecture on canonical transformations and their significance. 2. Introduction to the concept of generating functions. 3. Discussion on the preservation of Hamiltonian dynamics. 4. Examples illustrating canonical transformations and their properties.	- Participation in discussions and questions. - Quiz to assess understanding of basic concepts.	Whiteboard, markers, projector
2-3	Generating Functions	- Understand the role of generating functions in generating canonical transformations. - Learn how to construct and use generating functions.	1. Detailed explanation of generating functions and their use in canonical transformations. 2. Step-by-step demonstration of constructing generating functions. 3. Hands-on practice with generating functions and their application to derive canonical transformations.	- Accuracy in constructing and applying generating functions. - Participation in practical exercises.	Whiteboard, markers
4-5	Poisson Brackets	- Understand the concept of Poisson brackets and their role in classical mechanics. - Learn about the properties and algebraic structure of Poisson brackets.	1. Lecture on Poisson brackets and their properties. 2. Discussion on the algebraic structure of Poisson brackets. 3. Examples illustrating the use of Poisson brackets in classical mechanics. 4. Group exercises to practice calculating and	- Ability to calculate and apply Poisson brackets correctly. - Participation in group exercises and discussions.	Whiteboard, markers

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
			applying Poisson brackets.		
6-7	Equations of Motion	- Understand how canonical transformations and Poisson brackets are used to derive equations of motion in Hamiltonian mechanics. - Learn about the Hamilton-Jacobi equation and its significance.	1. Lecture on deriving equations of motion using canonical transformations and Poisson brackets. 2. Introduction to the Hamilton-Jacobi equation. 3. Discussion on the significance of the Hamilton-Jacobi equation. 4. Examples demonstrating the derivation of equations of motion.	- Understanding of the derivation process and significance of the Hamilton-Jacobi equation. - Ability to apply concepts to derive equations of motion.	Whiteboard, markers
8-9	Action-Angle Variables	- Understand the concept of action-angle variables and their role in integrable systems. - Learn how to find action-angle variables using the Hamilton-Jacobi theory.	1. Lecture on action-angle variables and their significance in integrable systems. 2. Step-by-step demonstration of finding action-angle variables using the Hamilton-Jacobi theory. 3. Group exercises to practice finding action-angle variables for various systems.	- Accuracy in finding action-angle variables using the Hamilton-Jacobi theory. - Participation in group exercises and discussions.	Whiteboard, markers
10	Real-World Applications and Wrap-Up	- Apply concepts learned to real-world problems in mechanics. - Review key concepts covered in the course.	1. Presentation of real-world applications of canonical transformations, Poisson brackets, and action-angle variables. 2. Group discussions and analysis of applications. 3. Review session covering key concepts and their applications.	- Ability to apply concepts to real-world problems. - Participation and engagement in discussions.	Whiteboard, markers, projector

Note:

- Each session should include a mix of lectures, discussions, examples, hands-on exercises, and real-world applications.
- Assessment methods include participation, quizzes, problem-solving exercises, and analysis of real-world applications.
- Materials needed include whiteboards, markers, projectors, textbooks or reference materials on advanced mechanics, and additional resources for hands-on exercises and real-world applications.

Sub Unit-4.2:

Here's a tabular plan for a 10-hour lesson on Advanced Mechanics focusing on Canonical Transformation, Generating Functions, Poisson Brackets, Equations of Motion, and Action-Angle Variables:

Teacher: DEBABRATA JANA (DJ)

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
1	Introduction to Canonical Transformations	- Understand the concept of canonical transformations and their significance in classical mechanics. - Recognize the role of generating functions in defining canonical transformations. - Learn the basic properties and examples of canonical transformations.	1. Lecture on the fundamentals of canonical transformations. 2. Discussion on the importance and applications of canonical transformations. 3. Introduction to generating functions and their role in defining canonical transformations.	- Participation in discussions and questions. - Quiz to assess understanding of basic concepts.	Whiteboard, markers, projector
2-3	Generating Functions	- Understand the concept of generating functions and their role in defining canonical transformations. - Learn how to use generating functions to perform canonical transformations.	1. Explanation of generating functions and their properties. 2. Derivation of canonical transformations using generating functions. 3. Step-by-step examples demonstrating the use of generating functions.	- Accuracy in understanding and applying generating functions to perform canonical transformations. - Participation in practical exercises.	Whiteboard, markers, textbook, paper
4	Poisson Brackets	- Understand the concept of Poisson brackets and their importance in classical mechanics.	1. Lecture on the definition and properties of Poisson brackets. 2. Discussion on the	- Ability to understand and apply properties of Poisson brackets. - Accuracy in	Whiteboard, markers, textbook, paper

Session Number	Session Title	Objectives	Instructional Activities	Assessment	Materials Needed
		  - Learn the properties and algebraic rules of Poisson brackets.	role of Poisson brackets in Hamiltonian mechanics. 3. Derivation of equations of motion using Poisson brackets.	deriving equations of motion using Poisson brackets.	
5-6	Equations of Motion	- Understand how to derive and solve equations of motion using Hamilton's equations. - Learn how to use canonical transformations to simplify the equations of motion.	1. Explanation of Hamilton's equations and their significance. 2. Derivation of equations of motion using Hamilton's equations. 3. Application of canonical transformations to simplify equations of motion.	- Accuracy and completeness of solutions to equations of motion. - Ability to apply canonical transformations to simplify equations.	Whiteboard, markers, textbook, paper
7-8	Action-Angle Variables	- Understand the concept of action-angle variables and their importance in integrable systems. - Learn how to find action-angle variables for Hamiltonian systems.	1. Lecture on action-angle variables and their significance. 2. Introduction to the concept of integrable systems. 3. Derivation of action-angle variables for simple Hamiltonian systems.	- Ability to understand and apply concepts of action-angle variables. - Accuracy in deriving action-angle variables for Hamiltonian systems.	Whiteboard, markers, textbook, paper
9-10	Real-world Applications	- Apply concepts learned to real-world problems in classical mechanics. - Analyze case studies involving canonical transformations, Poisson brackets, and action-angle variables.	1. Presentation of case studies involving the application of canonical transformations, Poisson brackets, and action-angle variables. 2. Group discussions and analysis of solutions. 3. Application of concepts to solve problems and case studies.	- Ability to apply concepts learned to solve real-world problems. - Analysis and presentation of findings from case studies. - Participation and engagement in case study analysis and discussions.	Case study materials, projector

Note:

- Each session should include a mix of lectures, discussions, derivations, examples, and problem-solving exercises.
- Assessment methods include participation, quizzes, problem-solving exercises, and case study analysis.
- Materials needed include whiteboards, markers, textbooks, paper, and projectors for presenting case studies and examples.

Teaching Plan for Mathematics - Semester 1

Semester	Course Type	Course Name	Unit / Teacher's Name	Sub Unit Name	Total No. of Classes	No. of Lesson Plans	Month	No. of Classes per Sub Unit	Total Marks
1	Core Course-CC1/GE1	Mathematics - CC1/GE1	Algebra-I / [Teacher's Name:DJ]	Complex Numbers	10	3	[Sep to Feb]	3	15
				Polynomials		3	[Sep to Feb	3	
				Matrix Rank		4	[Sep to Feb	4	
1	Core Course-CC1/GE1	Mathematics - CC1/GE1	Differential Calculus-I / [Teacher's Name:SB]	Functions and Limits	20	7	[Sep to Feb]	7	25
				Continuity and Derivatives		7	[Sep to Feb	7	
				Applications of Derivatives		6	[Sep to Feb	6	
1	Core Course-CC1/GE1	Mathematics - CC1/GE1	Differential Equation-I / [Teacher's Name:URM]	Ordinary Differential Equations	10	5	[Sep to Feb]	5	15
				First Order and Second Order Equations		5	[Sep to Feb	5	
1	Core Course-CC1/GE1	Mathematics - CC1/GE1	Coordinate Geometry / [Teacher's Name:GB]	Transformations and General Equations	20	10	[Sep to Feb]	10	25
				Conics and Polar Coordinates		10	[Sep to Feb	10	

Explanation:

- **Total No. of Classes**: Distributed based on the significance and depth of each sub-unit within each unit.
- **No. of Lesson Plans**: Represents the breakdown of each sub-unit into manageable teaching segments.
- **No. of Classes per Sub Unit**: Proportional distribution of total classes allocated to each unit among its sub-units.
- **Total Marks**: Indicative of the weightage each unit carries in the overall assessment structure of the course.

Teaching Plan for Mathematics - Semester 2

Semester	Course Type	Course Name	Unit / Teacher's Name	Sub Unit Name	Total No. of Classes	No. of Lesson Plans	Month	No. of Classes per Sub Unit	Total Marks
2	Core Course-CC2/GE2	Mathematics - CC2/GE2	Differential Calculus-II / [Teacher's Name:SB]	Sequence and Series	15	4	[May to July]	4	20
				Limit Theorems		3	[May to July]	3	
				Rolle’s and Mean Value Theorems		4	[May to July]	4	
				Applications of Calculus		4	[May to July]	4	
2	Core Course-CC2/GE2	Mathematics - CC2/GE2	Differential Equation-II / [Teacher's Name:URM]	First Order Linear Equations	10	3	[May to July]	3	15
				Higher Order Linear Equations		3	[May to July]	3	
				Applications of Differential Equations		4	[May to July]	4	
2	Core Course-CC2/GE2	Mathematics - CC2/GE2	Vector Algebra / [Teacher's Name:PG]	Basic Vector Operations	10	3	[May to July]	3	15
				Products and Applications		4	[May to July]	4	
				Geometric Applications		3	[May to July]	3	
2	Core Course-CC2/GE2	Mathematics - CC2/GE2	Discrete Mathematics / [Teacher's Name:GB]	Principles of Mathematical Induction	25	6	[May to July]	6	30
				Congruences and Their Applications		7	[May to July]	7	
				Boolean Algebra and Applications		6	[May to July]	6	
				Graph Theory Applications		6	[May to July]	6	

Teaching Plan for Mathematics - Semester 3

Semester	Course Type	Course Name	Unit / Teacher's Name	Sub Unit Name	Total No. of Classes	No. of Lesson Plans	Month	No. of Classes per Sub Unit	Total Marks
3	Core Course-CC3/GE3	Mathematics - CC3/GE3	Integral Calculus / [Teacher's Name:SB]	Definite Integrals	10	3	[Sep to Feb]	3	20
				Limit as Sum and Reduction Formulas		3	[Sep to Feb]	3	
				Applications of Integrals		4	[Sep to Feb]	4	
3	Core Course-CC3/GE3	Mathematics - CC3/GE3	Numerical Methods / [Teacher's Name:URM]	Approximation and Errors	25	5	[Sep to Feb]	5	30
				Interpolation Techniques		6	[Sep to Feb]	6	
				Numerical Integration		7	[Sep to Feb]	7	
				Numerical Solutions of Equations		7	[Sep to Feb]	7	
3	Core Course-CC3/GE3	Mathematics - CC3/GE3	Linear Programming / [Teacher's Name:PG]	Linear Programming Problems	25	6	[Sep to Feb]	6	30
				Formulation and Graphical Methods		6	[Sep to Feb]	6	
				Simplex Method and Duality		7	[Sep to Feb]	7	
				Applications of Linear Programming		6	[Sep to Feb]	6	

Explanation:

- **Total No. of Classes**: The distribution of classes for each sub-unit is designed to provide enough time for both teaching and in-depth exploration of each topic.
- **No. of Lesson Plans**: Each sub-unit includes a number of lesson plans that are tailored to cover the topic comprehensively.
- **No. of Classes per Sub Unit**: Allocated based on the estimated time required to effectively cover the material in each sub-unit.
- **Total Marks**: Reflects the weightage assigned to each unit for assessment purposes, aligning with the depth and breadth of the material covered.

Teaching Plan for Mathematics - Semester 4

Semester	Course Type	Course Name	Unit / Teacher's Name	Sub Unit Name	Total No. of Classes	No. of Lesson Plans	Month	No. of Classes per Sub Unit	Total Marks
4	Core Course-CC4/GE4	Mathematics - CC4/GE4	Algebra-II / [Teacher's Name:PG]	Group Theory	10	3	[April-June]	3	20
				Ring, Field, and Vector Spaces		4	[April-June]	4	
				Applications in Algebra		3	[April-June]	3	
4	Core Course-CC4/GE4	Mathematics - CC4/GE4	Computer Science & Programming / [Teacher's Name:URM]	History and Basics of Computing	25	6	[April-June]	6	30
				Programming Fundamentals		7	[April-June]	7	
				Data Structures and Algorithms		6	[April-June]	6	
				Applications of Programming		6	[April-June]	6	
4	Core Course-CC4/GE4	Mathematics - CC4/GE4	Probability & Statistics / [Teacher's Name:DJ]	Probability Theory	25	6	[April-June]	6	30
				Statistical Methods		7	[April-June]	7	
				Statistical Inference		6	[April-June]	6	
				Applications in Statistics		6	[April-June]	6	

Explanation:

- Total No. of Classes: Each unit has classes allocated based on the complexity and depth of each topic.
- No. of Lesson Plans: Represents the detailed breakdown of the content into manageable teaching segments for effective delivery.
- No. of Classes per Sub Unit: This is the distribution of the total classes allocated to each unit among its sub-units based on the required depth of study and importance.
- Total Marks: Indicates the weightage each unit carries in the overall assessment structure of the course.

Teaching Plan for C Programming Language - Semester 3

Semester	Course Type	Course Name	Unit / Teacher's Name	Sub Unit Name	Total No. of Classes	No. of Lesson Plans	Month	No. of Classes per Sub Unit	Total Marks
3	Skill Enhancement Course-SEC A	C Programming Language	Overview of C / [Teacher's Name:URM]	Computer Overview and C History	30	3	[Sep to Feb]	3	80
				Data Types, Constants, and Variables		4	[Sep to Feb]	4	
				Operators and Expressions		3	[Sep to Feb]	3	
				Decision Making and Branching		4	[Sep to Feb]	4	
				Control Statements		3	[Sep to Feb]	3	
			Programming Constructs / [Teacher's Name:URM]	Arrays		4	[Sep to Feb]	4	
				Functions		4	[Sep to Feb]	4	
				Introduction to Library Functions		5	[Sep to Feb]	5	

Explanation:

- **Total No. of Classes**: 30 classes are distributed to provide a thorough understanding of basic to intermediate C programming concepts.
- **No. of Lesson Plans**: Each sub-unit has a set number of lesson plans designed to cover all critical aspects.
- **No. of Classes per Sub Unit**: Classes are allocated based on the complexity and foundational importance of each topic.
- **Total Marks**: Indicates the course's overall grading system with a focus on practical and theoretical understanding.

Teaching Plan for Mathematical Logic - Semester 4

Semester	Course Type	Course Name	Unit / Teacher's Name	Sub Unit Name	Total No. of Classes	No. of Lesson Plans	Month	No. of Classes per Sub Unit	Total Marks
4	Skill Enhancement Course-SEC B	Mathematical Logic	Unit 1: Introduction to Mathematical Logic / [Teacher's Name:URM]	Propositions and Truth Tables	30	3	[April-June]	3	80
				Logical Connectives and Structures		4	[April-June]	4	
				Implications and Biconditional		3	[April-June]	3	
4	Skill Enhancement Course-SEC B	Mathematical Logic	Unit 2: Propositional Logic / [Teacher's Name:URM]	Formal Theory and Derivation		6	[April-June]	6	
				Normal Forms and Semantics		4	[April-June]	4	
				Logical Consequence and Consistency		5	[April-June]	5	
4	Skill Enhancement Course-SEC B	Mathematical Logic	Unit 3: Predicate Logic / [Teacher's Name:URM]	Symbolization and First Order Language		5	[April-June]	5	
				Models, Validity, and Satisfiability		4	[April-June]	4	
				Derivations and Theorems		6	[April-June]	6	

Explanation:

- **Total No. of Classes**: 30 classes are appropriately distributed to ensure deep and comprehensive coverage of each sub-topic in mathematical logic.
- **No. of Lesson Plans**: Each sub-unit within the three major units is structured with lesson plans that are crafted to address specific learning outcomes and cover theoretical foundations as well as practical applications.
- **No. of Classes per Sub Unit**: The distribution of classes reflects the complexity and educational value of each topic, ensuring adequate time for discussion, practice, and mastery.
- **Total Marks**: Represents the assessment structure, focusing on evaluating understanding and application of mathematical logic principles.

Teaching Plan for Particle Dynamics - Semester 5

Semester	Course Type	Course Name	Unit / Teacher's Name	Sub Unit Name	Total No. of Classes	No. of Lesson Plans	Month	No. of Classes per Sub Unit	Total Marks
5	Discipline Specific Elective-DSE-A	Particle Dynamics	Unit 1: Kinematics of a Particle / [Teacher's Name :DJ]	Velocity and Acceleration	15	5	[Sept - Jan]	5	65
				Rectangular and Polar Coordinates		5	[Sept - Jan]	5	
				Tangential and Normal Components		5	[Sept - Jan]	5	
5	Discipline Specific Elective-DSE-A	Particle Dynamics	Unit 2: Dynamics of a Particle / [Teacher's Name:DJ]	Newton's Laws of Motion	15	5	[Sept - Jan]	5	
				Work, Power, and Energy		5	[Sept - Jan]	5	
				Conservation of Energy and Momentum		5	[Sept - Jan]	5	
5	Discipline Specific Elective-DSE-A	Particle Dynamics	Unit 3: Advanced Particle Dynamics / [Teacher's Name:DJ]	Motion Under Constant and Variable Forces	15	5	[Sept - Jan]	5	
				Simple Harmonic Motion and Damped Oscillations		5	[Sept - Jan]	5	
				Energy Equations and Conservative Forces		5	[Sept - Jan]	5	
5	Discipline Specific Elective-DSE-A	Particle Dynamics	Unit 4: Two-Dimensional Motion / [Teacher's Name:DJ]	Projectiles and Resistive Forces	10	3	[Sept - Jan]	5	
				Motion Under Radial Forces		2	[Sept - Jan]	5	
5	Discipline Specific Elective-DSE-A	Particle Dynamics	Unit 5: Orbital Mechanics / [Teacher's Name:DJ]	Central Orbits and Kepler's Laws	5	2	[Sept - Jan]	2	
				Motion Under Inverse Square Law		2	[Sept - Jan]	3	

Explanation:

- **Total No. of Classes**: Allocated based on the complexity of topics and the sub-unit requirements, with a total of 60 classes distributed as per the suggested hours.
- **No. of Lesson Plans**: Each sub-unit has a specified number of lesson plans that are structured to comprehensively cover the topic and achieve specific learning outcomes.
- **No. of Classes per Sub Unit**: Reflects an evenly distributed workload based on the complexity and depth required for effective learning of each topic.
- **Total Marks**: Indicates the grading distribution focusing on practical application and understanding of dynamics principles.

Teacher's Name	
PG	DR. PAYEL GHOSH
URM	UTTAM ROY MANDAL
GB	GOUTAM BAIDYA
DJ	DEBADRATA JANA
SB	SWADHIN BANERJEE

Teaching Plan for Advanced Calculus - Semester 6

Semester	Course Type	Course Name	Unit / Teacher's Name	Sub Unit Name	Total No. of Classes	No. of Lesson Plans	Month	No. of Classes per Sub Unit	Total Marks
6	Discipline Specific Elective-DSE-B	Advanced Calculus	Unit 1: Convergence and Power Series / [Teacher's Name:DJ]	Point-wise and Uniform Convergence	30	10	[Feb-June]	10	65
				Properties of Uniformly Convergent Series		10	[Feb-June]	10	
				Power Series and Applications		10	[Feb-June]	10	
6	Discipline Specific Elective-DSE-B	Advanced Calculus	Unit 2: Fourier Series / [Teacher's Name :DJ]	Periodic Functions and Fourier Coefficients	15	5	[Feb-June]	7	
				Convergence Theorems for Fourier Series		5	[Feb-June]	8	
6	Discipline Specific Elective-DSE-B	Advanced Calculus	Unit 3: Laplace Transforms / [Teacher's Name: DJ]	Laplace Transform Techniques	15	5	[Feb-June]	7	
				Applications to Differential Equations		5	[Feb-June]	8	

Explanation:

- **Total No. of Classes**: Carefully allocated to reflect the complexity of each topic within the units, with a focus on detailed exploration and understanding.
- **No. of Lesson Plans**: Each sub-unit is designed to include several lesson plans, ensuring comprehensive coverage of all topics and theories.
- **No. of Classes per Sub Unit**: Distributed to provide ample time for thorough explanations, problem-solving sessions, and student inquiries.
- **Total Marks**: Reflects the course's assessment structure, which focuses on evaluating students' comprehension and application of advanced calculus principles.

Teaching Plan for MATH-H-CC1-1-Th: Calculus, Geometry & Vector Analysis

Semester: 1

- **Course Type:** 4 Year/3 Year
- **Course Name:** MATH-H-CC1-1-Th
- **Course Details:** Calculus, Geometry & Vector Analysis
- **Credits:** 4

Group Name / Teacher's Name	Sub Unit Name	Total No. of Classes	No. of Lesson Plan	Month	No. of Classes	Marks
Group A: Calculus		**16**				**20**
As per Syllabus / DJ	Differentiability and Hyperbolic Functions	4	1	Sep	4	
	Reduction Formulas	4	1	Sep	4	
	Parametric Equations and Arc Length	4	1	Oct	4	
	Area and Volume of Revolution	4	1	Nov	4	
Group B: Geometry		**28**				**35**
As per Syllabus / GB	Rotation of Axes and Conics	9	1	Sep	9	
	Spheres and Cylindrical Surfaces	9	1	Oct-Nov	9	
	Central Conicoids and Quadrics	10	1	Dec-Jan	10	
Group C: Vector Analysis		**16**				**20**
As per Syllabus / PG	Triple Product and Vector Equations	5	1	Sep	5	
	Applications to Geometry and Mechanics	6	1	Oct-Nov	6	
	Differentiation and Integration of Vector Functions	5	1	Dec	5	

Explanation:

- **Group Name / Teacher's Name:** Each group is managed by a designated teacher as per syllabus.
- **Sub Unit Name:** Reflects the content that each sub-unit will cover.
- **Total No. of Classes:** Indicates the total classes devoted to each group and distributed across the sub-units.
- **No. of Lesson Plan:** Every sub-unit has one lesson plan designed to cover all the topics within the designated number of classes.
- **Month:** The specific month for the classes can be inserted based on the academic calendar.
- **No. of Classes:** Each sub-unit's class distribution is tailored to ensure comprehensive coverage of the subject matter.
- **Marks:** Highlight the group's contribution to the overall course assessment.

Here is a comprehensive lesson plan based on the syllabus provided for the course "Calculus, Geometry & Vector Analysis." This plan includes a detailed breakdown for each sub-unit within the three main groups (A, B, and C) identified in the course structure.

Comprehensive Lesson Plan for MATH-H-CC1-1-Th

Semester: 1

- **Course Type:** 4 Year/3 Year
- **Course Name:** MATH-H-CC1-1-Th
- **Course Details:** Calculus, Geometry & Vector Analysis
- **Credits:** 4
- **Group Name / Teacher's Name:** [Insert Teacher's Name Here]

Group A: Calculus

Total Marks: 20
Total No. of Classes: 16

Sub Unit 1: Differentiability and Hyperbolic Functions

- **Total Classes: 4**
- **Lesson Plan Objective:**
  - Understand the concept of differentiability at a point and over an interval.
  - Learn to differentiate hyperbolic functions and apply higher order derivatives.
  - Explore the applications of Leibnitz's rule to specific function types.
- **Activities:**
  - Lecture on differentiability, including graphical interpretation and significance.
  - Interactive problem-solving session focusing on hyperbolic functions.
  - Group activities to derive and apply Leibnitz's rule to example problems.
- **Assessment:**
  - Quiz covering differentiability and hyperbolic functions.
  - Homework assignment involving practical applications of Leibnitz's rule.

Sub Unit 2: Reduction Formulas

- **Total Classes: 4**
- **Lesson Plan Objective:**
  - Master the derivation and use of various reduction formulas in integrals.
- **Activities:**
  - Demonstrations on deriving key reduction formulas.

  - Students practice on the blackboard to solidify understanding and technique.
- **Assessment:**
  - Class exercises on applying reduction formulas to solve integral problems.
  - Short test on reduction formulas at the end of the unit.

Sub Unit 3: Parametric Equations and Arc Length

- **Total Classes: 4**
- **Lesson Plan Objective:**
  - Understand parametric equations and their applications.
  - Calculate the arc length of parametric curves.
- **Activities:**
  - Lecture with visual aids to explain the concept of parametrization.
  - Hands-on activities to calculate arc length using integral calculus.
- **Assessment:**
  - Practical problems on parametric equations and arc length in class.
  - Group project on real-world applications of parametric curves.

Sub Unit 4: Area and Volume of Revolution

- **Total Classes: 4**
- **Lesson Plan Objective:**
  - Learn to calculate areas and volumes of shapes formed by revolving curves around axes.
- **Activities:**
  - Interactive lecture using models and animations to demonstrate the concept.
  - Students work through examples in class, deriving and solving relevant integrals.
- **Assessment:**
  - Classwork focused on problem-solving.
  - A project that involves calculating the area and volume of a complex shape.

Group B: Geometry

Total Marks: 35
Total No. of Classes: 28

Sub Unit 1: Rotation of Axes and Conics

- **Total Classes: 9**
- **Lesson Plan Objective:**
  - Understand the rotation of axes and its effects on the equation of conics.
  - Classify conics using discriminants and reduction to canonical form.
- **Activities:**

    - Interactive demonstrations on axis rotation.
    - Group exercises to classify conics and derive properties.
- **Assessment:**
    - Practical test on identifying and transforming equations of conics.

Sub Unit 2: Spheres and Cylindrical Surfaces

- **Total Classes: 9**
- **Lesson Plan Objective:**
    - Explore the geometry of spheres and cylindrical surfaces.
    - Apply geometric principles to identify and solve problems involving these surfaces.
- **Activities:**
    - Visual presentations and 3D models for better understanding.
    - Class exercises involving real-world geometric problems.
- **Assessment:**
    - Group presentations on assigned geometric figures and their properties.

Sub Unit 3: Central Conicoids and Quadrics

- **Total Classes: 10**
- **Lesson Plan Objective:**
    - Identify and classify various quadric surfaces.
    - Understand plane sections and generating lines of conicoids.
- **Activities:**
    - Use of software tools to visualize and manipulate quadric surfaces.
    - Student-led demonstrations of plane sections.
- **Assessment:**
    - Written test on the properties and classification of quadric surfaces.
    - Final project involving the comprehensive study of a specific quadric shape.

Group C: Vector Analysis

Total Marks: 20
Total No. of Classes: 16

Sub Unit 1: Triple Product and Vector Equations

- **Total Classes: 5**
- **Lesson Plan Objective:**
    - Master the calculations and applications of the scalar and vector triple products.
- **Activities:**
    - Lecture on vector products with graphical aids.

  - In-class activities to solve problems using vector equations in physics.
- **Assessment:**
  - Quiz on vector algebra and its applications to real-world problems.

Sub Unit 2: Applications to Geometry and Mechanics

- **Total Classes: 6**
- **Lesson Plan Objective:**
  - Apply vector analysis to solve problems in geometry and mechanics.
- **Activities:**
  - Problem-solving sessions focused on mechanics.
  - Application projects involving vector solutions in engineering.
- **Assessment:**
  - Practical test involving vector mechanics.
  - Peer review of application projects.

Sub Unit 3: Differentiation and Integration of Vector Functions

- **Total Classes: 5**
- **Lesson Plan Objective:**
  - Learn the differentiation and integration of vector functions.
- **Activities:**
  - Detailed lecture sessions with step-by-step problem-solving.
  - Hands-on practice sessions with guidance from the instructor.
- **Assessment:**
  - A comprehensive test covering all aspects of vector calculus.

Teaching Plan for MATH-H-CC2-2-Th: Basic Algebra

Semester: II

- **Course Type:** 4 Year/3 Year
- **Course Name:** MATH-H-CC2-2-Th
- **Course Details:** Basic Algebra
- **Credits:** 4

Group Name / Teacher's Name	Sub Unit Name	Total No. of Classes	No. of Lesson Plan	Month	No. of Classes	Marks
Group A: Complex Numbers and Equations		**20**				**25**
As per Syllabus / DJ	Polar Representation and n-th Roots	7	1	May-July	7	
	De Moivre’s Theorem and Applications	7	1	July-August	7	
	Inequalities and Their Applications	6	1	August-Sep	6	
Group B: Relations and Mappings		**20**				**25**
As per Syllabus / URM	Equivalence Relations and Classes	7	1	May-July	7	
	Partial Orders and Posets	7	1	July-August	7	
	Mapping and Operations	6	1	August-Sep	6	
Group C: Linear Systems and Vector Spaces		**20**				**25**
As per Syllabus / PG	Systems of Linear Equations	7	1	May-July	7	
	Matrix Operations	7	1	July-	7	

Group Name / Teacher's Name	Sub Unit Name	Total No. of Classes	No. of Lesson Plan	Month	No. of Classes	Marks
	and Rank			August		
	Linear Independence and Vector Spaces	6	1	August-Sep	6	

Based on the teaching plan for the course "Basic Algebra" (MATH-H-CC2-2-Th) and the detailed breakdown provided in the syllabus, here is a comprehensive lesson plan for each sub-unit within the three groups:

Comprehensive Lesson Plan for MATH-H-CC2-2-Th: Basic Algebra

Semester: II

- **Course Type:** 4 Year/3 Year
- **Course Name:** MATH-H-CC2-2-Th
- **Course Details:** Basic Algebra
- **Credits:** 4
- **Group Name / Teacher's Name:** [Insert Teacher's Name Here]

Group A: Complex Numbers and Equations

Total Marks: 25
Total No. of Classes: 20

Sub Unit 1: Polar Representation and n-th Roots

- **Total Classes: 7**
- **Lesson Plan Objective:**
  - Understand and apply the polar representation of complex numbers.
  - Explore the concept and calculation of n-th roots of unity.
- **Activities:**
  - Lecture on the geometric and algebraic interpretation of polar coordinates.
  - Hands-on exercises converting complex numbers to/from polar form.
- **Assessment:**
  - Quiz on polar forms and n-th roots.
  - Homework problems involving complex equations and polar representations.

Sub Unit 2: De Moivre's Theorem and Applications

- **Total Classes: 7**
- **Lesson Plan Objective:**
  - Master De Moivre's Theorem and its application to complex numbers.
  - Solve complex number problems using De Moivre's Theorem.
- **Activities:**
  - Interactive lecture demonstrating De Moivre's Theorem.
  - Group activities to apply the theorem to solve real-world problems.
- **Assessment:**
  - Class exercises focusing on the theorem's applications.
  - Group presentation of a complex problem solved using the theorem.

Sub Unit 3: Inequalities and Their Applications

- **Total Classes: 6**
- **Lesson Plan Objective:**
  - Understand various inequalities involving complex numbers and their proofs.
- **Activities:**
  - Discussion on AM-GM and other relevant inequalities.
  - Problem-solving session applying inequalities to optimization problems.
- **Assessment:**
  - In-class test on inequalities.
  - Problem set that applies inequalities to complex scenarios.

Group B: Relations and Mappings

Total Marks: 25
Total No. of Classes: 20

Sub Unit 1: Equivalence Relations and Classes

- **Total Classes: 7**
- **Lesson Plan Objective:**
  - Define and provide examples of equivalence relations.
  - Understand the concept of equivalence classes and partitions.
- **Activities:**
  - Lecture on the theory behind equivalence relations.
  - Class discussions on examples and counterexamples.
- **Assessment:**
  - Short quiz on identifying and proving equivalence relations.
  - Assignment on creating equivalence classes for given sets.

Sub Unit 2: Partial Orders and Posets

- **Total Classes: 7**
- **Lesson Plan Objective:**
  - Understand and identify partial orders and posets.
  - Explore applications of partial orders in data structures and algorithms.
- **Activities:**
  - Lecture with visual aids to explain posets.
  - Practical exercises involving sorting algorithms and lattice structures.
- **Assessment:**
  - Practical problems involving the application of posets.
  - A project on implementing a data structure using posets.

Sub Unit 3: Mapping and Operations

- **Total Classes: 6**
- **Lesson Plan Objective:**
  - Study different types of mappings and their properties.
  - Explore set operations and their implications on mappings.
- **Activities:**
  - Demonstrations on functions, injectivity, surjectivity, and bijectivity.
  - Hands-on mapping exercises to reinforce concepts.
- **Assessment:**
  - Written test covering functions and mappings.
  - Application-based homework on mappings in programming and mathematics.

Group C: Linear Systems and Vector Spaces

Total Marks: 25
Total No. of Classes: 20

Sub Unit 1: Systems of Linear Equations

- **Total Classes: 7**
- **Lesson Plan Objective:**
  - Solve systems of linear equations using various methods.
  - Analyze the conditions for unique solutions or multiple solutions.
- **Activities:**
  - Lectures on Gaussian elimination and matrix methods.
  - Group work on solving linear systems graphically and algebraically.
- **Assessment:**
  - Class exercise on solving diverse systems of equations.
  - A comprehensive test on methods of solving linear equations.

Sub Unit 2: Matrix Operations and Rank

- **Total Classes: 7**
- **Lesson Plan Objective:**
    - Master basic and advanced matrix operations.
    - Understand the concept of matrix rank and its implications.
- **Activities:**
    - Interactive sessions on matrix multiplication, inverses, and rank.
    - Practical applications involving systems of equations and transformations.
- **Assessment:**
    - Quiz on matrix operations.
    - Group project involving the use of matrices in real-world applications.

Sub Unit 3: Linear Independence and Vector Spaces

- **Total Classes: 6**
- **Lesson Plan Objective:**
    - Define and explore the concept of linear independence.
    - Examine the structure and utility of vector spaces in mathematics.
- **Activities:**
    - Lecture on basis, dimension, and subspaces.
    - Hands-on activities creating and analyzing vector spaces.
- **Assessment:**
    - In-class activities to assess understanding of vector spaces.
    - End-of-unit project on the application of vector spaces in theoretical and practical problems.

Teaching Plan for MATH-H-SEC1-1-Th: C Language with Mathematical Applications

Semester: I

- **Course Type:** 4 Year/3 Year
- **Course Name:** MATH-H-SEC1-1-Th
- **Course Details:** C Language with Mathematical Applications
- **Credits:** 4
- **Total No. of Classes:** 60
- **Total Marks:** 75

Unit Name / Teacher's Name	Sub Unit Name	Total No. of Classes	No. of Lesson Plan	Month	No. of Classes	Marks
Unit 1: Introduction to C		12		[Month]		15
As per Syllabus / URM	Overview of C Environment	2	1	Sep	2	
	Basic Syntax and Program Structure	2	1	Sep	2	
	Data Types, Variables, and Constants	2	1	Sep	2	
	Basic Input/Output Operations	2	1	Sep	2	
	Simple Arithmetic Operations	2	1	Oct	2	
	Introduction to Library Functions	2	1	Oct	2	

Unit Name / Teacher's Name	Sub Unit Name	Total No. of Classes	No. of Lesson Plan	Month	No. of Classes	Marks
Unit 2: Control Structures		12				15
As per Syllabus / URM	Conditional Statements (if, if-else)	4	1	Nov	4	
	Loops (for, while, do-while)	4	1	Nov	4	
	Switch Statement and Its Applications	4	1	Dec	4	
Unit 3: Functions and Arrays		12				20
As per Syllabus / URM	Functions: Definitions and Examples	4	1	Dec	4	
	Arrays: Single and Multi-dimensional	4	1	Dec	4	
	Using Arrays with Functions	4	1	Jan	4	
Unit 4: Library Functions		12				15
As per Syllabus / URM	Using stdio.h and string.h	3	1	Jan	3	
	Exploring math.h and stdlib.h	3	1	Jan	3	
	Practical Applications with time.h	3	1	Jan	3	
	Hands-on Exercises with Libraries	3	1	Feb	3	
Unit 5: Practical Applications		12				10
As per Syllabus / URM	File Handling: Reading and Writing Files	4	1	Feb	4	
	Integrating Functions and Files	4	1	Feb	4	
	Hands-On Programming Sessions	4	1	Feb	4	

Explanation of Units:

- **Introduction to C:** Sets the foundation with basic programming concepts, including an introduction to critical library functions.
- **Control Structures:** Teaches students how to control the flow of programs using various types of control structures.
- **Functions and Arrays:** Focuses on defining and using functions and arrays, enhancing data handling capabilities.
- **Library Functions:** Dedicated exploration of common C libraries like `stdio.h`, `math.h`, `string.h`, `stdlib.h`, and `time.h`, with practical programming exercises to demonstrate their usage.
- **Practical Applications:** Applies all learned topics in practical scenarios, focusing on file handling and comprehensive hands-on coding sessions.

Semester: I

- **Course Type:** 4 Year/3 Year
- **Course Name:** MATH-H-SEC1-1-Th
- **Course Details:** C Language with Mathematical Applications
- **Credits:** 4
- **Group Name / Teacher's Name:** [Insert Teacher's Name Here]

Unit 1: Introduction to C

- **Total Classes: 12**
- **Marks: 15**

Sub Unit 1: Overview of C Environment

- **Total Classes: 2**
- **Lesson Plan Objective:**
  - To familiarize students with the C programming environment and tools.
- **Activities:**
  - Introduction to the IDE and compiler setup.
  - Practice exercises to compile and run a basic program.
- **Assessment:**
  - Hands-on exercise to set up their own programming environment and run a "Hello, World!" program.

Sub Unit 2: Basic Syntax and Program Structure

- **Total Classes: 2**
- **Lesson Plan Objective:**

  - To understand the fundamental syntax and structure of a C program.
- **Activities:**
  - Lecture on basic syntax, keywords, and data type declarations.
  - Writing simple programs to practice syntax.
- **Assessment:**
  - Quiz on C keywords, data types, and basic program structure.

Sub Unit 3: Data Types, Variables, and Constants

- **Total Classes: 2**
- **Lesson Plan Objective:**
  - To learn about various data types and how to use variables and constants in C.
- **Activities:**
  - Interactive session on declaring and initializing variables and constants.
  - Exercises involving arithmetic operations and data type conversions.
- **Assessment:**
  - Coding assignment to demonstrate the use of different data types in mathematical expressions.

Sub Unit 4: Basic Input/Output Operations

- **Total Classes: 2**
- **Lesson Plan Objective:**
  - To master basic input and output operations using C.
- **Activities:**
  - Practical sessions on using `printf` and `scanf` for data input and output.
  - Group activity to create programs that take user input and produce output.
- **Assessment:**
  - Practical test on implementing user interaction in a C program.

Sub Unit 5: Simple Arithmetic Operations

- **Total Classes: 2**
- **Lesson Plan Objective:**
  - To apply arithmetic operators in practical programming scenarios.
- **Activities:**
  - Examples and practice problems on arithmetic operations, precedence, and associativity.
  - Exercises to solve simple mathematical problems using C.
- **Assessment:**
  - Assignment to create a calculator for basic arithmetic operations.

Sub Unit 6: Introduction to Library Functions

- **Total Classes: 2**
- **Lesson Plan Objective:**

- To introduce commonly used library functions in C.
- **Activities:**
  - Lecture on the use of functions from `stdio.h`, `math.h`, `string.h`, `stdlib.h`, and `time.h`.
  - Hands-on coding to implement functions from these libraries in sample programs.
- **Assessment:**
  - Short project to utilize multiple library functions in a single program to solve a mathematical or practical problem.

Unit 2: Control Structures

- **Total Classes: 12**
- **Marks: 15**

Sub Unit 1: Conditional Statements (if, if-else)

- **Total Classes: 4**
- **Lesson Plan Objective:**
  - To understand and effectively use conditional statements to control program flow.
- **Activities:**
  - Discussion and examples of `if` and `if-else` statements.
  - Exercises to apply conditional logic to solve problems like user input validation.
- **Assessment:**
  - Code exercises where students must implement conditional logic to handle decision-making in programs.

Sub Unit 2: Loops (for, while, do-while)

- **Total Classes: 4**
- **Lesson Plan Objective:**
  - To master the use of loops for repetitive tasks and managing sequences.
- **Activities:**
  - Lectures on `for`, `while`, and `do-while` loops with practical coding examples.
  - Group activities to implement loops in real-world applications such as data processing.
- **Assessment:**
  - Practical coding test to create loops for data entry, processing, and output.

Sub Unit 3: Switch Statement and Its Applications

- **Total Classes: 4**
- **Lesson Plan Objective:**
  - To learn when and how to use `switch` statements as an alternative to multiple `if` statements.
- **Activities:**

- Tutorial on the syntax and proper use of `switch` cases.
    - Hands-on lab session to convert lengthy `if-else` structures into cleaner `switch` cases.
- **Assessment:**
    - Project to develop a menu-driven program using `switch` statements for various user options.

Unit 3: Functions and Arrays

- **Total Classes: 12**
- **Marks: 20**

Sub Unit 1: Functions: Definitions and Examples

- **Total Classes: 4**
- **Lesson Plan Objective:**
    - To understand the definition, declaration, and scope of functions in C.
- **Activities:**
    - Explanation of user-defined functions, parameters, and return types.
    - Coding exercises to practice writing functions that perform specific tasks.
- **Assessment:**
    - Assignment to create a suite of mathematical functions that can be reused across various programs.

Sub Unit 2: Arrays: Single and Multi-dimensional

- **Total Classes: 4**
- **Lesson Plan Objective:**
    - To gain proficiency in using single and multi-dimensional arrays for data storage and manipulation.
- **Activities:**
    - Demonstrations on declaring, initializing, and accessing arrays.
    - Group projects to implement and manipulate large data sets using arrays.
- **Assessment:**
    - Coding challenge to handle matrix operations such as addition and multiplication using multi-dimensional arrays.

Sub Unit 3: Using Arrays with Functions

- **Total Classes: 4**
- **Lesson Plan Objective:**
    - To integrate arrays with functions to build more complex and modular programs.
- **Activities:**
    - Workshops on passing arrays to functions for sorting, searching, and modifying.

- Interactive coding sessions to develop small applications using arrays and functions.
- **Assessment:**
  - Practical test on creating an application that utilizes arrays and functions for data analysis or processing.

Unit 4: Library Functions

- **Total Classes: 12**
- **Marks: 15**

Sub Unit 1: Using stdio.h and string.h

- **Total Classes: 3**
- **Lesson Plan Objective:**
  - To explore the functionalities provided by the `stdio.h` and `string.h` libraries.
- **Activities:**
  - Detailed coverage of input/output functions and string manipulation functions.
  - Coding sessions to practice string operations like concatenation, comparison, and search.
- **Assessment:**
  - Quiz on functions from `stdio.h` and `string.h` and their practical use cases.

Sub Unit 2: Exploring math.h and stdlib.h

- **Total Classes: 3**
- **Lesson Plan Objective:**
  - To understand the mathematical functions in `math.h` and the utility functions in `stdlib.h`.
- **Activities:**
  - Examples of using mathematical functions for complex calculations.
  - Exercises on using `stdlib.h` for dynamic memory allocation, random numbers, etc.
- **Assessment:**
  - Coding assignments to implement custom mathematical solutions using `math.h` and manage memory with `stdlib.h`.

Sub Unit 3: Practical Applications with time.h

- **Total Classes: 3**
- **Lesson Plan Objective:**
  - To learn how to use time-related functions in real-world applications.
- **Activities:**
  - Lectures on measuring time, manipulating date/time structures.
  - Practical sessions to create logs or time-stamped events.

- **Assessment:**
    - Project to build a simple real-time system simulation using `time.h`.

Sub Unit 4: Hands-on Exercises with Libraries

- **Total Classes: 3**
- **Lesson Plan Objective:**
    - To reinforce knowledge through comprehensive practical exercises using multiple C libraries.
- **Activities:**
    - Integrated lab sessions combining different libraries to solve complex problems.
    - Team challenges to develop small projects incorporating learned libraries.
- **Assessment:**
    - Peer-reviewed coding projects showcasing the application of multiple libraries.

Unit 5: Practical Applications

- **Total Classes: 12**
- **Marks: 10**

Sub Unit 1: File Handling: Reading and Writing Files

- **Total Classes: 4**
- **Lesson Plan Objective:**
    - To master file operations in C, including opening, reading, writing, and closing files.
- **Activities:**
    - Tutorials on file I/O operations.
    - Hands-on exercises to manage data persistence in applications.
- **Assessment:**
    - Assignment to create a program that processes data from a file and outputs results to another file.

Sub Unit 2: Integrating Functions and Files

- **Total Classes: 4**
- **Lesson Plan Objective:**
    - To integrate file handling with function calls to build robust data processing applications.
- **Activities:**
    - Project-based learning to develop software that reads, processes, and writes data using modular functions.
- **Assessment:**
    - Practical exam where students must debug and enhance an existing application to improve its data handling capabilities.

Sub Unit 3: Hands-On Programming Sessions

- **Total Classes: 4**
- **Lesson Plan Objective:**
  - To apply all learned programming skills in comprehensive, real-world scenarios.
- **Activities:**
  - Capstone project sessions to design and develop a complete application using C.
- **Assessment:**
  - Final project presentation and code review session to evaluate each student's application in terms of design, functionality, and user experience.

Teaching Plan for MATH-MD-SEC 2.2-2-Th: Artificial Intelligence

Semester: II

- **Course Type:** 4 Year/3 Year
- **Course Name:** MATH-MD-SEC 2.2-2-Th
- **Course Details:** Artificial Intelligence
- **Credits:** 4
- **Total No. of Classes:** 60
- **Total Marks:** 75

Unit Name / Teacher's Name	Sub Unit Name	Total No. of Classes	No. of Lesson Plan	Month	No. of Classes	Marks
Unit 1: Introduction to AI		12		[Month]		15
As per Syllabus / Teacher's Name	Overview of AI	3	1	May	3	
	AI vs. Human Intelligence	3	1	May	3	
	Key Milestones in AI	3	1	July	3	
	Ethical and Social Implications	3	1	July	3	

Unit Name / Teacher's Name	Sub Unit Name	Total No. of Classes	No. of Lesson Plan	Month	No. of Classes	Marks
Unit 2: AI Subfields		12				15
As per Syllabus / Teacher's Name	Machine Learning	4	1	July	4	
	Deep Learning	4	1	Aug	4	
	NLP and Computer Vision	4	1	Aug	4	
Unit 3: Applications of AI		12				15
As per Syllabus / Teacher's Name	AI in Healthcare	3	1	Aug	3	
	AI in Finance	3	1	Sep	3	
	AI in Transportation	3	1	Sep	3	
	AI in Customer Service	3	1	Sep	3	
Unit 4: AI Ethics and Society		12				15
As per Syllabus / Teacher's Name	Bias and Fairness	3	1	Oct	3	
	Privacy Concerns	3	1	Oct	3	
	AI and Employment	3	1	Nov	3	
	AI in Global Perspective	3	1	Nov	3	
Unit 5: Future of AI		12				15
As per Syllabus / Teacher's Name	Emerging Trends	4	1	Dec	4	
	AI and Innovation	4	1	Dec	4	
	AI and Creativity	4	1	Jan	4	

Explanation of Units:

- **Introduction to AI:** Covers basic concepts, history, and ethical considerations surrounding AI to provide a foundational understanding.

- **AI Subfields:** Delves into specific areas of AI research and development including machine learning, deep learning, and applications in NLP and computer vision.
- **Applications of AI:** Discusses real-world applications of AI technologies in various sectors including healthcare, finance, and transportation.
- **AI Ethics and Society:** Focuses on the ethical considerations and societal impacts of AI, exploring issues such as bias, privacy, and the future of employment.
- **Future of AI:** Looks ahead to the potential future developments in AI, discussing emerging trends, the role of AI in driving innovation, and its creative applications.

Assessment Strategy:

- **Quizzes and Tests:** Regular quizzes to test understanding of fundamental concepts and terminologies.
- **Assignments:** Assignments and projects that involve critical analysis of AI applications and ethical considerations.
- **Project:** A final project requiring the development or critique of an AI application, considering ethical, societal, and technical aspects.
- **Examination:** A comprehensive final examination covering all units and emphasizing problem-solving and application of AI in real-world scenarios.

Based on the teaching plan provided for the course "Artificial Intelligence" (MATH-MD-SEC 2.2-2-Th), here is a comprehensive lesson plan for each unit and sub-unit as detailed in the structure.

Comprehensive Lesson Plan for MATH-MD-SEC 2.2-2-Th: Artificial Intelligence

Semester: II

- **Course Type:** 4 Year/3 Year
- **Course Name:** MATH-MD-SEC 2.2-2-Th
- **Course Details:** Artificial Intelligence
- **Credits:** 4
- **Group Name / Teacher's Name:** [Insert Teacher's Name Here]

Unit 1: Introduction to AI

- **Total Classes: 12**
- **Marks: 15**

Sub Unit 1: Overview of AI

- **Total Classes: 3**
- **Lesson Plan Objective:**
    - Introduce AI, its definition, and its importance in the modern world.
- **Activities:**
    - Lecture on the history and evolution of AI.
    - Discussion on the fundamental concepts of AI.
- **Assessment:**
    - Quiz to assess understanding of AI basics.

Sub Unit 2: AI vs. Human Intelligence

- **Total Classes: 3**
- **Lesson Plan Objective:**
    - Explore the differences between AI and human cognitive abilities.
- **Activities:**
    - Case studies comparing AI to human decision-making.
    - Group discussion on AI's capabilities and limitations.
- **Assessment:**
    - Written assignment analyzing a scenario where AI complements or competes with human intelligence.

Sub Unit 3: Key Milestones in AI

- **Total Classes: 3**
- **Lesson Plan Objective:**
    - Discuss key developments and breakthroughs in AI technology.
- **Activities:**
    - Timeline creation of AI milestones.
    - Video presentations of significant AI achievements.
- **Assessment:**
    - Presentation on the impact of a specific AI milestone.

Sub Unit 4: Ethical and Social Implications

- **Total Classes: 3**
- **Lesson Plan Objective:**
    - Understand the ethical and social challenges posed by AI.
- **Activities:**
    - Debates on topics like AI in warfare, privacy concerns, and job displacement.
    - Case study analysis on ethical dilemmas in AI applications.
- **Assessment:**
    - Group project proposing guidelines for ethical AI use.

Unit 2: AI Subfields

- **Total Classes: 12**
- **Marks: 15**

Sub Unit 1: Machine Learning

- **Total Classes: 4**
- **Lesson Plan Objective:**
  - Understand the basics of machine learning algorithms and their applications.
- **Activities:**
  - Interactive sessions on supervised, unsupervised, and reinforcement learning.
  - Hands-on exercises using simple machine learning tools.
- **Assessment:**
  - Practical test implementing a basic machine learning model.

Sub Unit 2: Deep Learning

- **Total Classes: 4**
- **Lesson Plan Objective:**
  - Dive into deep learning frameworks and neural networks.
- **Activities:**
  - Workshops on constructing and training neural networks.
  - Discussion on deep learning successes in various fields.
- **Assessment:**
  - Mini-project to design a simple neural network for a given task.

Sub Unit 3: NLP and Computer Vision

- **Total Classes: 4**
- **Lesson Plan Objective:**
  - Explore the fields of Natural Language Processing (NLP) and computer vision.
- **Activities:**
  - Demonstrations of NLP tools and computer vision techniques.
  - Lab sessions on implementing basic NLP and image recognition tasks.
- **Assessment:**
  - Coding challenge to develop a small NLP or computer vision application.

Unit 3: Applications of AI

- **Total Classes: 12**
- **Marks: 15**

Sub Unit 1: AI in Healthcare

- **Total Classes: 3**
- **Lesson Plan Objective:**
  - Examine how AI technologies are transforming healthcare through diagnostics, treatment plans, and patient monitoring.
- **Activities:**
  - Presentation on AI applications in medical imaging and diagnosis.
  - Group discussions on potential impacts of AI on healthcare quality and accessibility.
- **Assessment:**
  - Case study analysis on AI's role in a specific healthcare scenario.

Sub Unit 2: AI in Finance

- **Total Classes: 3**
- **Lesson Plan Objective:**
  - Discuss AI's role in financial markets, fraud detection, and personalized banking services.
- **Activities:**
  - Workshops on AI algorithms used in stock trading and risk assessment.
  - Simulation of an AI tool for credit scoring or fraud detection.
- **Assessment:**
  - Group presentation on the development of an AI solution for a financial challenge.

Sub Unit 3: AI in Transportation

- **Total Classes: 3**
- **Lesson Plan Objective:**
  - Explore the impact of AI on transportation, including autonomous vehicles and traffic management systems.
- **Activities:**
  - Videos and discussions on the current state and future of autonomous driving.
  - Interactive session on AI in logistics and supply chain optimizations.
- **Assessment:**
  - Analytical essay on the ethical implications of self-driving cars.

Sub Unit 4: AI in Customer Service

- **Total Classes: 3**
- **Lesson Plan Objective:**
  - Understand how AI is used to enhance customer service through chatbots and personal assistants.
- **Activities:**
  - Demonstration of chatbot interactions and their integration into business services.
  - Design a basic chatbot using AI tools.
- **Assessment:**

  - Practical test on creating and deploying a simple customer service chatbot.

Unit 4: AI Ethics and Society

- **Total Classes: 12**
- **Marks: 15**

Sub Unit 1: Bias and Fairness

- **Total Classes: 3**
- **Lesson Plan Objective:**
  - Address issues of bias in AI algorithms and explore methods to ensure fairness.
- **Activities:**
  - Discussions on examples of bias in AI and methods to mitigate it.
  - Group activities to evaluate and improve algorithmic fairness.
- **Assessment:**
  - Research paper on a case of AI bias and proposals for fairness enhancements.

Sub Unit 2: Privacy Concerns

- **Total Classes: 3**
- **Lesson Plan Objective:**
  - Investigate privacy issues raised by AI technologies and data usage.
- **Activities:**
  - Analysis of privacy laws and their interaction with AI systems.
  - Case studies on data breaches and privacy in AI applications.
- **Assessment:**
  - Presentation on privacy-preserving techniques in AI.

Sub Unit 3: AI and Employment

- **Total Classes: 3**
- **Lesson Plan Objective:**
  - Discuss the impact of AI on the labor market, including job displacement and creation.
- **Activities:**
  - Debate on AI's role in the future of work and its economic implications.
  - Exploration of new job categories emerging from AI advancements.
- **Assessment:**
  - Essay on how AI will change the job landscape in the next decade.

Sub Unit 4: AI in Global Perspective

- **Total Classes: 3**
- **Lesson Plan Objective:**
  - Explore how different countries are adopting and regulating AI.
- **Activities:**
  - Comparative study of global AI initiatives and policies.
  - Discussion on the global competitiveness and cooperation in AI.
- **Assessment:**
  - Group report on AI's global impact and strategic recommendations for policymakers.

Unit 5: Future of AI

- **Total Classes: 12**
- **Marks: 15**

Sub Unit 1: Emerging Trends

- **Total Classes: 4**
- **Lesson Plan Objective:**
  - Identify and explore the latest trends and technologies in AI.
- **Activities:**
  - Presentations on cutting-edge AI research and its potential applications.
  - Guest lecture from an AI industry expert.
- **Assessment:**
  - Analysis assignment on an emerging AI technology and its future implications.

Sub Unit 2: AI and Innovation

- **Total Classes: 4**
- **Lesson Plan Objective:**
  - Discuss how AI is driving innovation across various industries.
- **Activities:**
  - Case studies on AI-driven innovation in sectors such as entertainment, manufacturing, and agriculture.
  - Brainstorming session on innovative uses of AI in students' fields of interest.
- **Assessment:**
  - Project proposal for an innovative AI application in a chosen industry.

Sub Unit 3: AI and Creativity

- **Total Classes: 4**
- **Lesson Plan Objective:**
  - Examine the role of AI in creative processes and artistic expression.

- **Activities:**
  - Exploration of AI in music, art, and literature creation.
  - Hands-on session using AI tools to generate creative content.
- **Assessment:**
  - Creative project using AI to produce a piece of art, music, or literature.

LESSON PLAN 2022-23:
DEPT. OF MICROBIOLOGY, RAIDIGHI COLLEGE

Name of the faculty	Semester	MCBA/MCBG	Course (CORE/SEC/DSE)	Topics covered	Month (Hours)
Dr. Arunima Biswas	1	MCBA	CC1 TH	Unit 1 History of Development of Microbiology	Nov-Dec 2022 (15)
				Unit 3 An overview of Scope of Microbiology	Sep 2022 (5)
			CC1 PRAC	Microbiology Good Laboratory Practices and Bio-safety	Sep 2022
				Principle and applications of important instruments	Sep 2022
				Sterilization of heat sensitive material	Oct 2022
				Study of *Rhizopus, Penicillium, Aspergillus* using temporary mounts	Nov 2022
				Study of *Spirogyra* and *Chlamydomonas, Volvox*	Nov 2022
				Study of *Amoeba, Entamoeba, Paramecium and Plasmodium*	Nov 2022
			CC2 TH	Unit 3 Microscopy	Sep-Nov 2022 (6)
				Unit 4 Growth and nutrition	Dec 2022 (8)
				Unit 5 Reproduction in Bacteria	Dec 2022 (3)
			CC2 PRAC	Preparation of different media	Sep-Oct 2022
				Negative staining	Dec 2022
				Acid fast staining demo	Dec 2022
				Capsule staining	Dec 2022
				Estimation of CFU count by spread plate method	Nov 2022

		MCBG	GE 1 TH	Unit 1 History of Development of Microbiology	Nov-Dec 2022 (8)
				Unit 3 Microscopy	Sep-Nov 2022 (5)
				Unit 4 Sterilization	Dec 2022 (5)
			GE 1 PRAC	Microbiology Laboratory Management and Bio-safety	Sep 2022
				Principle and applications of important instruments	Sep 2022
				Sterilization of heat sensitive material	Oct 2022
				Study of *Rhizopus, Penicillium* using temporary mounts	Nov 2022
				Study of *Spirogyra* and *Chlamydomonas*	Nov 2022
				Study of *Amoeba, Entamoeba, Paramecium and Plasmodium*	Nov 2022
Dr. Shakuntala Ghorai	1	MCBA	CC1 TH	Unit 2 Diversity of Microbial World: A. Systems of classification	Sep 2022 (5)
				Unit 2 Diversity of Microbial World: B. General characteristics of different groups: Acellular microorganisms (Viruses, Viroids, Prions) and Cellular microorganisms: Fungi	Nov-Dec 2022 (5)
			CC1 PRAC	Sterilization of medium using Autoclave and assessment for sterility	Sep 2022
				Demonstration of the presence of microflora in the environment by exposing nutrient agar plates to air	Nov 2022
			CC2 TH	Unit 2 Bacteriological techniques	Sep 2022 (5)
				Unit 6 Bacterial Systematics	Nov 2022 (8)

				Unit 7 Important archaeal groups	Dec 2022 (5)
			CC2 PRAC	Simple staining	Oct 2022
				Endospore staining	Nov 2022
				Preservation of bacterial cultures	Dec 2022
				Motility by hanging drop method	Dec 2022
		MCBG	GE1 TH	Unit 2 Diversity of Microorganisms	Sep 2022 (5)
				Unit 5 Microbes in Human Health & Environment	Nov 2022 (4)
				Unit 6 Industrial Microbiology	December 2022 (8)
			GE1 PRAC	Sterilization of medium using Autoclave and assessment for sterility	Oct 2022
				Demonstration of the presence of microflora in the environment by exposing nutrient agar plates to air	Nov 2022
				Study of different shapes of bacteria	Dec 2022
Mr. Prabir Sahoo	1	MCBA	CC1 TH	Unit 2 B: Diversity of Microbial World Bacteria, Algae, Protozoa	Sept-Dec 2022 (10)
			CC1 PRAC	Preparation of culture media Sterilization of glassware using Hot Air Oven	Nov 2022
			CC2 TH	Unit 1 Cell organization Unit 7 Important eubacterial groups	Nov 2022 (15)
			CC2 PRAC	Gram's staining Isolation of pure cultures of bacteria by streaking Estimation of CFU count by pour plate method	Dec 2022
		MCBG	GE1 TH	Unit 2 Diversity of Microorganisms Unit 5 Microbes in Human Health & Environment Unit 7 Food and Dairy Microbiology	Sept-Dec 2022 (15)

			GE1 PRAC	Preparation of culture media Sterilization of glassware using Hot Air Oven	Dec 2022
Dr. Arunima Biswas	2	MCBA	CC3 TH	Unit 4 Proteins	April 2023 (8)
				Unit 5 Enzymes	April-May 2023 (10)
				Unit 6 Vitamins	May 2023 (4)
			CC3 PRAC	Study of protein secondary and tertiary structures Study of enzyme kinetics Study effect of temperature, pH and Heavy metals on enzyme activity	April-May 2023
			CC4 TH	Unit 4 Cell Signalling Unit 5 Cell Cycle, Cell Death and Cell Renewal	April-June 2023 (22)
			CC4 PRAC	Study a representative plant and animal cell by microscopy	April 2023
				Demonstration of the presence of mitochondria in cheek epithelial cell using vital stain Janus Green B	April 2023
				Study of polyploidy in Onion root tip	May 2023
				Study of different stages of Mitosis	April 2023
		MCBG	GE 2 TH	Unit 2 Bacterial growth and control	April 2023 (8)
				Unit 5 Structure and multiplication of viruses	May 2023 (8)
			GE 2 PRAC	Enumeration of colony forming units (CFU) count by spread plate method	April-June 2023

				Study of the methods of isolation and propagation of plant viruses Study of cytopathic effects of viruses using photographs	
Dr. Shakuntala Ghorai	2	MCBA	CC3 TH	Unit 1 Bioenergetics	April 2023 (6)
				Unit 4 Proteins (amino acids portion)	May 2023 (2)
			CC3 PRAC	Properties of water, Concept of pH and buffers, preparation of buffers and Numerical problems to explain the concepts	April 2023
				Numerical problems on calculations of Standard Free Energy Change and Equilibrium constant	April 2023
				Standard Free Energy Change of coupled reactions	May 2023
				Qualitative/Quantitative tests for carbohydrates, reducing sugars, non-reducing sugars	May 2023
			CC4 TH	Unit 2 Nucleus	April 2023 (4)
				Unit 3 Protein Sorting and Transport	May 2023 (12)
			CC4 PRAC	Study of the structure of cell organelles through EM	April 2023
				Cytochemical staining of DNA – Feulgen	May 2023
				Study of different stages of Meiosis	May 2023
				Identification and study of cancer cells by photomicrographs	June 2023
		MCBG	GE 2 TH	Unit 3 Bacterial Systematics and Taxonomy	April 2023 (4)

				Unit 4 Introduction to Viruses	May 2023 (8)
				Unit 6 Role of Viruses in Disease and its prevention	May 2023 (4)
			GE2 PRAC	Spore staining	April 2023
				Enumeration of colony forming units (CFU) count by pour plate	May 2023
				Study the morphological structures of viruses (DNA and RNA) and their important characters using EM	May-June 2023
Mr. Prabir Sahoo	2	MCBA	CC3 TH	Unit 2 Carbohydrates Unit 3 Lipids	April to May 2023 (20)
			CC3 PRAC	Qualitative/Quantitative tests for lipids and proteins Estimation of any one vitamin	April to May 2023
			CC4 TH	Unit 1 Structure and organization of Cell	June 2023 (12)
			CC4 PRAC	Cytochemical staining of DNA – Feulgen	June 2023
		MCBG	GE 2 TH	Unit 1 Cell organization Unit 3 Bacterial Systematics and Taxonomy Unit 6 Role of Viruses in Disease and its prevention	April and May 2023 (18)
			GE 2 PRAC	Preparation of different media: Nutrient agar, Nutrient broth To perform simple staining and Gram's staining	May and June 2023

				Isolation of pure cultures of bacteria by streaking	
Dr. Arunima Biswas	3	MCBA	CC5 TH	Unit 2 Bacteriophages	Aug 2022 (10)
				Unit 4 Viruses and Cancer	Sep 2022 (6)
				Unit 6 Applications of Virology	Nov 2022 (4)
			CC5 PRAC	Study of the structure of important bacterial viruses (ϕX 174, T4, λ) using EM	Aug 2022
				Isolation and enumeration of bacteriophages (PFU) from water/sewage sample using double agar layer technique	Jan 2022
			CC6 TH	Unit 3 Chemoheterotrophic Metabolism: Aerobic Respiration	Aug-Sep 2022 (10)
				Unit 6 Nitrogen Metabolism	Nov 2022 (6)
			CC6 PRAC	Study and plot the growth curve of *E. coli* by turbidometric and standard plate count methods Calculations of generation time and specific growth rate	Dec 2022
			CC7 TH	Unit 2 Replication of DNA	Aug 2022 (8)
				Unit 5 Translation	Sep-Oct 2022 (8)
				Unit 6 Regulation of gene expression in Prokaryotes, Eukaryots	Nov 2022 (10)
			CC7 PRAC	Isolation of genomic DNA from *E. coli*	Dec 2022
				Estimation of salmon sperm / calf thymus DNA	Nov 2022

				Estimation of RNA	Nov 2022
				Resolution and visualization of DNA by Agarose Gel Electrophoresis	Dec 2022
			SEC-A 1. Microbial Quality Control in Food and Pharmaceutical Industries	Unit 1 Microbiological Laboratory and Safe Practices	Nov-Dec 2022 (12)
				Unit 4 HACCP for Food Safety and Microbial Standards	
		MCBG	GE3 TH	Unit 3 Chemoheterotrophic Metabolism: Aerobic Respiration	Aug-Sep 2022 (8)
				Unit 6 Nitrogen Metabolism	Nov 2022 (6)
			GE3 PRAC	Study and plot the growth curve of *E. coli* by turbidometric and standard plate count methods Calculations of generation time and specific growth rate	Dec 2022
			SEC-A Microbial Quality Control in Food and Pharmaceutical Industries	Same as MCBA	Nov-Dec 2022 (12)
Dr. Shakuntala Ghorai	3	MCBA	CC5 TH	Unit 3 Viral Transmission, Salient features of viral nucleic acids	Aug 2022 (10)
				Unit 3 Viral Replication	Sep-Dec 2022 (4)
				Unit 4 Viruses and Cancer	Sep 2022 (6)
			CC5 PRAC	Study of the structure of important plant viruses (caulimo, Gemini, tobacco ring spot, cucumber mosaic and alpha-alpha mosaic viruses) using EM	Aug-Sep 2022

				Studying isolation and propagation of animal viruses by chick embryo technique	Oct 2022 (demo)
				Perform local lesion technique for assaying plant viruses	Nov 2022 (demo)
			CC6 TH	Unit 2 Nutrient uptake and Transport	Aug 2022 (8)
				Unit 5 Chemolithotrophic and Phototrophic Metabolism	Nov-Dec 2022 (10)
			CC6 PRAC	Effect of temperature on growth of *E. coli*	Sep 2022
				Effect of pH on growth of *E. coli*	Oct 2022
				Demonstration of the thermal death time and decimal reduction time of *E. coli*	Nov 2022
			CC7 TH	Unit 1 Structures of DNA and RNA / Genetic Material	Sep 2022 (10)
				Unit 6 Regulation of gene expression in Prokaryotes	Nov-Dec 2022 (10)
			CC7 PRAC	Study of different types of DNA and RNA	Sep 2022
				Study of semi-conservative replication of DNA	Oct 2022
				Resolution and visualization of proteins by SDS-PAGE	Jan 2023
			SEC-A 1. Microbial Quality Control in Food and Pharmaceutical Industries	Unit 3 Pathogenic Microorganisms of Importance in Food & Water	Nov-Dec 2022 (8)
		MCBG	GE3 TH	Unit 2 Nutrient uptake and Transport	Aug 2022 (10)
				Unit 5 Chemolithotrophic and Phototrophic Metabolism	Nov-Dec 2022 (8)

			GE3 PRAC	Effect of temperature on growth of *E. coli*	Sep 2022
				Effect of pH on growth of *E. coli*	Oct 2022
				Demonstration of the thermal death time and decimal reduction time of *E. coli*	Nov 2022
			SEC-A Microbial Quality Control in Food and Pharmaceutical Industries	Same as MCBA	Nov-Dec 2022 (8)
Mr. Prabir Sahoo	3	MCBA	CC5 TH	Unit 1 Nature and Properties of Viruses Unit 5 Prevention & control of viral diseases	Aug to Dec 2022 (16)
			CC5 PRAC	Study of the structure of important animal viruses (rhabdo, influenza, paramyxo hepatitis B and retroviruses) using EM Study of cytopathic effects of viruses using photographs Perform local lesion technique for assaying plant viruses	Sept to Dec 2022
			CC6 TH	Unit 1 Microbial Growth and Effect of Environment Unit 4 Chemoheterotrophic Metabolism-Anaerobic respiration and fermentation	Sept to Dec 2022 (16)
			CC6 PRAC	Effect of carbon and nitrogen sources on growth of *E.coli* Effect of salt on growth of *E. coli* Demonstration of alcoholic fermentation	Nov to Dec 2022
			CC7 TH	Unit 3 Transcription in Prokaryotes and Eukaryotes Unit 4 Post-Transcriptional Processing	Dec 2022 (14)

			SEC-A 1. Microbial Quality Control in Food and Pharmaceutical Industries	Unit 2 Determining Microbes in Food / Pharmaceutical Samples	Dec 2022 (10)
		MCBG	GE 3 TH	Unit 1 Microbial Growth and Effect of Environment Unit 4 Chemoheterotrophic Metabolism- Anaerobic respiration and fermentation	Sept to Dec 2022 (18)
			GE 3 PRAC	Effect of carbon and nitrogen sources on growth of *E.coli* Effect of salt on growth of *E. coli* Demonstration of alcoholic fermentation	Nov to Dec 2022
			SEC-A Microbial Quality Control in Food and Pharmaceutical Industries	Same as MCBA	Dec 2022 (10)
Dr. Arunima Biswas	4	MCBA	CC8 TH	Unit 1 Genome Organization and Mutations	March 2023 (14)
				Unit 2 Plasmids	April 2023 (8)
				Unit 4 Phage Genetics	April 2023 (8)
			CC8 PRAC	Isolation of Plasmid DNA from *E. coli*	May 2023
				Study different conformations of plasmid DNA through Agaraose gel electrophoresis	May 2023
				Demonstration of AMES test	March 2023

			CC10 TH	FULL	March-May 2023 (50
			CC10 PRAC	FULL	March-May 2023
			SEC B2. Microbiological analysis of air and water	Unit 1 Aeromicrobiology Unit 3: Control Measures	May-June 2023 (8)
		MCBG	GE4 TH	Unit 1 Structures of DNA and RNA / Genetic Material	March 2023 (6)
				Unit 2 Replication of DNA	April 2023 (5)
				Unit 4 Translation	May 2023 (5)
			GE4 PRAC	Estimation of DNA	March 2023
				Resolution and visualization of DNA by Agarose Gel Electrophoresis	May 2023
				Resolution and visualization of proteins by Polyacrylamide Gel Electrophoresis (SDS-PAGE)	May 2023 (demo)
				Demonstration of Bacterial Transformation and calculation of transformation efficiency	May 2023
			SEC B2. Microbiological analysis of air and water	Same as MCBA	May-June 2023 (8)
Dr. Shakuntala Ghorai	4	MCBA	CC8 TH	Unit 3 Mechanisms of Genetic Exchange	March 2023 (10)
				Unit 5 Transposable elements	April 2023 (10)
			CC8 PRAC	Preparation of Master and Replica Plates	March 2023
				Study the effect of chemical (HNO_2) and physical (UV) mutagens on bacterial cells	April 2023

				Study survival curve of bacteria after exposure to ultraviolet (UV) light	May 2023
			CC9 TH	Unit 1 Microorganisms and their Habitats	April 2023 (10)
				Unit 6 Water Potability	May 2023 (5)
			CC9 PRAC	Assessment of microbiological quality of water	April 2023
				Study the presence of microbial activity by detecting (qualitatively) enzymes (dehydrogenase, amylase, urease) in soil	May 2023
				Isolation of *Rhizobium* from root nodules	June 2023
			SEC B2. Microbiological analysis of air and water	Unit 2 Air Sample Collection and Analysis	April 2023 (7)
				Unit 5 Microbiological Analysis of Water	May 2023(7)
		MCBG	GE4 TH	Unit 7 Mechanisms of Genetic Exchange	March 2023 (8)
				Unit 8 Plasmids and Transposable Elements	April 2023 (8)
			GE4 PRAC	Study of different types of DNA and RNA	April 2023
				Study of semi-conservative replication of DNA	April 2023
				Study the effect of chemical (HNO_2) and physical (UV) mutagens on bacterial cells	May 2023
				Study survival curve of bacteria after exposure to ultraviolet (UV) light	May 2023
			SEC B2. Microbiological	Same as MCBA	May-June 2023 (14)

			analysis of air and water		
Mr. Prabir Sahoo	4	MCBA	CC9 TH	Unit 2 Microbial Interactions Unit 3 Biogeochemical Cycling: Unit 4 Waste Management Unit 5 Microbial Bioremediation	March to May 2023 (35)
			CC9 PRAC	Analysis of soil - pH, moisture content, water holding capacity, percolation, capillary action Isolation of microbes (bacteria &fungi) from soil (28ºC & 45ºC) Isolation of microbes (bacteria & fungi) from rhizosphere and rhizoplane Determination of BOD of waste water sample	April to June 2023
			SECB2.Microbiological analysis of air and water	Unit 4 Water Microbiology: PS Unit 6 Control Measures:	April and May 2023 (8)
		MCBG	GE4 TH	Unit 3 Transcription Unit 5 Regulation of Gene Expression Unit 6 Mutations	March to April 2023 (18)
			SECB2.Microbiological analysis of air and water	Same as MCBA	May and June 2023 (8)
Dr. Arunima Biswas	5	MCBA	CC11 TH	Unit 4 Fermented foods Unit 5 Food borne diseases	Aug-Oct 2022 (18)
			CC11 PRAC	MBRT of milk samples and their standard plate count; Alkaline phosphatase test to check the efficiency of pasteurization of milk	Sep 2022
			CC12 TH	Unit 5 Microbial production of industrial products	Aug-Oct 2022 (18)

			CC12 PRAC	2 Organic acid: Citric acid	Dec 2022
			DSE-A 1~ Microbial Biotechnology ~ TH	Unit 5 Microbes for Bio-energy and Environment	Aug-Sep 2022 (10)
				Unit 6 RNAi	Nov 2022 (6)
			DSE A1 PRAC	Study yeast cell immobilization in calcium alginate gels Study of algal Single Cell Proteins	Nov 2022
			DSE-B2 TH Microbes in sustainable agriculture and development~	UNIT 5 Biofertilization, Phytostimulation, Bioinsecticides	Oct 2022 (12)
				UNIT 7 GM crops	Dec 2022 (6)
			DSE B2 PRAC	Rhizobium as soil inoculants characteristics and field application	Sep-Oct 2022
				Azotobacter as soil inoculants characteristics and field application	Oct-Nov 2022
				Design and functioning of a biogas plant	Dec 2022
		MCBG	DSE-A 2 ~ Microbes in environment: TH	Unit 2 Microbial Interactions	No student
				Unit 5 Microbial Bioremediation	
			DSE A2 PRAC	Assessment of microbiological quality of water . Isolation of Rhizobium from root nodules	No student
Dr. Shakuntala Ghorai	5	MCBA	CC11 TH	Unit 1 Foods as a substrate for microorganisms	Aug 2022 (6)
				Unit 6 Food sanitation and control	Sep 2022 (5)
				Unit 7 Cultural and rapid detection methods of food borne pathogens in foods and introduction to predictive microbiology	Nov 2022 (5)
			CC11 PRAC	Isolation of any food borne bacteria from food products	Aug 2022

				Preparation of Yogurt/Dahi	Sep 2022
			CC12 TH	Unit 1 Introduction to industrial microbiology	Aug 2022 (2)
				Unit 2 Isolation of industrially important microbial strains and fermentation media	Sep 2022 (10)
				Unit 6 Enzyme immobilization	Oct 2022 (4)
			CC12 PRAC	2(a) Enzymes: Amylase and Protease (b) Amino acid: Glutamic acid	Sep-Nov 2022
			DSE-A 1~ Microbial Biotechnology ~ TH	Unit 2 Therapeutic and Industrial Biotechnology	Sep 2022 (8)
				Unit 3 Applications of Microbes in Biotransformations	Oct-Nov 2022 (6)
				Unit 7 IPR	Dec 2022 (4)
			DSE A1 PRAC	Study enzyme immobilization by sodium alginate method	Nov 2022
				Pigment production from fungi	Dec 2022
			DSE-B2 Microbes in sustainable agriculture and development~ TH	UNIT 1 Soil Microbiology	Sep 2022 (6)
				UNIT3 Microbial Activity in Soil and Green House Gases	Oct-Nov 2022 (5)
				UNIT4 Microbial Control of Soil Borne Plant Pathogens	Dec 2022 (7)
			DSE B2 PRAC	Study microflora of different types of soils	Nov 2022
				Isolation of cellulose degrading organisms	Dec 2022
		MCBG	DSE-A 2 ~ Microbes in environment: TH	Unit 1 Microorganisms and their Habitats	No student
				Unit 6 Water Potability	No student

			DSE A2 PRAC	Study the presence of microbial activity by detecting (qualitatively) enzymes(dehydrogenase, amylase, urease) in soil	No student
Mr. Prabir Sahoo	5	MCBA	CC11 TH	UNIT 2 Microbial spoilage of various foods UNIT 3 Principles and methods of food preservation	Aug to Sept 2022 (16)
			CC11 PRAC	Isolation of spoilage microorganisms from spoiled vegetables/fruits Isolation of spoilage microorganisms from bread	Sept to Nov 2022
			CC12 TH	Unit 3 Types of fermentation processes, bio-reactors and measurement of fermentation Parameters Unit 4 Down-stream processing	Sept to Nov 2022 (18)
			CC12 PRAC	Study different parts of fermenter 2D Alcohol: Ethanol	Sept 2022
			DSE-A 1~ Microbial Biotechnology ~ TH	Unit 1 Microbial Biotechnology and its Applications Unit 4 Microbial Products and their Recovery	Oct to Nov 2022 (16)
			DSE A1 PRAC	Isolation of xylanase or lipase producing bacteria	Dec 2022
			DSE-B2 Microbes in sustainable agriculture and development~ TH	Unit 2 Mineralization of Organic & Inorganic Matter in SoiL Unit6 Secondary Agriculture Biotechnology	Nov to Dec 2022 (14)
			DSE B2 PRAC	Study soil profile	Dec 2022
		MCBG	DSE-A 2 ~ Microbes in environment: TH	Unit 3 Biogeochemical Cycling Unit 4 Waste Management	No Student

			DSE A2 PRAC	Analysis of soil - pH, moisture content, water holding capacity, percolation, capillary action Isolation of microbes (bacteria &fungi) from soil (28ºC & 45ºC) Isolation of microbes (bacteria & fungi) from rhizosphere and rhizoplane Determination of BOD of waste water sample	No student
Dr. Arunima Biswas	6	MCBA	CC 13 TH	Unit 1 Introduction	March 2023 (2)
				Unit 2 Immune Cells and Organs	April 2023 (6)
				Unit 8 Immunological Disorders and Tumor Immunity	May 2023 (8)
			CC14 TH	Unit 1 Normal microflora of the human body and host pathogen interaction	March 2023 (7)
				Unit 7 Antimicrobial agents: General characteristics and mode of action	May 2023 (8)
			CC14 PRAC	FULL	March-May 2023
			DSE-A: 3. Plant pathology ~ TH	Unit 1 Introduction and History of plant pathology Unit 4 Host Pathogen Interaction	April-June 2023 (20)
			DSE-A: 3 PRAC	Demonstration of Koch's postulates in bacterial plant pathogens.	April 2023
			DSE-B: 3. Instrumentation and Biotechniques~ TH	Unit 1 Microscopy	April 2023 (10)
				Unit 4 Spectrophotometry	May 2023 (10)
			DSE-B: 3 PRAC	Study of fluorescent micrographs to visualize bacterial cells. Ray diagrams of phase contrast microscopy and EM	April 2023

				Separation of protein mixtures by Polyacrylamide Gel Electrophoresis (PAGE)	May 2023
				Determination of λmax for an unknown sample and calculation of extinction coefficient.	May 2023
		MCBG	DSE-B:1. Medical Microbiology and Immunology~ TH	Unit 1 Normal microflora of the human body and host pathogen interaction Unit 7 Antimicrobial agents: General characteristics and mode of action Unit 11 Immunological Disorders and Tumor Immunity	No student
			DSE-B:1 PRAC	Identify bacteria on the basis of cultural, morphological and biochemical characteristics: IMViC, TSI, nitrate reduction, urease production and catalase tests Study of composition and use of important differential media for identification of bacteria: EMB Agar, McConkey agar, Mannitol salt agar, Deoxycholate citrate agar, TCBS Study of bacterial flora of skin by swab method Perform antibacterial sensitivity by Kirby-Bauer method	No student
Dr. Shakuntala Ghorai	6	MCBA	CC13 TH	Unit 7 Generation of Immune Response	April 2023 (8)
				Unit 9 Immunological Techniques	April 2023 (10)
			CC13 PRAC	FULL	March-May 2023
			CC14 TH	Unit 2 Sample collection, transport and diagnosis	March 2023 (5)

				Unit 5 Protozoan diseases	April 2023 (5)
				Unit 6 Fungal diseases	May 2023 (5)
			DSE-A: 3. Plant pathology ~ TH	Unit 3 Plant disease epidemiology	March-April 2023 (5)
				Unit 5 Control of Plant Diseases	May 2023 (8)
			DSE-A: 3 PRAC	Demonstration of Koch's postulates in fungal plant pathogens.	March-May 2023
			DSE-B: 3. Instrumentation and Biotechniques~ TH	Unit 5 Centrifugation	April-May 2023 (10)
			DSE-B: 3 PRAC	Separation of components of a given mixture using a laboratory scale centrifuge.	April 2023
				Understanding density gradient centrifugation with the help of pictures.	May 2023
		MCBG	DSE-B:1. Medical Microbiology and Immunology~ TH	Unit 2 Sample collection, transport and diagnosis Unit 5 Protozoan diseases Unit 6 Fungal diseases Unit 10 Generation of Immune Response Unit 12 Immunological Technique	No student
			DSE-B:1 PRAC	Identification of human blood groups. To perform Total Leukocyte Count of the given blood sample. To perform Differential Leukocyte Count of the given blood sample. To separate serum from the blood sample (demonstration). To perform immunodiffusion by Ouchterlony method.	No student
Mr. Prabir Sahoo	6	MCBA	CC13 TH	Unit 3 Antigens	March to April 2023 (16)

				Unit 4 Antibodies Unit 5 Major Histocompatibility Complex Unit 6 Complement System	
			CC14 TH	Unit 3 Bacterial diseases Unit 4 Viral diseases	April to May 2023 (20)
			DSE-A: 3. Plant pathology ~ TH	Unit 2 Stages in development of a disease Unit 6 Specific Plant diseases	March to May 2023 (17)
			DSE-A: 3 PRAC	Demonstration of Koch's postulates in viral plant pathogens. Study of important diseases of crop plants	April 2023
			DSE-B: 3. Instrumentation and Biotechniques~ TH	Unit 2 Chromatography Unit 3 Electrophoresis	May to June 2023 (20)
			DSE-B: 3 PRAC	Separation of mixtures by paper / thin layer chromatography. Demonstration of column packing in any form of column chromatography. Separation of protein mixtures by any form of chromatography.	May to June 2023
		MCBG	DSE-B:1. Medical Microbiology and Immunology~ TH	Unit 3 Bacterial diseases Unit 4 Viral diseases Unit 8 Immune Cells and Organs Unit 9 Antigens and Antibodies	No Student

RAIDIGHI COLLEGE

TEACHING PLAN REPORT

Subject Name: Food and Nutrition **Session:2022-23**

ODD SEMESTER: SEM-1

Teacher's Name: Dr Arvinda Shaw

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
1	Honours-Theory	Basic Food Science-1	CC-1	Basic concepts of food, nutrition, nutrients, classification of food, nutrients.	September	2
1	Honours-Theory	Basic Food Science-1	CC-1	Carbohydrates- sources, functions, requirements, digestion, absorption.	November	2
1	Honours-Theory	Basic Food Science-1	CC-1	Lipids- sources, functions, requirements, digestion, absorption	November	2
1	Honours-Theory	Basic Food Science-1	CC-1	Proteins- sources, functions, requirements, digestion, absorption.	November	2
1	Honours-Theory	Basic Food Science-1	CC-1	Assessment of protein quality- BV, NPU, PER, factors affecting bioavailability.	December	2
1	Honours-Theory	Human Physiology-1	CC-2	Respiratory System- structure of lungs, functions	September	3
1	Honours-Theory	Human Physiology-1	CC-2	Gaseous exchange	November	2

Teacher's Name: Rukshana Irani

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
1	Honours-Theory	Basic Food Science	CC-1	Carbohydrate chemistry-introduction	September	1
1	Honours-Theory	Basic Food Science-1	CC-1	Structure and properties of monosaccharides-glucose, fructose, galactose	September	3
1	Honours-Theory	Basic Food Science-1	CC-1	Structure and properties od disaccharides-maltose, lactose, sucrose.	November	3
1	Honours-Theory	Basic Food Science-1	CC-1	Structure and properties of polysaccharides-dextrin, starch, glycogen, resistant starch.	November	3
1	Honours-Practical	Basic Food Science-1	CC-1	Identification of Mono, Di, Polysaccharides	December	2
1	Honours-Practical	Basic Food Science-1	CC-1	Identification of Proteins	December	2
1	Honours-Practical	Basic Food Science-1	CC-1	Identification of glycerol.	December	2
1	Honours -Theory	Human Physiology-1	CC-2	Digestive System-structure and function of G.I tract	September	3
1	Honours-Theory	Human Physiology-1	CC-2	Process of digestion and absorption of foods	November	2
1	Honours-Theory	Human Physiology-1	CC-2	Structure and functions of liver, gallbladder, and pancreas.	December	3

Teacher's Name: Srabanti Kundu

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
1	Honours-Theory	Basic Food Science-1	CC-1	Protein-definition, classification, properties.	September	2
1	Honours-Theory	Basic Food Science-1	CC-1	Amino acids-classification, types, functions.	September	2
1	Honours-Theory	Human Physiology-1	CC-2	Circulatory System-blood and its composition, formed elements, blood	November	3

				groups, mechanism of blood coagulation, immune system, erythropoiesis, anaemia.		
1	Honours-Theory	Human Physiology-1	CC-2	Cardiovascular System-structure and functions of heart, cardiac cycle, cardiac output, blood pressure and its regulation.	November	3
1	Honours-Practical	Human Physiology-1	CC-2	Determination of pulse rate in resting condition and after exercise (30 beats/10 beats method)	September	2
1	Honours-Practical	Human Physiology-1	CC-2	Determination of blood pressure by sphygmomanometer	September	2
1	Honours-Practical	Human Physiology-1	CC-2	Measurement of Peak Expiratory flow rate (by spirometer)	December	2
1	Honours-Practical	Human Physiology-1	CC-2	Determination of Bleeding time and clotting time.	November	2
1	Honours-Practical	Human Physiology-1	CC-2	Detection of Blood Group (slide method)	December	2
1	Honours-Practical	Human Physiology-1	CC-2	Measurement of Haemoglobin level (Sahli's or Drabkin method)	December	2

Teacher's Name: Jayanti Dhara

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
1	Honours-Theory	Basic Food Science-1	CC-1	Lipids- definition, classification, properties.	September	2
1	Honours-Theory	Basic Food Science-1	CC-1	Fatty acids-composition, properties, types.	September	2
1	Honours-Theory	Basic Food Science-1	CC-1	Role and nutritional significances of PUFA, MUFA, SFA, Omega-3 fatty acid.	November	2
1	Honours- Theory	Human Physiology-1	CC-2	Unit of Life-structure, functions of cell with special reference to plasma membrane, mitochondria, ribosome, endoplasmic reticulum, nucleus, nucleotide, homeostasis, positive and negative feedback.	September	4
1	Honours-Theory	Human Physiology-1	CC-2	Musculoskeletal System-formation and functions of muscles, bones, and teeth, Muscle energetics, isometric and isotonic muscle contraction.	November December	3

Signature: ___________________

ODD SEMESTER: SEM-3

Teacher's Name: Dr. Arvinda Shaw

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
3	Honours- Theory	Community Nutrition	CC-6	Concept of community, types, factors affecting community health	September	1
3	Honours- Theory	Community Nutrition	CC-6	Nutritional assessment and surveillance- meaning, need, objectives and importance	September	1
3	Honours- Theory	Community Nutrition	CC-6	Nutritional assessment of humans- clinical findings, nutritional anthropometry, biochemical tests, biophysical methods.	September	2
3	Honours- Theory	Community Nutrition	CC-6	Diet Survey- need, importance, methods, adult consumption unit, adequacy of diet in respect to RDA, concept of family food security.	November	2
3	Honours- Theory	Community Nutrition	CC-6	Clinical signs- needs, importance, identifying signs of PEM, vitamin A deficiency and Iodine deficiency, interpretation of descriptive list of clinical signs.	November	2
3	Honours- Theory	Community Nutrition	CC-6	Nutritional anthropometry- need, importance, standard for reference, techniques of measurement- height, weight, head circumference, chest circumference, mid-upper arm circumference, interpretation of these measurements. Use of growth charts.	December	2
3	Honours- Theory	Community Nutrition	CC-6	International, national, regional agencies and organizations.	December	2
3	Honours- Theory	Community Nutrition	CC-6	Nutritional intervention programmes to combat malnutrition.	December	2
3	Honours-Practical	Community Nutrition	CC-6	Anthropometric Measurements of infant- length, weight, circumference of chest, mid-upper arm circumference.	September	3
3	Honours-Practical	Community Nutrition	CC-6	Comparison with norms and interpretation of the nutritional assessment data and its significance.	September	2
3	Honours-Practical	Community Nutrition	CC-6	Growth Charts- plotting, monitoring, and promotion.	September	2
3	Honours-Practical	Community Nutrition	CC-6	Clinical assessments and signs of nutrient deficiencies specially PEM, Vitamin A deficiencies, Anaemia, Rickets, B-complex deficiencies	November	3
3	Honours-Practical	Community Nutrition	CC-6	Estimation of food and nutrient intake- household food consumption, adult consumption unit, 24-hour recall, weighment method, food dairies, food frequency data, use of each method, collection, and estimation of intakes.	December	3
3	Honours-Practical	Human Nutrition-1	CC-5	Preparation of food from different food groups and their significance in relation to health.	December	3
3	Honours-Practical	Human Nutrition-1	CC-5	Preparation of Supplementary foods for different age groups and their nutritional significance.	December	3
3	Honours-Practical	Human Nutrition-1	CC-5	Planning and preparation of low-cost diet for Grade 1 malnourished child.	December	3
3	Honours- Theory	Food Service Management	SEC-A2	Importance of sanitation and hygiene with respect to food, kitchen hygiene, handling of food, employee's health, hygiene of food service unit.	September	2
3	Honours- Theory	Food Service Management	SEC-A2	Personnel Management- selection, training, supervision of personnel, criteria for selection of dietician and food service staff.	November	2

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
3	Honours-Theory	Human Nutrition-1	CC-5	Concept and definition of terms-nutrition, malnutrition and health, scope of nutrition	September	1
3	Honours-Theory	Human Nutrition-1	CC-5	RDA-Formulation, dietary guidelines Reference Man and Woman, adult consumption unit	September	1
3	Honours-Theory	Human Nutrition-1	CC-5	Energy in human nutrition: Idea of energy, its units, energy balance, assessment of requirements-deficiency and excess. Determination of energy in food, B.M.R. and its regulation, S.D.A.	November	2
3	Honours-Theory	Human Nutrition-1	CC-5	Growth and Development from infancy to adulthood: Somatic, physical, brain and mental development, puberty, menarche, pre-pubertal and pubertal changes, factors affecting growth and development. Importance of nutrition for ensuring adequate development.	November	4
3	Honours-Theory	Human Nutrition-1	CC-5	Growth monitoring and promotion: Use of growth charts and standards, prevention of growth faltering.	December	2
3	Honours-Practical	Food Commodities	CC-7	Detection of starch, sucrose, formalin, boric acid and urea in milk.	December	3
3	Honours-Practical	Food Commodities	CC-7	Detection of urea in puffed rice, vanaspati in ghee, khesari flour in besan	December	3
3	Honours-Practical	Food Commodities	CC-7	Detection of metanil yellow in coloured sweet products, argemone oil in edible oil, artificial colour/ foreign matter in tea (dust/leaves).	December	3
3	Honours-Theory	Food Service Management	SEC-A2	Institutional Menu Planning- factors influencing menu planning, principles of menu planning, different kinds of menus.	September	4
3	Honours-Theory	Food Service Management	SEC-A2	Quality Food Service- Types, centralised, de-centralized, objectives, styles of service.	November	3

Teacher's Name: Rukshana Irani

Teacher's Name: Srabanti Kundu

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
3	Honours-Theory	Food Commodities	CC-7	Cereals and millets-structure, processing, storage, use in various preparation, variety, selection, cost. Cereal products, breakfast cereals, fast food.	September	2
3	Honours-Theory	Food Commodities	CC-7	Milk and milk products-composition, classification, selection, quality, cost, processing, storage, uses in different preparations. Nutritional aspects, shelf life and spoilage.	September	2
3	Honours-Theory	Food Commodities	CC-7	Meat, Fish, Poultry-types, selection, purchase, storage, uses, preparations, cost, spoilage.	November	2
3	Honours-Theory	Food Commodities	CC-7	Sugar, sugar products- types of natural, sweeteners, manufacture selection, storage, use as preservatives, stages in sugar cookery.	November	2
3	Honours-Theory	Food Commodities	CC-7	Raising and Leavening agents-types, constituents, uses in cookery and bakery, storage.	December	2
3	Honours-Theory	Food Commodities	CC-7	Convenience foods-roles, types, advantage, uses, cost and contribution to diet.	December	1
3	Honours-Theory	Food Commodities	CC-7	Salts-types and uses	December	1
3	Honours-Practical	Human Nutrition-1	CC-5	General concepts of weights and measures, eye estimation of raw and cooked foods.	November	2
3	Honours- Theory	Food Service Management	SEC-A-2	Planning a Food Service Unit, layout design, planning of work areas-	December	2

				preparation, cleaning, storing, serving, and dining areas. Lighting, ventilation, working heights in relation to equipment.		

Teacher's Name: Jayanti Dhara

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
3	Honours-Theory	Food Commodities	CC-7	Pulses, Legumes-structures, selection and variety, storage, processing, use in different preparations, nutritional aspects, and cost.	September	2
3	Honours-Theory	Food Commodities	CC-7	Eggs- production, quality, grade, selection, storage, spoilage, cost, nutritional aspects and uses in different preparations.	September	2
3	Honours-Theory	Food Commodities	CC-7	Vegetables and fruits- variety, selection, purchase, storage, availability, nutritional aspects of raw and processed products, uses in different preparations.	November	2
3	Honours-Theory	Food Commodities	CC-7	Fats and Oils- types, sources (animal and vegetable), processing, uses in different preparations, storage, cost, nutritional aspects.	November	2
3	Honours-Theory	Food Commodities	CC-7	Food Adjuncts-spices, condiments, herbs, extracts, food colours, origin, classification, description, uses, specifications, procurements, and storage.	November	2
3	Honours-Theory	Food Commodities	CC-7	Beverages- Tea, Coffee, chocolate, cocoa powder-processing, cost, nutritional aspects, other beverages, aerated beverages, juices.	December	2
3	Honours-Practical	Human Nutrition-1	CC-5	Process involved in cooking- pressure cooking, microwave, steaming, grilling, deep fat frying.	December	3
3	Honours- Theory	Food Service Management	SEC-A-2	Organization of Food Service Management-definition, various types of Food Service institutions, their characteristics, and functions.	December	2

Signature: _______________

ODD SEMESTER: SEM-5

Teacher's Name: Dr Arvinda Shaw

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
5	Honours-Theory	Diet Therapy-II	CC-11	Hypertension-classification, aetiology, symptoms, dietary management.	September	2
5	Honours-Theory	Diet Therapy-II	CC-11	Diseases of the cardiovascular system- definition of infarct, ischemia, angina pectoris, myocardial infarction, heart attack and stroke.	September	3
5	Honours-Theory	Diet Therapy-II	CC-11	Atherosclerosis and hyperlipidaemias- classification, symptoms, dietary and lifestyle management. Prevention of cardiovascular diseases.	November	2
5	Honours-Practical	Diet Therapy-II	CC-11	Planning and preparation of diets for- Diabetes Mellitus	December	3
5	Honours-Practical	Diet Therapy-II	CC-11	Planning and preparation of diets for- Hypertension and Atherosclerosis.	December	3
5	Honours-Theory	Nutritional Biochemistry-II	CC-12	Vitamins-chemistry and biochemical role of fat-soluble vitamins-A, D, E, K. Water soluble vitamins-B1, B2, B6, niacin and C.	September November	2 +2
5	Honours-Theory	Nutritional Biochemistry-II	CC-12	nucleotide, nucleoside, structure of DNA, RNA, Genetic codon	December	2
5	Honours-Theory	Public Health	DSE-A-1	Community water and waste management- importance, toxic agents, water borne infectious agents, sources of water, safe drinking water, potable water, waste disposal, sewage disposal and treatment, solid and liquid waste disposal.	September	3
5	Honours-Theory	Public Health	DSE-A-1	Communicable and infective disease control: nature of communicable and infectious diseases, infection, contamination, disinfection, decontamination, transmission-direct and indirect, vector borne disease, environmental agents, epidemiological principles of disease control.	November	4
5	Honours-Theory	Public Health	DSE-A-1	Public health hazards due to contaminated foods: food borne infections and intoxications, symptoms, mode of transmission, methods of prevention.	December	3
5	Honours-Practical	Public Health	DSE-A-1	Preparation of audio-visual aids like charts, posters, models related to health and nutrition education.	December	3
5	Honours-Practical	Public Health	DSE-A-1	Formulation and preparation of low cost and medium cost nutritious/ supplementary recipe.	December	3

5	Honours-Practical	Public Health	DSE-A-1	Field visit- health centre. Immunization centre, ICDS, MCH centre, NGO etc.	December	5

Teacher's Name: Rukshana Irani

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
5	Honours-Theory	Diet Therapy-II	CC-11	Diet in disease of the Endocrine pancreas- Diabetes mellitus- classification, symptoms, diagnosis, management- insulin therapy, oral hypoglycaemic agents, glucose monitoring at home.	September	**3**
5	Honours-Theory	Diet Therapy-II	CC-11	Nutrition care, therapy, meal plan, special diabetic foods, and artificial sweeteners.	September	**2**
5	Honours-Theory	Nutritional Biochemistry-II	CC-12	Proteins- general reaction of amino acid metabolism, urea cycle. Lipoproteins- types, composition, role, significance in disease. Translation	November	3
5	Honours-Theory	Food safety and Quality Control	DSE-B-1	Introduction to food safety- definition, types of hazards- physical, chemical, and biological, factors affecting food safety.	November	3
5	Honours-Theory	Food safety and Quality Control	DSE-B-1	Food hazards-types, physical, chemical (natural, environmental, and intentional), biological (food borne pathogens- bacteria, viruses, and eukaryotes; sea food and shellfish poisoning and mycotoxins) hazards.	November	4
5	Honours-Theory	Food safety and Quality Control	DSE-B-1	Management of food hazards- need, control of parameters, temperature control, personnel hygiene.	December	2
5	Honours-Theory	Food safety and Quality Control	DSE-B-1	Hygiene and sanitation- sources of contamination, control methods using physical and chemical agents, waste disposal, pest and rodent control, personnel hygiene.	December	**3**
5	Honours-Practical	Food safety and Quality Control	DSE-B-1	Preparation of Project on the above topics and demonstration/presentation	December	**6**

Teacher's Name: Srabanti Kundu

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
5	Honours-Theory	Diet Therapy-II	CC-11	Energy modifications and nutritional care for weight management- assessment, aetiology, complications, prevention, treatment of obesity and underweight.	September	3
5	Honours-Practical	Diet Therapy-II	CC-11	Planning and preparation of diets for- Obesity and Underweight	September	2
5	Honours-Theory	Nutritional Biochemistry-II	CC-12	Brief introduction of biological membranes to understand transport and replication	November	3
5	Honours-Theory	Public Health	DSE-A-1	Health and dimension of Health: positive health versus absence of disease.	November	2
5	Honours-Theory	Public Health	DSE-A-1	Secondary sources of community health data- vital statistics of infant, child, and maternal mortality rates.	December	3
5	Honours-Theory	Public Health	DSE-A-1	Immunization-importance, schedule for children, adults and for foreign travellers.	December	2
5	Honours-Theory	Public Health	DSE-A-1	Concept of epidemiology- study, approach, determinants of disease, preventive and social means.	December	3

Teacher's Name: Jayanti Dhara

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
5	Honours-Theory	Diet Therapy-II	CC-11	Renal Diseases- aetiology, symptoms, dietary management of acute and chronic glomerulonephritis, nephrotic syndrome- dietary management.	September	2
5	Honours-Theory	Diet Therapy-II	CC-11	Uraemia-dietary management, nephrolithiasis- dietary management. Use of sodium and potassium exchange list.	September	2
5	Honours-Practical	Diet Therapy-II	CC-11	Planning and preparation of diets for- Acute and Chronic glomerulonephritis	November	2
5	Honours-Theory	Nutritional Biochemistry-II	CC-12	Minerals- biochemical role of inorganic elements. Transcription	September	2
5	Honours-Practical	Nutritional Biochemistry-II	CC-12	Qualitative analysis of amino acids, proteins.	December	3
5	Honours-Practical	Nutritional Biochemistry-II	CC-12	Estimation of serum protein, creatinine, urea	December	3
5	Honours-Practical	Nutritional Biochemistry-II	CC-12	Estimation of serum Iron, phosphorous, calcium	December	4
5	Honours-Theory	Food Safety and Quality control	DSE-B-1	Food safety management tools- basic concept, prerequisites-GHPs, GMPs, HACCP, ISO series, TQM- concept and need for quality, components of TQM, Risk analysis.	September	3
5	Honours-Theory	Food Safety and Quality control	DSE-B-1	Food Laws and Standards- International Food Standards-ISO and Codex Alimentarius. National Food Standard (BIS, AGMARK) and Food Laws (PFA and FASSAI).	November	3
5	Honours-Practical	Food safety and Quality Control	DSE-B-1	Preparation of Project on the above topics and demonstration/presentation	December	2

Signature: ______________

EVEN SEMESTER: 2

Teacher's Name: Dr Arvinda Shaw

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
2	Honours-Theory	Basic Food Science-II	CC-3	Dietary fibres- classification, sources, composition, properties, and nutritional significance.	March	2
2	Honours-Theory	Basic Food Science-II	CC-3	Minerals and trace elements- biochemical and physiological role, bioavailability and requirements, sources, deficiency and excess- fluoride, zinc, selenium, iodine, chromium	March- April	4
2	Honours-Theory	Human Physiology-II	CC-4	Excretory system- structure and function of skin, regulation of temperature of body.	March	3
2	Honours-Theory	Human Physiology-II	CC-4	Structure and function of kidney in special reference to nephron, physiology of urine formation.	April	3

Teacher's Name: Rukshana Irani

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
2	Honours-Theory	Basic Food Science-II	CC-3	Water-functions, daily requirements, water balance.	March	2
2	Honours-Theory	Basic Food Science-II	CC-3	Water soluble B-Complex- biochemical and physiological role, bioavailability and requirements, sources, deficiency, and excess	March	3
2	Honours-Theory	Human Physiology-II	CC-4	Nervous System- concept of sympathetic and parasympathetic nervous system. Brief anatomy and functions of cerebrum, cerebellum, hypothalamus, and neuron. Concept on synapse, synaptic transmission, reflexes, special senses.	April	5

Teacher's Name: Srabanti Kundu

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
2	Honours-Theory	Basic Food Science-II	CC-3	Fat soluble vitamins- biochemical and physiological role, bioavailability and requirements, sources, deficiency, and excess -A, D, E, K.	March	4
				Water soluble vitamin C- biochemical and physiological role, bioavailability and requirements, sources, deficiency, and excess.	March	3
2	Honours-Theory	Human Physiology-II	CC-4	Endocrine system-structure, functions of pituitary, thyroid, parathyroid and adrenal gland. Structure and function of pancreas.	March	4
2	Honours-Practical	Human Physiology-II	CC-4	Harvard step test.	April	2
2	Honours-Practical	Human Physiology-II	CC-4	Identification with reasons of histological slides- lung, liver, kidney, small intestine, stomach, thyroid, adrenal. Pancreas, testis, ovary, muscle of mammals.	April	3
2	Honours-Practical	Human Physiology-II	CC-4	Qualitative determination of glucose acetone in urine	May	2

2	Honours-Practical	Human Physiology-II	CC-4	Blood film staining and identification of different types of blood cells.	May	3

Teacher's Name: Jayanti Dhara

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
2	Honours-Theory	Basic Food Science-II	CC-3	Minerals- biochemical and physiological role, bioavailability and requirements, sources, deficiency, and excess- Calcium, sodium, potassium, phosphorous, iron	March	4
2	Honours-Practical	Basic Food Science-II	CC-3	Determination of Ash and moisture content in food	March	3
2	Honours-Practical	Basic Food Science-II	CC-3	Determination of calcium, iron, and vitamin C content in foods.	April	4
2	Honours-Theory	Human Physiology-II	CC-4	Reproductive system- structure, functions of gonads, concept on menstrual cycle, brief idea of pregnancy, parturition, lactation, menopause. Brief concept on spermatogenesis and oogenesis process.	April	4

EVEN SEMESTER-4

Teacher's Name: Dr Arvinda Shaw

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
4	Honours-Theory	Human Nutrition-II	CC-8	Nutrition during infancy- physiology, breast feeding- colostrum, its composition and importance in feeding, initiation of breast feeding- advantages of exclusive breast feeding.	March	4
4	Honours-Theory	Human Nutrition-II	CC-8	Basic principles of breast feeding, supplementary feeding, weaning, baby led weaning. Bottle feeding circumstances under which bottle feeding is to be given. Care and sterilization of bottles. Preparation of formula, mixed feeding, artificial feeding.	March	4
4	Honours-Practical	Human Nutrition-II	CC-8	Planning and preparation of adequate meal for different age groups with special reference to different physiological conditions- infants, old age.	May	4
4	Honours-Theory	Diet Therapy-I	CC-9	Routine Hospital diets- regular, light, soft, fluid, parenteral and enteral feeding.	March	2
4	Honours-Theory	Diet Therapy-I	CC-9	Diet for Febrile conditions- influenza, malaria and typhoid.	April	3
4	Honours-Theory	Diet Therapy-I	CC-9	Etiological factors, symptoms, management of common diseases of stomach- Gastritis and Peptic Ulcer	April	4
4	Honours-Practical	Diet Therapy-I	CC-9	Planning and preparation of normal diets, fluid diets, soft diet.	May	3
4	Honours-Practical	Diet Therapy-I	CC-9	Planning and preparation of Peptic Ulcer.	May	3
4	Honours-Theory	Nutritional Biochemistry-1	CC-10	Lipids- oxidation and biosynthesis of fatty acids (saturated and mom-unsaturated), synthesis and utilization of ketone bodies, ketosis, fatty liver, essential fatty acids, cholesterol and its significance.	April	8
4	Honours-Theory	Nutrition and Health Education	SEC-B-1	Concept, objective and importance of nutrition and health education.	March	1
4	Honours-Theory	Nutrition and Health Education	SEC-B-1	Principles of Health education	March	1

Teacher's Name: Rukshana Irani

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
4	Honours-Theory	Human Nutrition-II	CC-8	Nutrition during pregnancy- factors affection pregnancy outcome, importance of adequate weight gain, antenatal care, and its schedule.	March	
4	Honours-Theory	Human Nutrition-II	CC-8	Nutritional requirement and modification of diet, supplementation, deficiency of nutrients- energy, iron, folic acid, protein, calcium, iodide.	March	
4	Honours-Theory	Human Nutrition-II	CC-8	Common problems of pregnancy and their managements specially- nausea, omitting, pica, food aversions, pregnancy induced hypertension, obesity, diabetes, adolescent pregnancy.	April	
4	Honours-Practical	Human Nutrition-II	CC-8	Planning and preparation of adequate meal for different age groups with special reference to different physiological conditions- pregnancy.	May	
4	Honours-Theory	Diet Therapy-I	CC-9	Basic concepts of diet therapy. Team approach to health care. Assessments of patient's need, Anaemia	March	
4	Honours-Practical	Diet Therapy-I	CC-9	Planning and preparation of Anaemia.	May	
4	Honours-Theory	Nutritional Biochemistry-I	CC-10	Intermediary metabolism- carbohydrate metabolism, glycolysis, TCA Cycle and energy generation, HMP Shunt pathway, gluconeogenesis, glycogenesis, glycogenolysis, blood sugar regulation.	April	
4	Honours-Theory	Nutrition and Health Education	SEC-B-1	Nutrition and health education communication process	March	
4	Honours-Theory	Nutrition and Health Education	SEC-B-1	Steps in planning health and nutrition education.	April	

Teacher's Name: Srabanti Kundu

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
4	Honours-Theory	Basic Food Science-II	CC-8	Management of preterm and low birth weight babies	March	4
4	Honours-Theory	Basic Food Science-II	CC-8	Nutritional need of toddler's preschoolers, school going children, adolescents.	March	6
4	Honours-Practical	Human Nutrition-II	CC-8	Planning and preparation of adequate meal for different age groups with special reference to different physiological conditions- pre-schooler, school children, adolescents, adults.	May	8
4	Honours-Theory	Human Physiology-II	CC-9	Intestinal diseases- aetiology, symptoms, dietary management- diarrhoea, steatorrhea, diverticular ds, inflammatory bowel ds, ulcerative colitis, flatulence, constipation, irritable bowel syndrome	April	5
4	Honours-Theory	Nutritional Biochemistry-I	CC-10	Introduction to Biochemistry-definition, objective, scope, inter relationship between biochemistry and other biological science. Enzymes.	March- April	4
4	Honours- Theory	Nutrition and Health Education	SEC-B-1	Methods involved in nutrition and health education.	May	2

Teacher's Name: Jayanti Dhara

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
4	Honours-Theory	Human Nutrition-II	CC-8	Nutrition during lactation-nutritional requirements, dietary management, food supplements, galactagogues, preparation for lactation, care, and preparation of nipples during breast feeding.	March	5
4	Honours-Practical	Human Nutrition-II	CC-8	Planning and preparation of adequate meal for different age groups with special reference to different physiological conditions- lactation	March	3
4	Honours-Theory	Diet Therapy-I	CC-9	Diseases of the Liver and Biliary system	April	2
4	Honours-Practical	Diet Therapy-I	CC-9	Planning and preparation of Viral Hepatitis.	April	3

4	Honours-Theory	Nutritional Biochemistry-I	CC-10	Enzymes-definition, types, classification; co-enzymes- definition, types. Functions of coenzymes and cofactors. Specificity of enzymes, isozymes, enzyme kinetics including factors effecting enzyme action, velocity, catalysed reactions, regulation, zymogen, allosteric enzymes, inhibition.	March	5
4	Honours-Practical	Nutritional Biochemistry-I	CC-10	Quantitative estimation of sugars- glucose, lactose, starch.	May	3
4	Honours-Practical	Nutritional Biochemistry-I	CC-10	Estimation of acid value, iodine value, saponification value of fats.	May	3
4	Honours-Practical	Nutritional Biochemistry-I	CC-10	Estimation of blood glucose, serum cholesterol	May	3
4	Honours- Theory	Nutrition and Health Education	SEC-B-1	Evaluation of nutrition and health education programmes.	March	2

EVEN SEMESTER-6

Teacher's Name: Dr Arvinda Shaw

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
6	Honours-Theory	Food Microbiology	CC-13	Primary sources of microorganisms in food, physical and chemical methods used in the destruction of microorganisms in food- sterilization and disinfection	March	2
6	Honours-Practical	Food Microbiology	CC-13	Staining techniques to study morphology of bacterial cells: methylene blue, methyl violet, carbolfuchsin. Differential staining with gram stain technique*	March	3
6	Honours-Practical	Food Microbiology	CC-13	Microscopic identification of microscope-*	May	1
6	Honours-Practical	Food Microbiology	CC-13	Introduction to microbiology- use of equipment- autoclave, incubator, inoculation chamber, compound microscope. *	May	1
6	Honours-Theory	Food Preservation	CC-14	Food preservation-definition, objectives, principles. Different methods of food preservation.	May	3
6	Honours-Theory	Food Preservation	CC-14	Food Standards- ISI, Agmark, FPO, MPO, PFA, FASSAI.	March	3
6	Honours-Theory	Food Fermentation	DSE-B-3	Batch, Fed batch, Continuous culture; open and closed system, growth phases, product formation in microbial cultures, factors affecting product formation.	April	3
6	Honours-Theory	Food Fermentation	DSE-B-3	Starter cultures, fermentation starters used in different cereal products.	April	2
6	Honours-Theory	Food Fermentation	DSE-B-3	Production and nutritional significance of fermented milk products and vinegar.	April	2
6	Honours-Theory	Food Fermentation	DSE-B-3	Development of fermented soy products- tofu, natto, miso, tempeh, soy sauce and vegetable products- sauerkraut, kimchi. Nutritional significance of the above products.	April	4
6	Honours-Practical	Food Fermentation	DSE-B-3	Demonstration of hygienic handling of equipment, utensils during food fermentation process.	May	2
6	Honours-Practical	Food Fermentation	DSE-B-3	Preparation of fermented foods- dahi, yoghurt.	May	1
6	Honours-Practical	Food Fermentation	DSE-B-3	Preparation of fermented vegetable pickles	May	4
6	Honours-Practical	Food Fermentation	DSE-B-3	Preparation of different food items from fermented products- idli, dhokla, jalebi, raita, lassi, srikhand, etc.	May	6

Note:* Certain CC13 practical sub-units are done by students at Dept of Microbiology, Raidighi College as our department doesn't have the required equipment and infrastructure.

Teacher's Name: Rukshana Irani

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
6	Honours-Theory	Food Microbiology	CC-13	Brief history of food microbiology, introduction to important microorganisms in food.	March	2
6	Honours-Theory	Food Microbiology	CC-13	Cultivation of microorganisms, nutritional requirements of microorganisms, types of media used, methods of isolation.	March	3
6	Honours-Theory	Food Preservation	CC-14	Preserved products- jam, jelly, marmalade, sauces, pickles, squashes, syrups- types, composition, manufacture, selection, cost, storage, uses, nutritional aspects.	April	6
6	Honours-Practical	Food Preservation	CC-14	Different methods of preservation- drying, freezing, frying, canning, bottling. Aseptic handling-sources of contamination of foods.	April	4
6	Honours-Practical	Food Preservation	CC-14	Preparation of pickles, tomato sauce, chilli sauce, jelly, tomato puree, squashes.	April	5
6	Honours-Theory	Geriatric Nutrition	DSE-A-4	Assessment of nutritional status of older adults.	April	2
6	Honours-Theory	Geriatric Nutrition	DSE-A-4	Nutritional requirements and general dietary guidelines for elderly	May	1
6	Honours-Theory	Geriatric Nutrition	DSE-A-4	Major nutritional and health problems during old age	May	1

Teacher's Name: Srabanti Kundu

Semester	Course Type	Unit Name (Topic)	Paper	Subunit Name	Month	No. of Classes
6	Honours-Theory	Food Microbiology	CC-13	Fundamentals of control of microorganisms in foods.	March	2
6	Honours-Theory	Geriatric Nutrition	DSE-A-4	Definition of ageing, senescence, old age, gerontology, geriatrics, geriatric nutrition, classification of old population.	March	3
6	Honours-Theory	Geriatric Nutrition	DSE-A-4	Physiological and biochemical changes during old age.	April	2
6	Honours-Practical	Geriatric Nutrition	DSE-A-4	Preparation of dishes suitable for older people- soft diet	April	3

Teacher's Name: Jayanti Dhara

Semester	**Course Type**	**Unit Name (Topic)**	**Paper**	**Subunit Name**	**Month**	**No. of Classes**
6	Honours-Theory	Food Microbiology	CC-13	Food spoilage-contamination and microorganisms in the spoilage of different kinds of foods such as cereal, cereal products, vegetables, fruits, fish, sea foods, meat products, eggs, poultry, milk products, canned foods.	March	6
6	Honours-Theory	Food Fermentation	DSE-B-3	Food fermentation-definition, microorganisms used for food fermentation, advantages.	March	2
6	Honours-Theory	Food Fermentation	DSE-B-3	Study of a bio-fermenter- its design and operations, Downstream processing, and product recovery.	April	3
6	Honours-Theory	Food Fermentation	DSE-B-3	Production of baker's yeast	April	2

Signature: ___________________________-

RAIDIGHI COLLEGE

TEACHING PLAN REPORT

Subject Name: **ZOOLOGY** Session: **2022-23**

Teacher Name: **Dr Ishita Samajdar**

Semester	Course Type	Unit Name (Topic)	Paper	Sub Unit Name	Month	No. of Classes
Semester1	**Honours**	Unit 3: Porifera	CC1-1-TH	General characteristics and Classification up to classes (Ruppert and Barnes, 1994, 6 th Ed.); Canal system and spicules in sponges	August	2
Semester1	**Honours**	Unit 2: DNA Replication	CC1-2-TH	Mechanism of DNA Replication in Prokaryotes, Prove that replication is Semi-conservative, bidirectional and discontinuous, RNA priming, Replication of telomeres.	August	3
Semester1	**Honours**		CC-1-2-P	Isolation and quantification of genomic DNA from goat liver	August	1
Semester2	**Honours**	Unit 7: Hemichordata	CC2-3-TH	General characteristics of phylum Hemichordata. Relationship with non-chordates and chordates	April	3
Semester2	**Honours**	Unit 1: Plasma Membrane	CC2-4-TH	Ultra-structure and composition of Plasma membrane: Fluid mosaic model, Transport across membrane - Active and Passive transport, Facilitated transport, Cell junctions: Tight junctions, Gap junctions, Desmosomes	April	4
Semester2	**Honours**	Unit 7: Cell Signalling	CC2-4-TH	Cell signalling transduction pathways; Types of signalling molecules and receptors (Classification and Example only): RTK & JAK/STAT. Apoptosis	May	2
Semester2	**Honours**		ZOOA-CC-2-4-	Cell viability study by Trypan Blue staining	May	1

			P			
Semester3	**Honours**	Unit 4: Pisces	CC3-5-TH	General characteristics and classification up to living sub classes (Young, 1981); Accessory respiratory organ, Migration in fishes; Parental care in fishes; Swim bladder in fishes.	September	2
Semester3	**Honours**		CC-3-5-P	Identification with Reasons: Scoliodon, Sphyrna, Pristis, Torpedo, Mystus, Heteropneustes, Labeo rohita, Exocoetus, Hippocampus, Anabas, Flat fish	September	1
Semester3	**Honours**	Unit 6: Endocrine System	CC3-6-TH	Classification of hormones; Mechanism of Hormone action; Signal transduction pathways for Steroidal and Non-steroidal hormones; Hypothalamus (neuroendocrine gland) - Placental hormones	September	2
Semester3	**Honours**		CC3-6-P	Microtomy: Preparation of permanent slide of any five mammalian (Goat/white rat) tissues	October	3
Semester3	**Honours**	Unit 4: Nucleic Acids	CC3-7-TH	Structure of Purines, Pyrimidines, Nucleosides and Nucleotides; Nucleic Acid Metabolism: Catabolism of adenosine, Guanosine, cytosine and thymine.	October	2
Semester3	**Honours**		CC-7-3-P	Quantitative estimation of water soluble proteins following Lowry Method	October	1
Semester4	**Honours**	Unit 2: Physiology of Respiration	CC4-9-TH	Coronary Circulation, Structure and working of conducting myocardial fibres, Origin and conduction of cardiac impulses; Cardiac Cycle and cardiac output	April	2
Semester4	**Honours**		CC4-9-P	Estimation of haemoglobin using	April	1

				Sahli's haemoglobin meter(IS)		
Semester4	**Honours**	Unit 1: Overview of Immune System	CC4-10-TH	Introduction – concept of health and disease; Cells and organs of the Immune system	May	1
Semester4	**Honours**	Unit 8: Hypersensitivity	CC4-10-TH	Gell and Coombs' classification and brief description of various types of hypersensitivities.	May	1
Semester4	**Honours**		CC4-10-TH	Various types of vaccines. Active & passive immunization (Artificial and natural)	May	1
Semester4	**Honours**		CC4-10-P	Histological study of Bursa fabricius, spleen, thymus and lymph nodes through slides/ photographs	May	1
Semester5	**Honours**	Unit 2: Population	-CC5-11-TH	Unitary and Modular populations Unique and group attributes of population: Demographic factors, life tables, fecundity tables, survivorship curves, dispersal and dispersion. Geometric, exponential and logistic growth, equation and patterns, r and K strategies Population regulation - densitydependent and independent factors, Population Interactions, Gause's Principle with laboratory and field examples, Lotka-Volterra equation for competition.	January	3
Semester5	**Honours**		CC5-11-P	Determination of population density in a natural/hypothetical community by quadrate method and calculation of Shannon-Weiner diversity index for the same community	January	2
Semester5	**Honours**		CC5-11-P	Report on a visit to National	January	2

				Park/Biodiversity Park/Wild life sanctuary/ any place of ecological interest/ ecological uniqueness/ Zoological garden		
Semester5	**Honours**	Unit 6: Genetic Fine Structure	CC5-12-TH	Complementation test in Bacteriophage (Benzer's experiment on rII locus)	February	1
Semester5	**Honours**	Unit 7: Transposable Genetic Elements	CC5-12-TH	IS element in bacteria, Ac-Ds elements in maize and P elements in Drosophila, LINE, SINE, Alu elements in humans	February	2
Semester5	**Honours**		CC5-12-P	Identification of chromosomal aberration in Drosophila and man from photograph	February	1
Semester5	**Honours**	Unit 4: Parasitic Nematodes	DSE(A)-5-1-TH	Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of Ascaris lumbricoides, Ancylostoma duodenale, Wuchereria bancrofti, Nematode plant interaction.	January	3
Semester5	**Honours**		DSE(A)-5-1-P	Study of monogenea from the gills of fresh/marine fish [Gills can be procured from fish market as by product of the industry]	January	2
Semester5	**Honours**		DSE(A)-5-1-P	Submission of a brief report on parasitic vertebrates	January	
Semester5	**Honours**	Unit 4: Regulation of Hormone Action	DSE(B)-5-1-TH	Mechanism of action of steroidal, non-steroidal hormones with receptors (cAMP, IP3-DAG), Calcium and Glucose homeostasis in mammals. Bioassays of hormones using RIA & ELISA, Estrous cycle in rat and menstrual cycle in human.	February	3
Semester5	**Honours**	Unit 5. Non	DSE(B)-	Functions of Prolactin in	February	2

		Mammalian Vertebrate Hormone	5-1-TH	Fishes, Amphibia & Birds Function of Melanotropin in Teleost fishes, Amphibians and Reptiles		
Semester5	**Honours**		DSE(B)-5-1-P	Dissect and display of Endocrine glands in laboratory bred rat	January	1
Semester5	**Honours**		DSE(B)-5-1-P	Tissue fixation, embedding in paraffin, microtomy and slide preparation of any endocrine gland	January	1
Semester6	**Honours**	Unit 3: Post Embryonic Development	CC6-13-TH	Development of brain and Eye in Chick. Molecular Induction in Brain and Eye development	April	2
Semester6	**Honours**	Unit 5	CC6-14-TH	Species concept, Isolating mechanisms, modes of speciation; Speciation by chromosome rearrangement in Drosophila. Adaptive radiation/macroevolution (exemplified by Galapagos finches).	May	3
Semester6	**Honours**	Unit 6	CC6-14-TH	Origin and Evolution of Man, Unique Hominid characteristics contrasted with primate characteristic	May	1
Semester6	**Honours**	Unit 8	CC6-14-TH	Extinction, back ground and mass extinctions, detailed example of K-T extinction	May	1
Semester6	**Honours**		CC6-14-P	Study of homology and analogy from suitable specimens	July	1
Semester6	**Honours**	Unit 1: Introduction	DSE(A)-6-2-TH	Organization of E.coli and Drosophila genome	July	1
Semester6	**Honours**	Unit 4: Culture Techniques and Applications	DSE(A)-6-2-TH	Animal cell culture, Expressing cloned genes in mammalian cells, Molecular diagnosis of 27 genetic diseases (Cystic fibrosis, Sickle cell anaemia, Thalassemia). Dolly	August	3

				&Polly cloning Genetically modified economically important animal Gene Therapy		
Semester6	**Honours**		DSE(A)-6-2-P	Project report on animal cloning & Application & ethical Issues	September	1
Semester6	**Honours**	Unit 2: Morphology and Physiology	DSE(B)-6-2-TH	Types of fins and their modifications; Locomotion in fish; Hydrodynamics; Types of Scales, Use of scales in Classification and determination of age of fish; Gills and gas exchange; Swim Bladder: Types and role in Respiration, buoyancy; Electric organ, Bioluminescence	September	3
Semester6	**Honours**	Unit 5: Fish in research	DSE(B)-6-2-TH	Transgenic fish Zebra fish as a model organism in research	November	2
Semester6	**Honours**		DSE(B)-6-2-P	Identification of Petromyzon, Myxine, Pristis, Exocoetus, Hippocampus, Gambusia, Labeo, Heteropneustes, Anabas	July	2
Semester6	**Honours**		DSE(B)-6-2-P	Project Report on a visit to any fish farm/ pisciculture unit/Zebrafish rearing Lab.	November	3
Semester1	**General**	Unit 2: Phylum Porifera	CC1-1-TH	General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Canal System in Sycon	July	1
Semester2	**General**	Unit 3: Respiratory System	CC2-2-TH	Brief account of Gills, lungs, air sacs and swim bladder	May	1
Semester3	**General**	Unit 6:Reproduction and Endocrine Glands	CC3-3-TH	Physiology of male reproduction: Histology of testis, hormonal control of spermatogenesis; Physiology of female, reproduction: Histology of ovary, hormonal	December	2

				control of menstrual cycle. Structure and function of pituitary, thyroid, pancreas and adrenal.		
Semester3	**General**		ZOOG-CC3-3-P	Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland.	September	1
Semester4	**General**	Unit 5: Maintenance of Aquarium	ZOOG-SEC-B-4-2-TH	General Aquarium maintenance - budget for setting up an Aquarium Fish Farm as a Cottage	May	2
Semester5	**General**	Unit 10: Fish Technology	ZOOG-DSE-A-5-1-TH	Genetic improvements in aquaculture industry; Induced breeding and transportation of fish seed	October	2
Semester5	**General**		ZOOG-DSE-A-5-1-P	Visit to poultry farm or animal breeding centre. Submission of visit report	October	1
Semester5	**General**	Unit 4: Management of Aquatic Resources	ZOOG-DSE-A-5-2-TH	Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills, Eutrophication, Management and conservation ;legislations, Sewage treatment Water quality assessment - BOD and COD	September	3
Semester5	**General**		ZOOG-DSE-A-5-2-P	Visit to any aquatic Ecosystem and preparation and submission of report	September	1
Semester6	**General**	Unit 1: Diagnostics Methods Used for Analysis of Blood	ZOOG-SEC-B-6-4-TH	Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentation Rate (E.S.R)	July	2
Semester6	**General**		ZOOG-SEC-B-6-4-TH	Unit 9: Visit to Pathological Laboratory and Submission of Project	July	1

RAIDIGHI COLLEGE

TEACHING PLAN REPORT

Subject Name: **ZOOLOGY** Session: **2022-23**

Teacher Name: **Ashraful Alam**

Semester	Course Type	Unit Name (Topic)	Paper	Sub Unit Name	Month	No. of Classes
Semester1	**Honours**	Unit 1:Ctenophora	CC1-1-TH	General characteristics	August	2
Semester1	**Honours**	Unit 7: DNA Repair Mechanisms	ZOOA-CC-1-2-TH	Types of DNA repair mechanisms, RecBCD model in prokaryotes, nucleotide and base excision repair, SOS repair	May	3
Semester1	**Honours**	Unit 8: Molecular Techniques	CC2-4-TH	PCR, Western and Southern blot, Northern Blot	September	2
Semester2	**Honours**	Unit 4:Onychophora	CC-2-3-TH	General characteristics and Evolutionary significance	September	3
Semester2	**Honours**	Practical	CC-2-3-P	Anatomy study: Nervours system, Reproductive system (Male & female), Mouth parts & Salivary apparatus in Periplaneta sp.	September	3
Semester3	**Honours**	Unit1: Introduction to Chordates	CC-3-5-TH	General characteristics and outline classification of Phylum Chordata (Young, 1981)	October	1
Semester3	**Honours**	Unit 1:Tissues	CC-3-6-TH	Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue	October	2
Semester4	**Honours**	Unit 6: Nervous system and sense organs	CC-4-8-TH	Comparative account of brain in vertebrates; cranial nerves; olfactory and auditory receptors in vertebrates	October	2
Semester4	**Honours**	Unit7: Skeletal system	CC4-8-TH	Overview of axial and appendicular skeleton – limbs, girdles of pigeon; jaw suspension in mammals	April	2
Semester4	**Honours**	Practical	CC-4-8-P	Study of disarticulated skeleton of toad, Pigeon,	April	2

				Guineapig (limb bones, vertebrae, limb and girdle		
Semester4	**Honours**	Practical	CC-4-8-P	dentification of skulls: Pigeon, one herbivore (Guineapig) and one carnivore (Dog) animal	May	2
Semester6	**Honours**	Unit3:Fisheries	DSE(B)-6-2-TH	Inland Fisheries; Marine Fisheries; Fishing crafts and Gears; Depletion of fisheries resources; Application of remote sensing and GIS in fisheries; Fisheries law and regulations	May	2
Semester3	**Honours**	Unit2:Biology of silk worm	SEC(A)-3-2-TH	Life cycle of Bombyx mori Structure of silk gland and secretion of silk	May	3
Semester3	**Honours**	Unit 4: Pests and Diseases	SEC(A)-3-2-TH	Pests of silkworm: Uzi fly, dermestid beetles and vertebrates Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial Control and prevention of pests and diseases	May	2
Semester4	**Honours**	Unit3: Food and feeding of Aquarium fishes	SEC(B)-4-1-TH	Use of live fish feed organisms. Preparation and composition of formulated fish feeds, Aquarium fish as larval predator	January	1
Semester 4	**Honours**	Unit5: Maintenance of Aquarium	SEC(B)-4-1-TH	General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry	January	2
Semester1	**General**	Unit 6: Phylum Annelida	CC1-1-TH	General characters and classification up to classes (Rupert and Barnes, 1994, 6th Ed.); Metamerism in Annelida	July	4
Semester1	**General**	Unit 7: Phylum Arthropoda	CC1-1-TH	General characters and classification up to classes (Ruppert and Barnes, 1994, 6 th Ed.); Eye in Cockroach, Metamorphosis in Lepidoptera	May	4
Semester1	**General**	Unit 8: Phylum Mollusca	CC1-1-TH	General characters and classification up to classes (Ruppert and Barnes, 1994, 6th	December	3

				Ed.); Respiration in Pila		
Semester1	**General**	Unit 9: Phylum Echinodermata	ZOOG-CC1-1-TH	eneral characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Watervascular system in Asteroidea	September	2
Semester1	**General**	Unit 10: Protochordates	ZOOG-CC-1-1-TH	General Characters ; Pharynx and feeding mechanism in Amphioxus	May	2
Semester1	**General**	Unit 11: Agnatha	ZOOG-CC-1-TH	General features of Agnatha and classification of cyclostomes up to classes (Young, 1981)	October	2
Semester1	**General**	Unit 12: Pisces	ZOOG-CC1-1-TH	General features and Classification up to orders (Young, 1981); Osmoregulation in Fishes	October	2
Semester1	**General**	Unit 15: Aves	ZOOG-CC-1-TH	General features and Classification up to orders (Young, 1981); Flight adaptations in birds	September	2
Semester1	**General**	Unit 1: Integumentary System	CC2-2-TH	Derivatives of integument with respect to glands in Birds & Mammals	September	2
Semester1	**General**	Unit 2: Digestive System	CC2-2-TH	Stomach and Dentition	July	3
Semester1	**General**	Practical	CC-2-2-P	Osteology: Limb bones, girdle and vertebra of Pigeon & Guineapig, Mammalian skulls: One herbivorous; Guinea pig and one carnivorous; Dog	July	2
Semester-3	**General**	Unit 4: Cardio-vascular system	CC-3-3-TH	Composition of blood, Structure of Heart, Origin and conduction of the cardiac impulse, cardiac cycle	august	2
Semester-3	**General**	Unit 8: Lipid metabolism	CC-3-3-TH	Beta oxidation of Palmitic acid {saturated (C 16:0)} and Linoleic acid {unsaturated (C 18:2)	November	3
Semester-4	**General**	Unit 1:Mendelian Genetics and its Extension	CC-4-4-TH	rinciples of Inheritance, Chromosome theory of inheritance, Incomplete dominance and codominance, Multiple alleles, lethal alleles, sex linked inheritance in Drosophila (White eye locus) & Human (Thalassemia)	september	2
Semester-4	**General**	Unit 3: Mutation	CC-4-4-TH	Chromosomal mutation, Deletion, duplication,	november	2

				inversion, translocation, aneuploidy, gene mutation, induced mutation, types & example		
Semester-4	**General**	Unit 7: Process of Evolutionary changes	CC-4-4-TH	Isolating mechanism, Natural Selection.	December	2
Semester-5	**General**	Unit 2: Epidemiology of Diseases	DSE-A-5-1-TH	Transmission, Prevention and Control of Tuberculosis and Typhoid.		
Semester-5	**General**	Unit 6: Insect of Medical Importance	DSE-A-5-1-TH	Medical Importance and control of Anopheles		
Semester-5	**General**	Unit 8: Animal Husbandry	DSE-A-5-1-TH	Preservation and artificial insemination in cattle; Induction of early puberty and synchronization of estrus in cattle		
Semester-5	**General**	Unit 9: Poultry Farming	DSE-A-5-1-TH	Principles of poultry breeding, Management of breeding stock and broilers, Processing and preservation of eggs		
Semester-5	**General**	Unit 1: Aquatic Bionics	DSE-A-5-2-TH	Brief introduction of the aquatic biomes: Freshwater ecosystem; lakes, wetlands, streams and rivers, estuaries, intertidal zones, oceanic pelagic zone, marine benthic zone and coral reefs		
Semester-5	**General**	Unit 2: Freshwater Biology lakes	DSE-A-5-2-TH	Origin and classification, Lake as an Ecosystem, Lake morphometry, Physico-chemical Characteristics: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity; dissolved gases; Oxygen, Carbon dioxide. Nutrient Cycles in Lakes-Nitrogen, Sulphur and Phosphorous.		
Semester-6	**General**	Unit I: Introduction to Insects	DSE-B-6-1-TH	General Features of Insects, Morphological features, Head, Eyes, Types of antennae, Mouth parts with respect to feeding habits		
Semester-6	**General**	Unit 5: Siphonaptera as Disease Vectors	DSE-B-1-TH	Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases - Plague,		

				Typhus fever; Control of fleas		
Semester-6	**General**	Practical	DSE-6-1-P	Study of following insect vectors through permanent slides/photographs: Aedes, Culex, Anopheles, Pediculus humanuscapitis, Pediculus humanuscorporis, Phlebotomus argentipes, Musca domestica		

RAIDIGHI COLLEGE

TEACHING PLAN REPORT

Subject Name: **ZOOLOGY** Session: **2022-23**

Teacher Name: **SK Abul Kasem**

Semester	**Course Type**	**Unit Name (Topic)**	**Paper**	**Sub Unit Name**	**Month**	**No. of Classes**
Semester1	**Honours**	Unit 1: Basics of Animal Classification	CC1-1-TH	Definitions: Classification, Systematics and Taxonomy; Taxonomic Hierarchy, Taxonomic types Codes of Zoological Nomenclature; Principle of priority; Synonymy and Homonymy; Concept of classification – three kingdom concept of Carl Woese, 1977 and five kingdom concept of Whittaker, 1969	August	2
Semester-1	**Honours**	Unit: Protista and Metazoa	CC-!-TH	Protozoa General characteristics and Classification up to phylum (according to Levine et. al., 1980) Locomotion in Euglena, Paramoecium and Amoeba; Conjugation in Paramoecium. Life cycle and pathogenicity of Plasmodium vivax and Entamoeba histolytica Metazoa Evolution of symmetry and segmentation of Metazoa	september	2
Semes	**Honours**	Practical:practi	CC1-1-P	Identification with reason &	semtem	2

ter 1		cal		Systematic position of *Amoeba*, *Euglena*, *Entamoeba*, *Paramecium*, *Plasmodium*, *Balantidium*, *Vorticella*	ber	
Semester1	**Honours**	Unit 6: Gene Regulation	CC1-2-TH	Regulation of Transcription in prokaryotes: lac operon and trp operon; Regulation of Transcription in eukaryotes: Activators, enhancers, silencer, repressors, miRNA mediated gene silencing. Epigenetic Regulation: DNA Methylation, Histone Methylation & Acetylation.	August	3
Semester2	**Honours**	Unit 1: Introduction	CC2-3-TH	Evolution of coelom	May	2
Semester2	**Honours**	Practical	ZOOA-CC-2-3-P	Anatomy study: Nervours system, Reproductive system (Male & female), Mouth parts & Salivary apparatus in *Periplaneta* sp**.**	May	3
Semester3	**Honours**	Unit 2: Cytoplasmic organelles-1	CC2-4-TH	Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes; Protein sorting and mechanisms of vesicular transport	September	2
Semester2	**Honours**	Unit 4:cytoskeleton	CC-2-4-TH	Type, structure and functions of cytoskeleton; Accessory proteins of microfilament & microtubule	September	3
Semester2	**Honours**	Unit 6:cell cycle	CC-2-4-TH	Cell cycle and its regulation, Cancer (Concept of oncogenes and tumor suppressor genes with special reference to p53, Retinoblastoma and Ras.	September	3

				Process of Proto-oncogene activation		
Semester2	**Honours**	practical	CC-2-4-P	Preparation of permanent slide to show the presence of Barr body in human female blood cells/cheek cells.**(**	October	1
Semester2	**Honours**	practical	CC-2-P	DNA by feulgen reaction	October	2
Semester3	**Honours**	Unit 5:Amphibia	CC-3-5-TH	General characteristics and classification up to living Orders (Young, 1981); Metamorphosis, Paedomorphosis, Parental care in Amphibia	October	2
Semester3	**Honours**	Practical	CC3-5-P	*Necturus, Bufo (Duttaphrynus) melanostictus, Rana (Hoplobatrachus) tigerinus, Hyla,* *Tylototriton*, Axolotllarva**(**	April	2
Semester3	**Honours**	Practical	CC-3-5-P	Dissection of brain and pituitary – *ex situ*, digestive and Urino-genital system of *Tilapia* Pecten from Fowl head	April	2
Semester3	**Honours**	Unit 1: Tissue	CC-3-6-TH	Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue	May	2
Semester3	**Honours**	Practical	CC3-7-P	Paper chromatography of amino acids	May	2
Semester4	**Honours**		CC4-8-TH	Succession of kidney in different vertebrate groups; evolution of urino-genital ducts	May	3
Semester4	**Honours**	Unit 6:Renal physiology	CC4-9-TH	Structure of Kidney and its functional unit, Mechanism of urine formation, Regulation of acid- base	May	2

				balance		
Semester4	**Honours**	Practical	CC-4-9-P	Demonstration of blood pressure by digital meter	January	1
Semester 5	**Honours**	practical	CC-5-10	Determination of population density in a natural/hypothetical community by quadrate method and calculation of Shannon-Weiner diversity index for the same community**(**	January	2
Semester5	**Honours**	Unit 4:Sex determination	CC5-12-TH	Mechanisms of sex determination in *Drosophila* and in man; Dosage compensation in *Drosophila* & Human	January	2
Semester5	**Honours**	practical	CC-5-12-P	Identification of chromosomal aberration in *Drosophila* and man from photograph**(**	February	1
Semester 5	**Honours**	Unit 6:parasite vertebates	DSE(A) 5-1-TH	Cookicutter Shark, Hood Mocking bird, Vampire bats their parasitic behaviour and effect on host.	February	2
Semester5	**Honours**	Pratical	DSE(A)-5-1-P	Study of nematode/cestode parasites from the intestines of Poultry bird [Intestine can be procured from poultry/market as a by-product] & Goat.	February	2
Semester6	**Honours**	Unit 3:genetically modified organism	DSE(A)-6-2-TH	Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection. Applications of transgenic animals: Production of pharmaceuticals, production of donor organs,	January	2

				knock-out mice.		
Semester6	**Honours**	Unit 1:Introdution and classification	DSE(B)-6-2-TH	Feeding habit, habitat and manner of reproduction. Classification of fish (upto Subclasses) (Romar, 1959)	January	2
Semester6	**Honours**	Unit 4:Aquaculture	DSE(B)-6-2-TH	Extensive, semi-intensive and intensive culture of fish; Pen and cage culture; Polyculture; Composite fish culture; Brood stock management; Induced breeding of fish; Management of finfish hatcheries; Preparation and maintenance of fish aquarium; Preparation of compound diets for fish; Role of water quality in aquaculture; Fish diseases: Bacterial, viral and parasitic; Preservation and processing of harvested fish, Fishery by-products	January	4
Semester3	**Honours**	Unit1:Introducion	SEC(A)-3-2-TH	Sericulture: Definition, history and present status; Silk route Types of silkworms, Distribution and Races Exotic and indigenous races Mulberry and non-mulberry Sericulture	February	3
Semester4	**Honours**	Unit 1:Introduction to aquarium fish keeping	SEC(B)-4-1-TH	The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes	February	2
Semester4	**Honours**		DSE(B)-5-1-P	Dissect and display of Endocrine glands in laboratory bred rat	January	1
Semester4	**Honours**	Unit2:Biology of aquarium fisf	SEC(B)-4-1-TH	Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue	January	2

				morph, Anemone fish and Butterfly fish		
Semester4	**Honours**	Unit 4:fish transprtation	CC6-13-TH	Live fish transport - Fish handling, packing and forwarding techniques.	April	2
Semester1	**General**	Unit 1: Kingdom Protista	CC1-1-TH	General characters and classification up to classes (Levine et. al., 1980); Locomotory Organelles and locomotion in Amoeba and Paramecium	July	4
Semester1	**General**	Unit 14:Reptiles	CC1-1-TH	General features and Classification up to orders (Young, 1981); Poisonous and non-poisonous snakes, Biting mechanism	May	4
Semester1	**General**	practical	CC1-1-P	Amoeba, Euglena, Paramecium, Sycon, Obelia, Aurelia, Metridium, Taenia solium, Ascaris lumbricoides (Male and female), Aphrodite, Nereis, Hirudinaria, Palaemon, Cancer, Limulus, Apis, Chiton, Dentalium, Unio, Sepia, Octopus, Echinus, Cucumaria and Antedon	December	3
Semester2	**General**	Unit 5:urinogenital system	ZOOG-CC2-2-TH	Succession of kidney, Evolution of urino-genital ducts	September	2
Semester3	**General**	Unit3 ;Respiration	ZOOG-CC-3-3-TH	Pulmonary ventilation, Transport of Oxygen and carbon	May	2
Semester5	**General**	Unit-1:Host and parasitic Relationship	ZOOG-DSE-A-5-1-TH	Type of Host, Types of Parasites, Other types of Relations	October	2
Semester5	**General**	Unit-3:Marine biology	ZOOG-DSE-A-5-2-P	Salinity and density of Sea water, Continental shelf, Adaptations of deep sea organisms, Coral reefs, Sea weeds	October	2
Semester6	**General**	Unit3:Insects as vectors	ZOOG-DSE-B-6-1-TH	Classification of insects up to orders, detailed features of orders with insects as vectors - Diptera,	September	2

				Siphonaptera, Siphunculata, Hemiptera		
Semester6	**General**	Unit1:Introduction to ecology	ZOOG-DSE-B-6-2-TH	Ecosystem, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of Physical factors, The Biosphere.	September	2
Semester6	**General**	Unit 5:Wild life	ZOOG-SEC-B-6-4-TH	Wildlife Conservation (in-situ and ex-situ conservation): Necessity for wildlife conservation; National parks & sanctuaries, Tiger conservation - Tiger reserves in India; Management challenges in Tiger reserve	July	3
Semester6	**General**	Practical	ZOOG-DSE-B-6-2-P	Familiarization and study of animal evidences in the field; Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers, etc	July	2
Semester-3	**General**	Unit 4:Bee economy	ZOOG-SEC-A-3-1-TH	Products of Apiculture Industry and its Uses ;Honey, Bees Wax, Propolis, Pollen etc	august	2
Semester-4	**General**	Unit2:Biology of aquarium fishes	ZOOG-SEC-B-4-2-TH	Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish	november	3
Semester-5	**General**	Unit1:Introduction	ZOOG-SEC-A-5-3-TH	Sericulture: Definition, history and present status; Silk route; Types of silkworms, Distribution and Races Exotic and indigenous races Mulberry and non-mulberry Sericulture	september	2
Semester-5	**General**	Unit-5: Entrepreneurship in Sericulture(	ZOOG-SEC-A-5-3-TH	Prospectus of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture.	november	2

				Visit to various sericulture centres		
Semester-6	**General**	Unit-4: Infectious Diseases(	ZOOG-SEC-B-6-4-TH	Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis, Malarial parasite	December	2

RAIDIGHI COLLEGE

TEACHING PLAN REPORT

Subject Name: **ZOOLOGY** Session: **2022-23**

Teacher Name: **SAFIKA SULTANA**

Semester	**Course Type**	**Unit Name (Topic)**	**Paper**	**Sub Unit Name**	**Month**	**No. of Classes**
Semester1	**Honours**	Unit 3: Phylum Cnidaria	CC1-1-TH	General characteristics and Classification up to classes (Ruppert and Barnes, 1994, 6th Ed.), Metagenesis in Obelia; Polymorphism in Cnidaria; Corals and coral reef diversity, Role of symbiotic algae in reef formation. Conservation of coral and coral reefs	August	2
Semester-1	**Honours**	Unit 4: Translation (SS)	CC-!-TH	Genetic code, Degeneracy of the genetic code and Wobble Hypothesis. Mechanism of protein synthesis in prokaryotes	september	2
Semester 1	**Honours**	Practical:practical	CC1-1-P	Staining/mounting of any protozoa/helminth from gut of Periplaneta sp.(SS)	semtember	2
Semester1	**Honours**	Unit 4: Translation (SS)	CC1-2-TH	Genetic code, Degeneracy of the genetic code and Wobble Hypothesis. Mechanism of protein synthesis in prokaryotes..	August	3
Semester2	**Honours**	Unit 3: Arthropoda(SS)	CC2-3-TH	General characteristics and Classification up to classes (Ruppert and Barnes, 1994); Insect Eye (Cockroach only). Respiration in Prawn and Cockroach; Metamorphosis	May	2

				in Lepidopteran Insects; Social life in Termite		
Semester2	**Honours**	Practical	ZOOA-CC-2-3-P	. Arthropods - Limulus, Palaemon, Balanus, Eupagurus, Scolopendra, Peripatus, Silkworm – life history stages, Termite – members of a colony and Honey bee – members of the colony (SS)	May	3
Semester2	**Honours**	Unit 5: Nucleus(SS)	CC2-4-TH	Nuclear envelope, Nuclear pore complex, Nucleolus; Chromatin: Euchromatin and Heterochromatin and packaging (nucleosome),	September	2
Semester2	**Honours**	Unit 4:cytoskeleton	CC-2-4-TH	Type, structure and functions of cytoskeleton; Accessory proteins of microfilament & microtubule	September	3
Semester2	**Honours**	Unit 6:cell cycle	CC-2-4-TH	Cell cycle and its regulation, Cancer (Concept of oncogenes and tumor suppressor genes with special reference to p53, Retinoblastoma and Ras. Process of Proto-oncogene activation	September	3
Semester2	**Honours**	practical	CC-2-4-P	. Preparation of temporary stained squash of onion/arum root tip to study various stages of mitosis(SS)	October	1
Semester2	**Honours**	practical	CC-2-P	DNA by feulgen reaction	October	2
Semester3	**Honours**	Unit 7: Aves(SS)	CC-3-5-TH	General characteristics and classification up to living Sub-Classes (Young, 1981); Exoskeleton and migration in Birds; Principles and aerodynamics of flight	October	2
Semester3	**Honours**	Unit 2: Bone and Cartilage	CC3-5-TH	Structure and types of bones and cartilages, Ossification	April	2
Semester3	**Honours**	UNIT-6	CC-3-6-TH	Structure and types of bones and cartilages, Ossification	April	2

Semes ter3	**Honours**	Unit 1: Carbohydrates(SS)	CC-3-7-TH	Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides; Derivatives of Monosaccharides; Carbohydrate metabolism: Glycolysis, Citric acid cycle, Pentose phosphate pathway, Gluconeogenesis	May	3
Semes ter3	**Honours**	Unit 2: Lipids	CC3-7-TH	Lipid metabolism: β-oxidation of fatty acids - a. Palmitic acid {saturated (C 16:0)}, b. Linoleic acid {unsaturated (C 18:2)}; Fatty acid biosynthesis	May	2
Semes ter3	**Honours**	Unit 5: Enzymes	CC4-7-TH	Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Derivation of Michaelis-Menten equation, Lineweaver-Burk plot; Factors affecting rate of enzyme-catalyzed reactions; Enzyme inhibition.	May	3
Semes ter4	**Honours**	Unit 4: Circulatory System(	CC4-8-TH	General plan of circulation, Comparative account of heart and aortic arches	May	2
Semes ter4	**Honours**	Practical	CC-4-8-P	Study of placoid, cycloid and ctenoid scales through permanent slides/photographs	January	1
Semes ter 4	**Honours**	Unit 5: Thermoregulation & Osmoregulation	CC-4-9 TH-	Thermal regulation in camel and polar bear, Osmoregulation in aquatic vertebrates	January	2
Semes ter4	**Honours**	PRACTICAL	CC4-9P	Identification of blood cells from human blood	January	2
Semes ter4	**Honours**	PRACTICA	CC4 -9-P	IdentiIdentification of blood cells from cockroach haemolymph	February	1
Semes	**Honours**	Unit 2: Innate	CC4-10-	Anatomical barriers,	February	2

ter 4		and Adaptive Immunity	TH	Inflammation, Cell and molecules involved in innate immunity, Adaptive immunity (Cell mediated and humoral)		
Semes ter4	**Honours**	Unit 4: Immunoglobulin s	CC4-10-TH	Structure and functions of different classes of immunoglobulins, Antigen-antibody interactions, Immunoassays (ELISA and RIA), Monoclonal antibody production	January	2
Semes ter4	**Honours**	PRACTICA	CC4-10P	. Demonstration of lymphoid organs (by picture). (SS) 2. Histological study of Bursa fabricius, spleen, thymus	January	2
Semes ter5	**Honours**	Unit 4: Ecosystem(	CC5-11 TH	Types of ecosystem with an example in detail, Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains, Food web, Energy flow, Ecological pyramids and Ecological efficiencies; Nitrogen cycle.	January	2
Semes ter5	**Honours**	Unit 5: Applied Ecology	CC5-11 TH	Types & level of biodiversity Mega-diversity countries, Biodiversity Hot spot, Flagship species, Keystone species, Wildlife Conservation (in situ and ex situ conservation), concept of protected areas. Red data book, Indian wild life act & Schedule. Concept of corridor, advantages and problem of corridor. Threats to survival and conservation strategies for Tiger, Olive ridley, White Rumped Vulture. Ecolog	January	4
Semes ter5	**Honours**	Unit 3: Mutations	CC5-12	Types of gene mutations (Classification), Types of chromosomal aberrations (Classification with one suitable example from Drosophila and Human of each), variation in	February	3

				chromosome number; Nondisjunction of X chromosome in Drosophila; Non-disjunction of Human Chromosome 21. Molecular basis of mutations in relation to UV light and chemical mutagens. Mutation detection in Drosophila by attached X method. Biochemical mutation detection in Neurospora.		
Semester5	**Honours**	PRACTICAL	CC5-12	. Chi-square analyses for genetic ratio test	February	2
Semester5	**Honours**	PRACTICAL	CC512	Pedigree analysis of some inherited traits in animals	January	1
Semester6	**Honours**	Unit 3	CC-6-14	Geological time scale, Fossil: types and age determination by Carbon dating, Evolution of horse	January	2
Semester6	**Honours** Unit 7	Unit 4	CC6-14-TH	Live f Natural Selection: Modes with Examples;	July	2
Semester6	**Honours**	Unit 7	CC1-14-TH	Population genetics: Hardy-Weinberg Law; factors disrupting H-W equilibrium (Genetic Drift, Migration and Mutation and Selection in changing allele frequencies (only derivations required). Simple problems related to estimation of allelic and gene frequencies.	July	4
Semester6	**Honours**	Unit 9	CC6-14-TH	Phylogenetic trees, construction and interpretation of Phylogenetic tree using parsimony, convergent and divergent evolution.	August	4
Semester1	**Honours**	practical	CC1-1-P	Phylogenetic trees, Construction & interpretation of Phylogenetic tree using parsimony, Construction of dendrogram following principles of phenetics & cladistics from a data table	July	3
Semester3	**Honours**	Unit 3: Rearing of Silkworms	SEC(A)-3-2-TH	Selection of mulberry variety and establishment of mulberry garden Rearing house and rearing appliances. Disinfectants: Formalin,	October	2

				bleaching powder, RKO Silkworm rearing technology: Early age and Late age rearing Types of mountages Spinning, harvesting and storage of cocoons		
Semes ter5	**Honours**	Unit 2: Hypothalamo-Hypophyseal Axis	-DSE(B)-5-1-TH	Structure and functions of hypothalamus and Hypothalamic nuclei, Regulation of neuroendocrine glands, Feedback mechanisms, Hypothalamo-Hypophyseal-Gonadal Axis. Structure of pituitary gland, Hormones and their functions, Hypothalamo-hypophyseal portal system	January	2
Semes ter5	**l Honours**	Unit 2: Hypothalamo-Hypophyseal Axis	ZOOA-DSE-B-5-1-TH	Structure and functions of hypothalamus and Hypothalamic nuclei, Regulation of neuroendocrine glands, Feedback mechanisms, Hypothalamo-Hypophyseal-Gonadal Axis. Structure of pituitary gland, Hormones and their functions, Hypothalamo-hypophyseal portal system	February	2
Semes ter5	**Honours**	Unit3: Hypothalamo-Hypophyseal Axis	ZOOA-DSE-B-5-1-TH	Structure, Hormones and Functions of Thyroid gland, Parathyroid, Adrenal, Pancreas, Ovary and Testis. Disorders of endocrine glands (Diabetes mellitus type I & Type II; Graves' Disease)	JAnuary	2
Semes ter6	**Honours**	Unit 4: Regulation of Hormone Action	-DSE(B)-5-1-TH	Mechanism of action of steroidal, non-steroidal hormones with receptors (cAMP, IP3-DAG), Calcium and Glucose homeostasis in mammals. Bioassays of hormones using RIA & ELISA, Estrous cycle in rat and menstrual cycle in human.	January	2
Semes ter6	**Honours**	practical	ZOOG-DSE-B-6-2-p	study of the permanent slides of all the endocrine glands	January	2

Semester1	**General**	Unit 3: Phylum Cnidaria	ZOOG-CC1-1-TH	General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Metagenesis in Obelia	July	3
Semester1	**General**	Unit 13: Amphibia	ZOOG-CC1-1-TH	General features and Classification up to orders (Young, 1981); Parental care	July	2
Semester-2	**General**	Unit 4: Circulatory System(	ZOOG-CC2-2-TH	Evolution of heart and aortic arches	September	2
Semester-3	**General**	Unit 5: Excretion	ZOOG-CC3-3-TH	Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish Structure of nephron, Mechanism of Urine formation; Counter-current Mechanism and Butterfly fish	May	3
Semester-3	**General**	Unit 7: Carbohydrate Metabolism	ZOOG-CC3-3-p	Glycolysis, Kreb's cycle, Glycogenesis, Electron Transport Chain.	August	2
Semester-4	**General**	Unit 5: Origin of Life	ZOOG-CC4-4-TH	Chemical Origin of life	May	2
Semester-4	**General**	Practical	ZOOG-CC4-4-P	Verification of Mendelian Ratio using Chi square test	May	2
Semester-5	**General**	Unit 5: Insect of Economic Importance(	-DSE-A-5-1-TH	Biology, Control and Damage caused by Heliocoverpa armigera, Pyrilla perpusilla, Sytophilus oryzae and Tribolium casteneum.	September	2
Semester-5	**General**	practical	-DSE-A-5-1-p	. Study of Plasmodium vivax, Entamoeba histolytica, Trypanosoma gambiense, Ancylostoma duodenale and Wuchereria bancrofti and their life stages through permanent slides/photomicrographs or specimens.	October	2

Semester-5	**General**	practical	-DSE-A-5-2-P	Determine the amount of dissolved Oxygen, and free Carbon dioxide, in water collected from a nearby lake / water body	Novem,ber	2
Semester-6	**General**	Unit IV: Dipteran as Disease Vectors	-DSE-A-6-2-TH	dy of mosquitoborne diseases - Dengue, Viral encephalitis, Filariasis; Control of mosquitoes	september	2
Semester-6	**General**	: Siphunculata as Disease Vector	-DSE-B-6-1-TH	Human louse; Head, Body and Pubic louse as important insect vectors; Study of louse-borne diseases -Typhus fever, Relapsing fever, Trench fever; Control of human lous	July	2
Semester-6	**General**	practical	DSE-B-6-1-P	. Study of different kinds of mouth parts of insects	July	2
Semester-6	**General**	practical	DSEB-6-p	. Submission of a project report	December	2

RAIDIGHI COLLEGE

TEACHING PLAN REPORT

Subject Name: **ZOOLOGY** Session: **2022-23**

Teacher Name: MANJUSHREE DAS

Semester	**Course Type**	**Unit Name (Topic)**	**Paper**	**Sub Unit Name**	**Month**	**No. of Classes**
Semester1	**Honours**	Unit 7: Nematoda(MD	CC1-1-TH	General characteristics and Classification up to classes (Ruppert and Barnes, 1994, 6th Ed.) Life cycle, and pathogenicity and control measures of Ascaris lumbricoides and Wuchereria bancrofti Parasitic adaptations in helminthe	August	2
Semester-1	**Honours**	Unit 3: Transcription (MD)	CC-!-TH	Mechanism of Transcription in prokaryotes and eukaryotes, Transcription factors, Difference between prokaryotic and eukaryotic transcription	september	4
Semester 1	**Honours**	Practical:practical	CC1-1-P	dentification with reason & Systematic position of Sycon, Poterion (Neptune’s	semtember	2

				Cup), Obelia, Physalia, Aurelia, Gorgonia, Metridium, Pennatula, Madrepora, Fasciola hepatica, Taenia solium and Ascaris lumbricoides.		
Semester1	**Honours**	Unit 6: Gene Regulation (MD	CC1-2-TH	Regulation of Transcription in prokaryotes: lac operon and trp operon; Regulation of Transcription in eukaryotes: Activators, enhancers, silencer, repressors, miRNA mediated gene silencing. Epigenetic Regulation: DNA Methylation, Histone Methylation & Acetylation.	August	3
Semester2	**Honours**	Unit 5: Mollusca(MD)	CC2-3-TH	General characteristics and Classification up to classes (Ruppert and Barnes, 1994); Nervous system in Pila sp. Torsion in Gastropoda. Feeding and respiration in Pila sp.	May	2
Semester2	**Honours**	Practical	ZOOA-CC-2-3-P	Molluscs - Dentalium, Patella, Chiton, Pila, Achatina, Pinctada, Sepia, Octopus, Nautilus (MD)	May	2
Semester2	**Honours**	Unit 2: Cytoplasmic organelles-1I	CC2-4-TH	Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis Mitochondrial Respiratory Chain, Chemiosmotic hypothesis; Peroxisomes: Structure and Functions	September	2
Semester2	**Honours**	Unit 4:cytoskeleton	CC-2-4-TH	Type, structure and functions of cytoskeleton; Accessory proteins of microfilament & microtubule	September	2
Semester2	**Honours**	Unit 6:cell cycle	CC-2-4-TH	Cell cycle and its regulation, Cancer (Concept of oncogenes and tumor suppressor genes with special	September	2

Semester2	**Honours**	practical	CC-2-4-P	Preparation of permanent slide to show the presence of Barr body in human female blood cells/cheek cells.**(**	October	1
Semester2	**Honours**	practical	CC-2-P	DNA by feulgen reaction	October	2
Semester3	**Honours**	Unit 2: Protochordata(MD)	CC-3-5-TH	General characteristics and classification of sub-phylum Urochordata and Cephalochordata up to Classes (Young, 1981). Metamorphosis in Ascidia. Chordate Features, structure of pharynx and feeding in Branchiostoma	October	2
Semester3	**Honours**	Unit 8: Mammals (MD)	CC3-3-TH	General characters and classification up to living sub classes (Young, 1981); Exoskeleton derivatives of mammals; Adaptive radiation in mammals with reference to locomotory appendages; Echolocation in Micro chiropterans	April	2
Semester3	**Honours**	PRACTICAL	CC-3-5-P	Mammalia: Bat (Insectivorous and Frugivorous), Funambulus (Indian Palm squirrel) (MD)	April	2
Semester3	**Honours**	Unit 5: Reproductive System(MD)	CC-3-6-TH	Histology of mammalian testis and ovary; physiology of mammalian reproduction – menstrual and oestrous cycle	May	2
Semester3	**Honours**	Practical	CC3-6-P	Study of permanent slides of Mammalian Skin, Spinal cord, Pancreas, Testis, Ovary, Adrenal, Lung, pyloric stomach, cardiac stomach, Thyroid, small intestine and large intestine of white rat	May	2
Semester3	**Honours**	Practical	CC3-7-P	Succes Qualitative tests for carbohydrates, proteins and lipids	May	3

Semes ter3	**Honours**	practical	CC3-7-P	Qualitative estimation of Urea & Uric acid	May	3
Semes ter3	**Honours**	Practical	CC-3-7-P	Quantitative estimation of water soluble proteins following Lowry Method(	January	3
Semes ter 4	**Honours**	Unit 1: Integumentary System	CC-4-8	DeterStructure, function and derivatives of integument in amphibian, birds and mammals	January	2
Semes ter4	**Honours**	Unit 4: Circulatory System	CC4-8-TH	General plan of circulation, Comparative account of heart and aortic arches	January	2
Semes ter4	**Honours**	practical	CC-4-8-P	General plan of circulation, Comparative account of heart and aortic arches	Februar y	1
Semes ter 4	**Honours**	practical	CC-4-8-P	Comparative study of heart and brain, with the help of model/picture	Februar y	2
Semes ter4	**Honours**	Unit 3: Physiology of Circulation(	Cc4-9 TH	Study of nematode/cestode parasites from the intestines of Poultry bird [Intestine can be procured from poultry/market as a by-product] & Goat.	Februar y	2
Semes ter4	**Honours**	practical	-CC4-9 P	Preparation of haemin crystals and haemochromogen crystals -	January	2
Semes ter4	**Honours**	Unit 5: Major Histocompatibili ty Complex	CC4-10TH	Structure and functions of MHC molecules. Structure of T cell Receptor and its signalling, T cell development & selectio	April	2
Semes ter5	**Honours**	Unit 4: Ecosystem	CC5-11	Types of ecosystem with an example in detail, Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains, Food web, Energy flow, Ecological pyramids and Ecological efficiencies; Nitrogen cycle.	January	3
Semes ter5	**Honours**	Unit 5: Applied Ecolog	CC5-11	Types & level of biodiversity	Februar y	3

				Mega-diversity countries, Biodiversity Hot spot, Flagship species, Keystone species, Wildlife Conservation (in situ and ex situ conservation), concept of protected areas. Red data book, Indian wild life act & Schedule. Concept of corridor, advantages and problem of corridor. Threats to survival and conservation strategies for Tiger, Olive ridley, White Rumped Vulture.		
Semes ter5	**Honours**	Unit 1: Mendelian Genetics and its Extension	CC512	Principles of inheritance, Incomplete dominance and co-dominance, Epistasis, Multiple alleles, Isoallele (White eye mutations), Pseudoallele (Lozenge Locus) & Cis-trans test for allelism, Lethal alleles, Pleiotropy, Penetrance & Expressivity	Februar y	2
Semes ter5	**Honours**	Unit 1: Early Embryonic Development(	CC5-12	Dissect and display of Endocrine glands in laboratory bred rat	January	1
Semes ter6	**Honours**	Unit 1: Early Embryonic Development(	CC6-13	Gametogenesis: Spermatogenesis, Oogenesis (sea urchin & mammal); Types of eggs, Egg membranes; Fertilization in sea urchin and mammal; Planes and patterns of cleavage; Types of Blastula [frog and chick]; Fate map in chick embryo, fate mapping using vital dye and radioactive technique; Gastrulation in frog and chick; Embryonic induction and organizers in Xenopus (Spemann & Mangold's experiment	January	2
Semes ter6	**Honours**	Unit 2: Late Embryonic Development(	CC6-13-TH	L Extra-embryonic membranes in Chick; Implantation of embryo in humans, Placenta (Structure, types and functions of placenta)	April	2
Semes	**Honours**	practical	CC6-13P	Study of different sections of	April	2

ter6				placenta (photomicropgraph/ slides		
Semester6	**Honours**	TH	CC1-1-TH	General features and Classification up to orders (Young, 1981); Poisonous and non-poisonous snakes, Biting mechanism	February	2
Semester6	**Honours**	practical	CC6-14-P	Study of fossils from models/ pictures: Dickinsonia, Paradoxides (Trilobita), Asteroceras (Ammonoid), Pentremites (Blastoid Echinoderm), Ichthyosaur, Archaeopteryx, Cynodont	December	2
Semester5	**Honours**	Unit 1: Introduction to Endocrinology	-DSE(B)-5-1-TH	General idea of Endocrine systems, Classification, Characteristic and Transport of Hormones, Neuro-secretions and Neuro-hormones: Examples and Functions	September	2
Semester5	**Honours**	- Unit 5. Non Mammalian Vertebrate Hormone	-DSE(B)-5-1-TH	Functions of Prolactin in Fishes, Amphibia & Birds Function of Melanotropin in Teleost fishes, Amphibians and Reptiles.	April	2
Semester1	**General**	Unit 5: Phylum Nemathelminthes	ZOOG-CC1-1-TH	General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Life history of Ascaris lumbricoides and its adaptation	December	2
Semester1	**General**	Unit 17: Mammals	ZOOG-CC1-1-TH	Classification up to orders (Young, 1981); Hair, Horn & A Amoeba, Euglena, Paramecium, Sycon, Obelia, Aurelia, Metridium, Taenia solium, Ascaris lumbricoides (Male and female), Aphrodite, Nereis, Hirudinaria, Palaemon, Cancer, Limulus, Apis ntler, Nail & claw	July	2
Semester1	**General**	practical	ZOOG-CC1-1-P	, Amoeba, Euglena, Paramecium, Sycon, Obelia, Aurelia, Metridium, Taenia solium, Ascaris lumbricoides (Male and female), Aphrodite, Nereis, Hirudinaria, Palaemon, Cancer, Limulus, Apis	May	2
Semester2	**General**	Unit 7: Late Embryonic Development	CC2-2-TH	Placenta types and function; Metamorphic events in frog life cycle and its hormonal	September	1

				regulation		
Semester2	**General**	practical	ZOOG-CC2-2-P	. Study of the different types of placenta- histological sections through photomicrographs.	July	3
Semester2	**General**	Practical	, ZOOG-CC2-2-P	. Developmental stages of chick embryo: 24 Hrs., 48 Hrs, 72 Hrs., 96 Hrs	July	2
Semester-3	**General**	Unit 2: Digestion	ZOOG-CC3-3-TH	Physiology of digestion in the alimentary canal; Absorption of carbohydrates, proteins, lipids	August	2
Semester-3	**General**	Unit 10. Enzyme	ZOOG-CC3-3-TH	Enzyme Classification, factors affecting enzyme action, Inhibition	April	2
Semester-3	**General**	practical	ZOOG-CC3-3-P	. Qualitative test for carbohydrate samples.	september	2
Semester-4	**General**	Unit 2: Linkage, Crossing Over	ZOOG-CC4-4-TH	Linkage and crossing over, Complete & Incomplete Linkage, Recombination frequency as a measure of linkage intensity. Holiday Model	november	2
Semester-4	**General**	Unit 4: Sex determination(	ZOOG-CC4-4-TH	Genic Balance theory and dosage compensation in Drosophila	December	2

Semester1	**General**	Unit 17: Mammals	ZOOG-CC1-1-TH	Classification up to orders (Young, 1981); Hair, Horn & A Amoeba, Euglena, Paramecium, Sycon, Obelia, Aurelia, Metridium, Taenia solium, Ascaris lumbricoides (Male and female), Aphrodite, Nereis, Hirudinaria, Palaemon, Cancer, Limulus, Apis ntler, Nail & claw	October	1
Semester1	**General**	practical	ZOOG-CC1-1-P	, Amoeba, Euglena, Paramecium, Sycon, Obelia, Aurelia, Metridium, Taenia solium, Ascaris lumbricoides (Male and female), Aphrodite, Nereis, Hirudinaria, Palaemon,	September	2

				Cancer, Limulus, Apis		
Semester2	**General**	Unit 7: Late Embryonic Development	CC2-2-TH	Placenta types and function; Metamorphic events in frog life cycle and its hormonal regulation	September	2
Semester2	**General**	practical	ZOOG-CC2-2-P	. Study of the different types of placenta- histological sections through photomicrographs.	May	2
Semester2	**General**	Practical	, ZOOG-CC2-2-P	. Developmental stages of chick embryo: 24 Hrs., 48 Hrs, 72 Hrs., 96 Hrs	September	2
Semester-3	**General**	Unit 2: Digestion	ZOOG-CC3-3-TH	Physiology of digestion in the alimentary canal; Absorption of carbohydrates, proteins, lipids	October	2
Semester-3	**General**	Unit 10. Enzyme	ZOOG-CC3-3-TH	Enzyme Classification, factors affecting enzyme action, Inhibition	november	2
Semester-3	**General**	practical	ZOOG-CC3-3-P	. Qualitative test for carbohydrate samples.	september	2
Semester-4	**General**	Unit 2: Linkage, Crossing Over	ZOOG-CC4-4-TH	Linkage and crossing over, Complete & Incomplete Linkage, Recombination frequency as a measure of linkage intensity. Holiday Model	november	2
Semester-4	**General**	Unit 4: Sex determination(	ZOOG-CC4-4-TH	Genic Balance theory and dosage compensation in Drosophila	December	1

Semester-4	**General**	Unit 6: Evolutionary Theories	ZOOG-CC4-4-TH	Lamarckism, Darwinism, Neo-Darwinism.	November	`1
Semester-4	**General**	practical	ZOOG-CC4-4-P	Study and identification of Darwin Finches from photographs.	november	2
Semester-4	General	Practical	ZOOG-CC4-4-P	Visit to natural history museum and submission of report	December	1

Semester-5	General	Unit 4: Parasitic Helminthes	ZOOG-DSE-A-5-1-TH	Life History and pathogenicity of Alcylostoma duodenale, Wuchereria bancrofti	January	2
Semester-5	General	practical	ZOOG-DSE-A-5-1-P	. Study of arthropod vectors associated with human diseases: Pediculus, Culex, Anopheles, Aedes	Januarty	2
Semester-6	General	Unit II: Concept of Vectors	DSE-B-6-1-TH	nical and biological vector, Reservoirs, Hostvector relationship, Adaptations as vectors, Host Specific	February	2
Semester-6	General	Unit VII: Hempitera as Disease Vectors	DSE-B-6-1-TH	Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors,Control and prevention measures	January	2
Semester-6	General	Unit 2: Population	ZOOG-DSE-B-6-2-TH	Attributes of population: Life tables, fecundity tables, survivorship curves, dispersal and dispersion. Geometric, exponential and logistic growth, equation and	February	2

				patterns, Population regulation: density-dependent and independent factors,		
Semester-6	General	Practical	ZOOG-DSE-B-6-2-p	Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, salinity, determination of pH, and Dissolved Oxygen content	January	2

Semester	Paper	Topic	JULY-SEPTEMBER/ OCTOBER-DECEMBER	Faculty Name
Semester-I HONOURS	**BOT-A-CC-1-1-TH(PHYCOLOGY & MICROBIOLOGY)** **50 Marks: 4 credits**	Phycology-General account	July-August	DURBADAL BARMAN
		Classification	September-November	DURBADAL BARMAN
		Cyanobacteria	November	DURBADAL BARMAN
		Bacillariophyta	November	DURBADAL BARMAN
		Life History	November-December	DURBADAL BARMAN
	BOT-A-CC-1-1-P(PHYCOLOGY & MICROBIOLOGY) **30 Marks: 2 credits**	Virus	September-November	ASIMPANDA
		Bacteria	November-December	ASIM PANDA
		Work out of the following algae with reproductive structure (Free hand drawing and drawing under drawing prism with magnification): Oedogonium, Chara, Ectocarpus.	September-December	DURBADAL BARMAN
		Study of (a) Permanent slides : Gloeotrichia, Volvox, Vaucheria, Coleochaete, Polysiphonia, Centric and Pennate diatom; (b) Macroscopic specimens: Laminaria, Sargassum.	November	DEBANJAN PANDIT

		Preparation of bacterial media – (a) Nutrient agar and nutrient broth, (b) Preparation of slants and pouring Petri-plates	September-November	ASIM PANDA

			Sub-culturing of bacterial culture	November	ASIM PANDA
			Gram staining from bacterial culture	November-December	ASIM PANDA
			Field excursions-2	December	DURBADAKL BARMAN & DEBANJAN PANDIT
			Microscopic examination of bacteria from natural habitat (curd) by simple staining.	December	ASIM PANDA
	BOT-A-CC-1-2-TH(MYCOLOGY & PHYTO-PATHOLOGY) **50 Marks: 4 credits**		Mycology-General account	July-August	DEBANJAN PANDIT
			Classification of fungi	September	DEBANJAN PANDIT
			Life history	November-December	DEBANJAN PANDIT
			Mycorrhiza	November-December	DEBANJAN PANDIT
			Lichen	December	DEBANJAN PANDIT
			Phyto-pathology-Terms & Definitions	July-August	DR. MADHUMITA MAJUMDER
			Host – Parasite Interaction	September	DR. MADHUMITA MAJUMDER
			Plant Disease Management	November	DR. MADHUMITA MAJUMDER

			Symptoms, Causal organism, Disease cycle and Control measures of: Late blight of Potato, Brown spot of rice, Black stem rust of wheat, Stem rot of jute.	November-December	DR. MADHUMITA MAJUMDER

Semester	Paper	Topic	JULY-SEPTEMBER/ OCTOBER-DECEMBER	Faculty Name
	BOT-A-CC-1-2-P (MYCOLOGY & PHYTO-PATHOLOGY) **30 Marks: 2 credits**	Work out of the following fungi with reproductive structures (including microscopic measurement of Reproductive structures): Rhizopus (asexual), Ascobolus , Agaricus .	September	DEBANJAN PANDIT
		Study from permanent slides: Zygospore of Rhizopus, Conidia of Fusarium,Conidiophor e of Penicillium.	September-November	DEBANJAN PANDIT
		Morphological study of Fungi (fruit body of Polyporus, Cyathus), Lichens (fruticose and foliose).	November	DEBANJAN PANDIT
		Preparation of fungal media (PDA).	November	DEBANJAN PANDIT & DR. MADHUMITA MAJUMDER
		Sterilization process.	November-December	DEBANJAN PANDIT & DR. MADHUMITA MAJUMDER
		Isolation of pathogen from diseased leaf	November-December	DEBANJAN PANDIT & DR. MADHUMITA MAJUMDER
		Inoculation of fruit and subculturing.	November-December	DEBANJAN PANDIT & DR. MADHUMITA MAJUMDER

		Identification: Pathological specimens of Brown spot of rice, Bacterial blight of rice, Loose smut of wheat, Stem rot of jute, Late blight of potato; Slides of uredial, telial, pycnial & aecial stages of Puccinia graminis.	November-December	DEBANJAN PANDIT & DR. MADHUMITA MAJUMDER
		Field study	December	MADHUMITA MAJUMDER & ASIM PANDA

Semester	Paper	Topic	JULY-SEPTEMBER/ OCTOBER-DECEMBER	Faculty Name
Semester-III HONOURS	**BOT-A-CC-3-5-TH(PALAEOBOTANY AND PALYNOLOGY) 50 Marks: 4 credits**	Geological time scale with dominant plant groups through ages	July-August	ASIM PANDA
		Plant Fossil	August-September	MADHUMITA MAJUMDER
		Fossil Pteridophytes	November-December	MADHUMITA MAJUMDER
		Fossil gymnosperms	November-December	MADHUMITA MAJUMDER
		Indian Gondwana System	December	MADHUMITA MAJUMDER
		Palynology	August-November	MADHUMITA MAJUMDER
		Applied Palynology	November-December	MADHUMITA MAJUMDER
	BOT-A-CC-3-5 P(PALAEOBOTANY AND PALYNOLOGY) 30 Marks: 2 credits	Morphological study: Ptilophyllum and Glossopteris leaf fossils	September	MADHUMITA MAJUMDER
		Study of Pollen types (colpate, porate and colporate) from permanent slides	November	MADHUMITA MAJUMDER
	BOT-A-CC-3-6-TH(REPRODUCTIVE BIOLOGY OF ANGIOSPERMS) 50 Marks: 4 credits	Morphology of Angiosperms: Inflorescence types with examples.	September	ASIM PANDA
		Flower	November	ASIM PANDA

		Induction of flowering, flower development-genetic and molecular aspects	November	ASIM PANDA
		Embryology: Pre fertilisation changes	August	DEBANJAN PANDIT
		Fertilisation	September-November	DEBANJAN PANDIT
	BOT-A-CC-3-6-P(REPRODUCTIVE BIOLOGY OF ANGIOSPERMS) 30 Marks: 2 credits	Post-fertilization changes	November-December	DEBANJAN PANDIT
		Apomixis & Polyembryony	December	DEBANJAN PANDIT
		Inflorescence types- study from fresh/ preserved specimens	July-August	DEBANJAN PANDIT & ASIM PANDA
		Flowers-study of different types from fresh/ preserved specimens	August-September	DEBANJAN PANDIT & ASIM PANDA
		Fruits- study from different types from fresh/preserved specimens	November	DEBANJAN PANDIT & ASIM PANDA
		Study of ovules (permanent slides/ specimens/photo graphs)-types (anatropous, orthotropous, amphitropous and	November	DEBANJAN PANDIT & ASIM PANDA

		campylotropous		
		Field study	September	DEBANJAN PANDIT & ASIM PANDA MUKHERJEE
	BOT-A-CC-3-7-TH(PLANT SYSTEMATICS) 50 Marks: 4 credits	Taxonomy of Angiosperms: Introduction Nomenclature Systems of classification Phenetics and Cladistics Data sources in Taxonomy	July-August August-September September-November-December November November-December	DURBADAL BARMAN DURBADAL BARMAN DURBADAL BARMAN DURBADAL BARMAN

	BOT-A-CC-3-7-P(PLANT SYSTEMATICS) 30 Marks: 2 credits	Diagnostic features, Systematic position (Bentham & Hooker and Cronquist), Economically important plants (parts used and uses) of the selected monocot and dicot families Work out, description, preparation of floral formula and floral diagram, identification up to genus with the help of suitable literature of wild plants and systematic position according to Benthum Hooker system of classification from the following families: Malvaceae, Fabaceae (Papilionaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Labiatae (Lamiaceae), Rubiaceae. Spot identification (Binomial, Family) of common wild plants from families included in the	November-December August-September November-December December	DURBADAL BARMAN DURBADAL BARMAN DURBADAL BARMAN

		theoretical syllabus.		

		Field visit Botanical Garden and two local field visit.	September-December	DURBADAL BARMAN , DEBANJAN PANDIT, ASIM PANDA & MADHUMITA MAJUMDER
		Preparation of Herbarium specimen	September-December	
	BOT-A-SEC-A-3-1- TH(APPLIED PHYCOLOGY, MYCOLOGY AND MICROBIOLOGY) 80 Marks: 2 credits	Applied Phycology	August-September November-December	DURBADAL BARMAN
		Applied Mycology	August-September November-December	DEBANJAN PANDIT
		Applied Microbiology	August-September November-December	ASIM PANDA

Semester	**Paper**	**Topic**	**JULY-SEPTEMBER/OCTOBER-DECEMBER**	**Faculty Name**
Semester- V HONOURS	**BOT-A-CC-5-11- TH(CELL & MOLECULAR BIOLOGY)** **50 Marks: 4 credits**	Origin & Evolution of cells	July-August	DR.MADHUMITA MAJUMDER
		Nucleus and Chromosome	September-November	DR.MADHUMITA MAJUMDER
		Cell cycle and its regulation	November	DR.MADHUMITA MAJUMDER
		DNA Replication, Transcription and Translation (Prokaryotes &	August-September - November	DR.MADHUMITA MAJUMDER

		Eukaryotes)		
		Gene Regulation	November-December	DURBADAL BARMAN
		Genetic Code	November-December	ASIM PANDA
		Recombinant DNA Technology	August-September - November	ASIM PANDA
		Development and causes of Cancer	August-September	ASIM PANDA
	BOT-A-CC-5-11- P(CELL BIOLOGY) 30 Marks: 2 credits	Study of plant cell structure with the help of epidermal peal mount of Onion/Rhoeo/Crinum	August	DEBANJAN PANDIT & MADHUMITA MAJUMDER
		Measurement of cell size by the technique of micrometry.	August-September	DEBANJAN PANDIT & MADHUMITA MAJUMDER
		Counting cells per unit volume with the help of haemocytometer (Yeast/pollengrains)	November	DEBANJAN PANDIT & MADHUMITA MAJUMDER
		Cytochemical staining of DNA-Pyronine-methyl green staining	December	DEBANJAN PANDIT & MADHUMITA MAJUMDER
		Estimation of DNA content through DPA staining.	December	DEBANJAN PANDIT & MADHUMITA MAJUMDER
		Estimation of RNA through orcinol method	December	DEBANJAN PANDIT & MADHUMITA MAJUMDER

		Study of nucleolus through hematoxylin/ orcin staining and determination of nucleolar frequency.	December	DEBANJAN PANDIT & MADHUMITA MAJUMDER
		Preparation of models/ charts : rolling circle, theta replication, semi-discontinuous replication, prokaryotic RNA polymerase and	November-December	DEBANJAN PANDIT & MADHUMITA MAJUMDER
		eukaryotic RNA polymerase II, assembly of spliceosome mechinary, splicing mechanism in group I and group II introns, ribozyme and alternative splicing.		
	BOT-A-CC-5-12-TH(BIOCHEMISTR Y) **50 Marks: 4 credits**	Biochemical Foundations	July-August	DEBANJAN PANDIT
		Molecules of life	August-September, November-December	DEBANJAN PANDIT
		Energy flow and enzymology	August-September, November-December	DEBANJAN PANDIT
		Cell membrane	November	DEBANJAN PANDIT
		Phosphorylation	December	DEBANJAN PANDIT

	BOT-A-CC-5-12-P(BIOCHEMISTRY) **30 Marks: 2 credits**	Detection of organic acids: citric, tartaric, oxalic and malic from laboratory samples. Detection of carbohydrate and protein from plant samples. Detection of the nature of carbohydrate – glucose, fructose, sucrose and starch from laboratory samples. Detection of Ca, Mg, Fe, S from plant ash sample	November-December November-December November-December November-December	ASIM PANDA & DEBANJAN PANDIT ASIM PANDA & DEBANJAN PANDIT ASIM PANDA & DEBANJAN PANDIT ASIM PANDA & DEBANJAN PANDIT
		Preparation of solutions and buffers Estimation of amino- nitrogen by formol	August-September August-September	ASIM PANDA & DEBANJAN PANDIT

		titration method (glycine). Estimation of glucose by Benedict s quantitative reagent Estimation of titratable acidity from lemon. Estimation of catalase activity in plant samples and effect of substrate, enzyme concentration and pH on enzyme activity. Estimation of urease activity in plant samples. Colorimetric estimation of protein by Folin phenol reagent.	August-September August-September August-September August-September August-September July-August	ASIM PANDA & DEBANJAN PANDIT ASIM PANDA & DEBANJAN PANDIT ASIM PANDA & DEBANJAN PANDIT ASIM PANDA & DEBANJAN PANDIT ASIM PANDA & DEBANJAN PANDIT
	BOT-A-DSE-A-5-1-TH(BIOSTATIS TIC S) **50 Marks: 4 credits**	Biostatistics Biometry Central tendency Test of significance Probability Measurement of gene frequency	August-September November August-September September-November November-December	ASIM PANDA

	BOT-A-DSE-A-5-1-P(BIOSTATISTICS) **30 Marks: 2 credits**	Univariate analysis of statistical data: Statistical tables, mean, mode, median, standard deviation and standard error (using seedling population / leaflet size)	August-September	MADHUMITA MAJUMDER & ASIM PANDA
		Calculation of correlation coefficient values and finding out the probability.	November-December	ASIM PANDA & DEBANJAN PANDIT
		Determination of goodness of fit in Mendellian and modified mono- and dihybrid ratios (3:1, 1:1, 9:3:3:1, 1:1:1:1, 9:7, 13:3, 15:1) by Chi-square analysis and comment on the nature of inheritance.	November	ASIM PANDA & DEBANJAN PANDIT
				ASIM PANDA
		Calculation of 'F' value and finding out the probability value for the F value	December	ASIM PANDA & DEBANJAN PANDIT
		Basic idea of computer programme for statistical analysis of correlation coefficient,'t' test, standard error, standard deviation.	December	
	BOT-A-DSE-B-5-5- TH(PLANT BIOTECHNOLOGY) **50 Marks: 4 credits**		July-August	ASIM PANDA & DEBANJAN PANDIT
		Plant tissue culture –Introduction Callus Culture	August-September	MADHUMITA MAJUMDER
		Plant Regeneration	September	

		Haploid Culture Protoplast Culture Plant Genetic Engineering	November November-December August-September - November - December	MADHUMITA MAJUMDER
	BOT-A-DSE-B-5-5- P(PLANT BIOTECHNOLOGY) **30 Marks: 2 credits**	Familiarization of basic equipments in plant tissue culture Study through photographs/ charts/ models of anther culture, somatic embyogenesis, endosperm and embryo culture, micropropagation. Preparation of basal media. Sterilization techniques Demonstration of any tissue culture technique during visit in a plant tissue culture lab	September November-December November-December November-December	MADHUMITA MAJUMDER

Semester	Paper	Unit	Topic	JANUARY-MARCH/APRIL-JUNE	Faculty Name
Semester- II HONOURS	**BOT-A-CC- 2-3-TH (PLANT ANATOMY)** **50 Marks:4 credits**		Cell Wall	January	ASIM PANDA
			Stomata	January	ASIM PANDA
			Stele	February	ASIM PANDA
			Primary Structure of Stem & Root	February	ASIM PANDA
			Secondary growth	February	ASIM PANDA
			Mechanical tissues and the principles governing their distribution in plants.	March	ASIM PANDA
			Developmental Anatomy	April-May	DURBADAL BARMAN
			Ecological Anatomy	April-May	DURBADAL BURMAN
			Scope of plant anatomy: application in systematics, forensics and pharmacognosy	May-June	DURBADAL BURMAN
			Microscopic studies on: Types of stomata, sclereids, raphides (Colocasia), cystolith	February-March	DURBADAL BURMAN
			Pteridophytes- Heterospory and Origin of Seed habit	April	DURBADAL BURMAN
			Pteridophytes- Economic importance as food, medicine and Agriculture.	April	DURBADAL BURMAN
			Gymnosperms- Classification of vascular plants by Gifford & Foster (1989) upto division (Progymnospermoph yta to Gnetophyta) with diagnostic characters	Januar-February	DEBANJAN PANDIT

		and examples.		
		Progymnosperms- Diagnostic characters of the group, Vegetative and reproductive features of Archeopteris, Phylogenetic importance.	March	DEBANJAN PANDIT
		Gymnosperms- Life History : Distribution in India; Vegetative and Reproductive structure of sporophyte, Development of gametophyte in Cycas , Pinus and Gnetum.	April-May	DEBANJAN PANDIT
		Gymnosperms- Economic Importance with reference to Wood, Resins, Essential oils, and Drugs.	May	DEBANJAN PANDIT
	BOT-A-CC- 2-4-P (ARCHAEG ONIATAE) **30 Marks:2 credits**	BRYOPHYTES 1. Morphological study of the plant body: Genera as mentioned in theoretical syllabus and Riccia, Porella. 2. Study from	January	MADHUMITA MAJUMDER

		permanent slides : Riccia (V.S. of thallus with sporophyte), Marchantia (L.S. through gemma cup, antheridiophore , archegoniophore) , Anthoceros (L.S. of sporophyte) , Funaria (L.S. of capsule).		**MADHUMITA MAJUMDER**
		PTERIDOPHYTES 1. Morphological study of the sporophytic plant body: Genera as mentioned in the theoretical syllabus and Lycopodium, Ophioglossum and Marsilea. 2. Workout of the reproductive structures: Selaginella, Equisetum, Pteris. 3. Study from permanent slides: Psilotum (T.S. of synangium), Lycopodium (L.S. of strobilus), Ophioglossum (L.S. of spike), Dryopteris (gametophyte), Marsilea (L.S. of sporocarp)	February-March	DURBADAL BARMAB

		GYMNOSPERMS 1. Morphological study: Cycas (microsporophyll and megasporophyll), Pinus (female and male cone), Gnetum (female and male cone). 2. Study from permanent slides: Cycas (L.S. of ovule), Pinus (L.S. of male and female cone), Ginkgo (L.S. of female strobilus), Gnetum (L.S. of male cone and ovule)	February-March	DEBANJAN PANDIT
		FIELD STUDY Botanical excursion to familiarize the students with the natural habitats of these groups is desirable. No individual collection should be allowed. Students should submit only photographs in their field report.	April	MADHUMITA MAJUMDER, DEBANJAN PANDIT, DURBADAL BARMAN

Semester	Paper	Topic	JANUARY-MARCH/APR IL-JUNE	Faculty Name
Semester- IV HONOURS	**BOT-A-CC-4-8- TH (PLANT GEOGRAPHY, ECOLOGY & EVOLUTION)**	Phytogeographical regions	January-February	MADHUMITA MAJUMDER
		Endemism	January-February	MADHUMITA MAJUMDER
		Ecology (Preliminary idea)	January	MADHUMITA MAJUMDER

	50 Marks: 4 credits	Community Ecology	January-February	MADHUMITA MAJUMDER
		Plant Indicators	February	MADHUMITA MAJUMDER
		Conservation of Biodiversity.	January-February - March	MADHUMITA MAJUMDER
		Evolution (Topic 1)	March-April-May	DURBADAL BARMAN
		Evolution (Topic 2)	April-May	DURBADAL BARMAN
		Evolution (Topic 3)	April-May-June	DURBADAL BARMAN
	BOT-A-CC-4-8-P (PLANT GEOGRAPHY, ECOLOGY & EVOLUTION)	Field visit	May	DURBADAL BARMAN & DEBANJAN PANDIT
		Quadrat Study	April	DEBANJAN PANDIT
	30 Marks: 2 credits	Comparative anatomical studies of leaves from polluted and less polluted areas	March-April	MADHUMITA MAJUMDER
		Measurement of dissolved O2 by azide modification of Winkler's method.	April-May	DEBANJAN PANDIT

		Comparison of free CO_2 from different sources	April-May	DEBANJAN PANDIT
	BOT-A-CC-4-9-TH (ECONOMIC BOTANY) **50 Marks: 4 credits**	Origin of Cultivated crops	January-February	ASIM PANDA
		Cereals	January-February	
	BOT-A-CC-4-9- TH (ECONOMIC BOTANY) **50 Marks: 4 credits**	Legumes	March-April	-DO-
		Sugar & Starches	March-April	
		Spices	March	
		Beverages	April	MADHUMITA MAJUMDER
		Oil & Fats	May-	
		Drug Yielding Plants	June	
			May-June	-DO-
		Timber		
		Fib	June	
			June	

Semester	**Paper**	**Topic**	**JANUARY-MARCH/APR**	**Faculty Name**

			IL-JUNE	
Semester- IV HONOURS	**BOT-A-CC-4-10- TH (GENETICS)** **50 Marks: 4 credits**	Mendelian Genetics	January	DEBANJAN PANDIT
		Linkage, Crossing over and Gene mapping	January - February	DEBANJAN PANDIT
		Epistasis & Polygenic inheritance in plants	January	DEBANJAN PANDIT
		Aneuploidy & Polyploidy	February-March	MADHUMITA MAJUMDER
		Chromosomal aberration	March-April	MADHUMITA MAJUMDER
		Mutation	March-April	MADHUMITA MAJUMDER
		Structural organisation of Gene	May-June	MADHUMITA MAJUMDER
	BOT-A-CC-4-10-P(GENETICS) **30 Marks: 2 credits**	Introduction to chromosome preparation	January	MADHUMITA MAJUMDER
		Determination of mitotic index and frequency of different mitotic stages in pre-fixed root tips of Allium cepa	January - February	MADHUMITA MAJUMDER
		Study of mitotic chromosome	January-February	MADHUMITA MAJUMDER
		Study of chromosomal aberrations developed due to exposure to any two pollutants/ pesticides etc.	March-April	MADHUMITA MAJUMDER
		Study of meiotic chromosome	March-April	MADHUMITA MAJUMDER
		Identification from permanent slides	March-April	MADHUMITA MAJUMDER

Semester	Paper	Topic	JANUARY-MARCH/APR IL-JUNE	Faculty Name
Semester- IV HONOURS	**BOT-A-SECB-4- 4-TH (MUSHROOM CULTURE TECHNOLOGY)** **80 Marks: 2 credits**	Introduction, nutritional and medicinal value of edible mushrooms; poisonous mushrooms, types of edible mushrooms available in India- *Volvariella volvacea, Pleurotus citrinopileatus, Agaricus bisporus*.	January	ASIM PANDA
		Cultivation technology	January-February	
		Storage and nutrition	March	
		Food preparation	April	

Semester	Paper	Topic	JANUARY-MARCH/APR IL-JUNE	Faculty Name
Semester-VI HONOURS	**BOT-A-CC-6-13- TH (PLANT PHYSIOLOGY)** **50 Marks: 4 credits**	Plant water relations	January-February	DEBANJAN PANDIT
		Mineral nutrition	January-February	
		Organic Translocation	March-April	
		Plant Growth Regulators	January-February-March	
		Photomorphogenesis	January-February-March	
		Seed dormancy	April-May	

	BOT-A-CC-6-13-P(PLANT PHYSIOLOGY) **30 Marks: 2 credits**	Determination of loss of water per stoma per hour.	April	
		Measurement of osmotic pressure of storage tissue by weighing method.	January-February	DEBANJAN PANDIT & ASIM PANDA
		Measurement of osmotic pressure of Rhoeo leaf by plasmolytic method.	January-February	
		Effect of temperature on absorption of water by storage tissue and determination of Q10	March-April	-DO-
		Rate of imbibition of water by starchy, proteinaceous and fatty seeds and effect of seed coat.	March-April	
		To study the phenomenon of seed germination(effect of light)	May-June	
		To study the induction of amylase activity in germinating grains	May-June	
		To study the effect of different concentrations of IAA on Avena coleopotile elongation (IAA bioassay	May-June	

Semester- VI HONOURS	**BOT-A-CC-6-14- TH (PLANT METABOLISM)** **50 Marks: 4 credits**	Concept of metabolism	January	DEBANJAN PANDIT
		Photosynthesis	January-February-March	-DO-
		Respiration	April-May-June	
		Nitrogen Metabolism	March-April-May	
		Lipid metabolism	April-May-June	
		Mechanism of signal transduction	April-May-June	

Semester	**Paper**	**Unit**	**Topic**	**JANUARY - MARCH/ APRIL-JUNE**	**Faculty Name**
Semester- VI HONOURS	**BOT-A-CC-6-14- P(PLANT METABOLISM)** **Marks:30 2credits**		A basic idea of chromatography: Principle, paper chromatography and column chromatography; demonstration of column chromatography.	January-February	DEBANJAN PANDIT
			Separation of plastidial pigments by solvent and paper chromatography	January-February	
			Estimation of total chlorophyll content from different chronologically aged leaves (young, mature and senescence) by Arnon method	March-April	

			Effect of HCO3 concentration on oxygen evolution during photosynthesis in an aquatic plant and to find out the optimum and toxic concentration (either by volume measurement or bubble counting).	March-April	
			Measurement of oxygen uptake by respiring tissue (per g/hr.)	April-May	
			Determination of the RQ of germinating seeds	April-May	
			Test of seed viability by TTC method	May-June	
	BOT-A-DSEA-6- 3-TH (MEDICINAL & ETHNOBOTANY 50 Marks: 4 credits		Medicinal botany	January-February-March	MADHUMITA MAJUMDER
			Pharmacognosy	January-February-March	
			Secondary metabolites	April-May-June	
			Pharmacologically active constituents	April	
			Ethnobotany & Folk Medicine	March-May-June	

	BOT-A-DSEA-6- 3-P (MEDICINAL & ETHNOBOTANY) **30 Marks: 2 credits**	Chemical tests for (a) Tannin (Camellia sinensis / Terminalia chebula), (b) Alkaloid (Catharanthus roseus). Powder microscopy – Zingiber and Holarrhena Histochemical tests of (a) Curcumin (Curcuma longa), (b) Starch in non- lignified vessel (Zingiber), (c) Alkaloid (stem of Catharanthus and bark of Holarrhena)	February March April Janury January-February	MADHUMITA MAJUMDER

	BOT-A-DSEB-6- 8-TH (NATURAL RESOURCE MANAGEMENT **50 Marks: 4 credits**	Natural resources Sustainable utilization Land Water Biological resources Forests Energy Contemporary practices in resource management National and international efforts in resource management and conservation	February-March March April-May May May-June January June	DURBADAL BARMAN

	BOT-A-DSEB-6- 8-P (NATURAL RESOURCE MANAGEMENT **30 Marks: 2 credits**	Estimation of solid waste generated by a domestic system (biodegradable and non- biodegradable) and its impact on land degradation Estimation of foliar dust deposition. Determination of total solid in water (TDS) Determination of chemical properties of soil by rapid spot test (carbonate, iron, nitrate) Estimation of organic carbon percentage present in soil sample. Collection of data on forest cover of specific area	April April	DURBADAL BARMAN & MADHUMITA MAJUMDER

Department of Botany
Raidighi College

Prof. Asim Panda				
Class	**Semester**	**Topics to be covered**	**No. of lectures**	**Examination**
B.Sc. General (CBCS Syllabus, 2018)	Semester 1 CC 1/ GE 1: Theory	PLANT DIVERSITY I (BOT-G-CC-1-1-TH) **1. Introduction to different plant groups**	2	Class test, Internal examination University semester examination
		PLANT DIVERSITY I (BOT-G-CC-1-1-TH) 4. PHYTOPATHOLOGY 4.1. Symptoms- Necrotic, Hypoplastic, Hyperplastic	1	
		4.2. Koch's Postulates, Biotroph, Necrotroph	1	
		4.3. Disease Triangle, Pathotoxin, Phytoalexin	**1**	
		4.5. Symptoms, causal organism, disease cycle and control measures of plant disease- Late Blight Of Potato	2	
		4.6. Symptoms, causal organism, disease cycle and control measures of plant disease- Stem Rot of Jute	1	
	Semester 1 CC 1/ GE 1: Practical	3b. Pathological specimens (Herbarium Sheets) of Late Blight of Potato, Brown Spot of Rice and Stem rot of	2	University semester examination

		Jute		
	Semester 2 CC 2/ GE 2: Theory	3. **Paleobotany& Palynology** 3.1 Fossil, fossilization process and factors of fossilization	**3**	
		3.2 Importance of fossil study.	**1**	
		3.3 Geological time scale	**2**	
		3.4 Palynology - Definition, spore & pollen (brief idea), Applications	**2**	
		PLANT DIVERSITY II (BOT-G-CC-2-2-TH) 4.**Angiosperm Morphology** 4.1 Inflorescence types with examples	**2**	
		4.2 Flowers	**2**	
		4.3 Fruits and types and example	**2**	
		4.4 Seeds- types and example	**1**	
	Semester 3 CC 3/ GE 3: Theory	CELL BIOLOGY, GENETICS AND MICROBIOLOGY (BOT-G-CC-3-3-TH) **2. MICROBES** 2.1.1Viruses- Discovery, General Structure, Replication(General account)	**2**	
		2.1.2. DNA Virus (T-Phage); RNA Virus (TMV)	**1**	
		2.1.3. Lytic and Lysogenic Cycle	**2**	

		2.1.4. Economic Importance	**1**	
		2.2.1. Bacteria-Discovery, General Characteristics, and Cell Structure	**2**	
		2.2.2. Reproduction - Vegetative, Asexual, Recombination (Conjugation)	**3**	
		2.2.3. Transformation and Transduction	2	
		2.2.4. Economic Importance	**1**	
	Semesters 3 CC3/GE3: Practical	PRACTICAL- (BOT-G-CC-3-3-P) 2. Microbiology: Workout gram staining (curd/any natural source	**2**	University Exam of Semester-2
		3. Identification with reasons: Different forms of bacteria (Coccus, Bacillus, Spiral)	**1**	
	Semester 4 CC 4/ GE 4: Theory	**PLANT PHYSIOLOGY AND METABOLISM (BOT-G-CC-4-4-TH)** **4. Photosynthesis** 4.1 Pigments, Action spectra and Enhancement effect, 4.2 Electron transport system and Photophosphorylation, 4.3 C3 and C4 photosynthesis, CAM-Reaction and Significance	**6**	Class test, Internal examination University semester examination
		5. Respiration 5.1 Glycolysis & Krebs cycle— Reactions and	**6**	

		Significance, 5.2 ETS and oxidative phosphorylation.		
		6. Nitrogen Metabolism. 6.1. Biological Di-nitrogen fixation	**2**	
		6.2. Amino acid synthesis (Reductive Animation & Transformation	**2**	
		7. Plant Growth regulators 7.1 Physiological roles of Auxin, Gibberellin, Cytokinin, Ethylene, ABA	**2**	
	Semester 4 CC 4/ GE 4: Practical	**Plant Physiology:** i) Experiment on Plasmolysis	**1**	University Exam of Semester-4
		iii) Imbibition of water by dry seeds - proteinaceous and fatty seeds	**1**	
		iv) Evolution of O2 during photosynthesis (using graduated tube).	**2**	
		v) Evolution of CO2 during aerobic respiration and measurement of volume	**2**	
	Semester 5 **SEC A**	**PLANT BREEDING AND BIOMETRY (BOT-G-SEC-A-3/5-1)** **1. Plant breeding:** 1.1 Introduction and objective, 1.2 Techniques of hybridisation	**2**	Class test, Internal examination University semester examination
		2. Mass and Pure line selection: 2.1 Procedure, 2.2 Advantages and limitations	**2**	

		3. Heterosis and hybrid seed production	**2**	
		4. Role of mutation, polyploidy, distant hybridization and role of biotechnology in crop improvement	**2**	
		5. Biometry: 5.1 Measures of central tendency (Mean, Median and Mode), 5.2 Standard error and standard deviation, 5.3 Test of significance: Chi-square test for goodness of fit	**4**	
	Semester 5 **DSE A Theory**	**PHYTOCHEMISTRY AND MEDICINAL BOTANY**		Class test, Internal examination University semester examination
		5.ETHNOBOTANY AND FOLK MEDICINES 5.1 Brief idea	**1**	
		5.2 Application of Ethnobotany	**1**	
		5.3. Application of natural product to certain disease- Jaundice, Cardiac and Diabetics	**3**	
		1. Medicinal Botany. History, scope & importance of medicinal plants. A brief idea about indigenous medicinal science, Ayurveda, Siddha, Unani. Polyherbal Formulation.	**4**	

Department of Botany
Raidighi College

Prof. Durbadal Barman				
Class	**Semester**	**Topics to be covered**	**No. of lectures**	**Examination**
B.Sc. General (CBCS Syllabus, 2018)	Semester 1 CC 1/ GE 1: Theory	PLANT DIVERSITY I (BOT-G-CC-1-1-TH) **1. Introduction to different plant groups**	2	Class test, Internal examination University semester examination
		2. Phycology: 2.1. Diagnostic characters and examples of Cyanophyceae, Rhodophyceae, Chlorophyceae, Charophyceae and Phaeophyceae	3	
		2.2 Classification: Criteria and system of Fritsch	1	
		2.3. Life histories of *Chlamydomonas*	**2**	
		2.3. Life histories of *Chara* 2.3. Life histories of *Ectocarpus*	3	
		2.4. Role of algae in the environment, agriculture, biotechnology and industry.	2	
	Semester 1 CC 1/ GE 1: Theory	6.3. Stele types and evolution	**2**	
		6.4. Secondary growth normal dicot stem and	**4**	

		anomaly in stem of *Tecoma* and *Dracaena*		
	Semester 2 CC 2/ GE 2: Theory	**5. TAXONOMY OF** ANGIOSPERMS 5.1.Artificia, Natural, and Phylogenetic system of Classification with one example each	**7**	Class test, Internal exam University semester examination
		5.2. Diagnostic Features of Following Families- Malvaceae, Leguminosae, Cucurbitaceace, Rubiaceae, Asteraceae, Solanaceae, Acanthaceae, Lamiaceae, Orchidaceae, Poaceae	**7**	
	Semester 2 CC 2/ GE 2: Practical	PRACTICAL- PLANT DIVERSITY II (BOT-G-CC-2-2-P) 1. Dissect, Drawing and labelling, Description of Angiospermic Plants and floral Parts, floral formula, floral diagram ,identification (family) from the following families: Leguminosae, Malvaceae, Solanaceae, Labiate, Acanthaceae	**12**	University semester examination
		3. Spot identification of the Angiospermic plant	**5**	
	Semester 3 CC 3/ GE 3: Theory	**CELL BIOLOGY, GENETICS AND MICROBIOLOGY (BOT-G-CC-3-3-TH)** **3. Central Dogma,** 3.1 Transcription .	**6**	Class test, Internal exam University semester examination
		3.1 Translation	**4**	
		7. Brief concept of Split gene, Transposons	**2**	

Department of Botany
Raidighi College

Prof. Debanjan Pandit				
Class	**Semester**	**Topics to be covered**	**No. of lectures**	**Examination**
B.Sc. General (CBCS Syllabus, 2018)	Semester 1 CC 1/ GE 1: Theory	PLANT DIVERSITY I (BOT-G-CC-1-1-TH)	2	Class test, Internal examination University semester examination
		Mycology: 3.1 Diagnostic characters and examples of Oomycotina, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina (Ainsworth, 1973).	3	
		3.2 Life histories of *Rhizopus*		
		3.2 Life histories of *Ascobolus*		
		3.3. Economic importance of fungi		
		3.4 Fungal symbioses: Mycorrhiza and their importance.		
	Semester 1 CC 1/ GE 1: Practical	Work out: Microscopic preparation, drawing and labelling of *Rhizopus* and *Ascobolus*	1	
	Semester 2 CC 2/ GE 2:	PLANT DIVERSITY II (BOT-G-CC-2-2-TH)		

	Theory	**2. Gymnosperms** 2.1 Progymnosperms (brief idea)		
		2.2 Diagnostic characters and examples of Cycadophyta, Coniferophyta and Gnetophyta (Gifford & Foster 1989		
		2.3 Life histories of *Cycas* Life histories of Pinus	**2**	
		2.4 *Williamsonia* (reconstructed)	3	
		2.5 Economic importance of Gymnosperms	2	
	Semester 2 CC 2/ GE 2: Practical	PRACTICAL- PLANT DIVERSITY II (BOT-G-CC-2-2-P) 2. Identification with reasons: male and female strobilus of *Cycas* and *Pinus*		
	CC 3/ GE 3: Theory	4. Genetic Code- properties		
		5. **Linkage** group and Genetic map (three-point test cross		
		6. **Mutation** – 6.1 Point mutation (tautomerisation; transition, transversion and frame shift), 6.2 Mutagen- physical and chemical.		
	Semester 4 CC 4/ GE 4: Theory	**PLANT PHYSIOLOGY AND METABOLISM (BOT-G-CC-4-4-TH)** **1. PROTEINS** 1.1.Primary, Secondary, and Tertiary Structure		
		1.2. Nucleic Acid- DNA structure		
		1.2. RNA- Types		

		1.3..1 Enzymes Classifications with examples(IUBMB		
		1.3.2. Enzyme- Mechanism of Action		
		2. Transport in Plants. 2.1. Ascent of sap and xylem cavitation.		
		2.2. Phloem transport and source- sink reaction		
		3. Transpiration 3.1. Mechanism of stomatal movement. Significance.		
		8. Photoperiodism Plant types. Role of Phytochrome. G.A in Flowering. Vernalization. Senescence		
	Semester 4 CC 4/ GE 4: Practical	**Plant Physiology:** i. Measurement of leaf area (graphical method) and determination of transpiration rate per unit area by weighing method		
		6.3. Stele types and evolution 6.4. Secondary growth normal dicot stem and anomaly in stem of *Tecoma* and *Dracaena*		
	Semester 2 CC 2/ GE 2: Theory	**PLANT DIVERSITY II(BOT-G-CC-2-2-TH)** **1. Pteridophyes** 1.1. Diagnostic characters and examples of Psilophyta, Lycophyta, Spenophyta and Fillicophyta (Gifford& Foster 1989)		

		1.2. Life histories of *Selaginella* and *Pteris*		
		1.3.Economic Importance		
	Semester 2 CC 2/ GE 2: Practical	Plant Diversity -II Pteridophyte and Morphology. BOT-G-CC-2-2-P. 1. Macroscopic specimens of Selaginella and Pteris. 2. Anatomical Slides Identification- Stellar types, Transfusion Tissue, Sieve tube, Sunken Stomata, Lenticels	2	University Exam of Semester-2
	Semester 3 CC 3/ GE 3: Theory	**CELL BIOLOGY, GENETICS AND MICROBIOLOGY (BOT-G-CC-3-3-TH)** 1. Cell Biology and Genetics 1.1. Ultrastructure of nuclear envelop. Nucleolus and their functions.		
		1.2. Molecular organization of Metaphase Chromosome (Nucleosome Concept		
		2. Chromosomal Aberrations. 2.1.Deletion, Duplication, Inversion and Translocation		
		2.2. Aneuploidy and Polyploidy- Types, Importance, and Role in Evolutions.		
	Semesters 3 CC3/GE3: Practical	Cell Biology, Genetics and Microbiology. BOT-G-CC-3-3-P. 1. Cell Biology- Staining (Aceto-orcein) and Squash preparation of Onion Root Tips: Study of mitotic stages. 2. Determination of Mitotic Index from Onion root tips.		

	Semester 5 Theory	**DISCIPLINE SPECIFIC ELECTIVE COURSES-A PHYTOCHEMISTRY AND MEDICINAL BOTANY** 1. Medicinal Botany. History, scope & importance of medicinal plants. A brief idea about indigenous medicinal science, Ayurveda, Siddha, Unani. Polyherbal Formulation.		
		3. Organoleptic Evolution of crude drugs.		
		4. PHARMACOLOGICALLY ACTIVE CONSTITUENTS Source Plants, parts used and uses of- 4.1Steroids(Diosgenin, Digitoxin)		
		4.2 Tanin(Catechin).		
		.3. Resins(Gingerol, Curcumnoids)		
		4.4 Alkaloids(Strychnine, Reserpine, Vinblastine)		
		4.5Phenols(Capsaicin)		
	Semester 5 **DSE A** **Practical**	**PHYTOCHEMISTRY AND MEDICINAL BOTANY** 5. Identification of Medicinal plants		
		PRACTICAL- PHYTOCHEMISTRY AND MEDICINAL BOTANY (BOT-G-DSE-A-5-1-P) 3. Qualitative test for proteins and carbohydrates, reducing and non reducing sugar (glucose, fructose and sucrose)		

		4. Tests (chemical) for tannin and alkaloid		
		DSE-A: Phytochemistry and Medicinal Botany. BOTG-DSE-A-5-1-P. Acquaintance with Laboratory instrument- Autoclave, Incubator, Clinical Centrifuge, Analytical Balance, PH meter. Colorimeter. Water bath, Distillation plan, Laminar air flow.		
	Semester 6. Theory	**DISCIPLINE SPECIFIC ELECTIVE COURSES – B HORTICULTURAL PRACTICES AND POST HARVEST. (BOT-G-DSE-B-6-4-TH** .		

Lesson plan for undergraduate General Course

Department of Botany
Raidighi College

Lesson plan for General students

Dr. Madhumita Majumder				
Class	**Semester**	**Topics to be covered**	**No. of lectures**	**Examination**
B.Sc. General (CBCS Syllabus, 2018)	Semester 1 CC 1/ GE 1: Theory	PLANT DIVERSITY I (BOT-G-CC-1-1-TH) **1. Introduction to different plant groups**	2	Class test, Internal examination University semester examination
		2. Phycology: 2.1. Diagnostic characters and examples of Cyanophyceae, Rhodophyceae, Chlorophyceae, Charophyceae and Phaeophyceae	3	
		2.2 Classification: Criteria and system of Fritsch	1	
		2.3. Life histories of *Chlamydomonas*	**2**	
		2.3. Life histories of *Chara* 2.3. Life histories of *Ectocarpus*	3	
		2.4. Role of algae in the environment, agriculture, biotechnology and industry.	2	
	Semester 1 CC 1/ GE 1: Practical	PRACTICAL- PLANT DIVERSITY I (BOT-G-CC-1-1-P) 1. Work out: Microscopic preparation, drawing and labelling of *Chlamydomonas, Chara, Ectocarpus*	**2**	
		Work out: Microscopic preparation, drawing and labelling of *Rhizopus*	**3**	

		and *Ascobolus*		
		3. Identification with reasons: 3a. Cryptogamic specimens (macroscopic/microscopic as prescribed in the theoretical syllabus	**2**	
		Anatomical Slides (Following double staining method) of: Stem-Cucurbita, Sunflower and Maize. Root- Colocassia, Gram and Orchid. Leaf- Nerium	**3**	
	Semester 1 CC 1/ GE 1: Theory	5. BRYOPHYTE 5.1.Unifying Features of Archaegoniates and transiton to land plants, Amphibian nature of Bryophytes	**1**	
		5.2. Diagnostic character and examples of Hepaticopsida, Anthocerotopsida and Bryopsida(Proskauer-1957	**2**	
		5.3. Life histories of *Marchantia*	**2**	
		5.4 Life histories of *Funaria*	**1**	
		5.5.Ecological and Economical importance	**1**	
	Semester 1 CC 1/ GE 1: Theory	6. Anatomy 6.1. Stomata: Types (Metcalfe & Chalk	**1**	
		6.2. Anatomy of root, stem and leaf of monocots and dicots	**2**	
		6.3. Stele types and evolution 6.4. Secondary growth normal dicot stem and anomaly in stem of *Tecoma* and *Dracaena*	**2**	
	Semester 2 CC 2/ GE 2: Theory	**PLANT DIVERSITY II(BOT-G-CC-2-2-TH)** **1. Pteridophyes** 1.1. Diagnostic characters and examples of Psilophyta, Lycophyta, Spenophyta and Fillicophyta	**3**	

		(Gifford& Foster 1989)		
		1.2. Life histories of *Selaginella* and *Pteris*	**1**	
		1.3.Economic Importance	**1**	
	Semester 2 CC 2/ GE 2: Practical	Plant Diversity -II Pteridophyte and Morphology. BOT-G-CC-2-2-P. 1. Macroscopic specimens of Selaginella and Pteris. 2. Anatomical Slides Identification- Stellar types, Transfusion Tissue, Sieve tube, Sunken Stomata, Lenticels	2	University Exam of Semester-2
	Semester 3 CC 3/ GE 3: Theory	**CELL BIOLOGY, GENETICS AND MICROBIOLOGY (BOT-G-CC-3-3-TH)** 1. Cell Biology and Genetics 1.1. Ultrastructure of nuclear envelop. Nucleolus and their functions.	**3**	
		1.2. Molecular organization of Metaphase Chromosome (Nucleosome Concept	**1**	
		2. Chromosomal Aberrations. 2.1.Deletion, Duplication, Inversion and Translocation	**2**	
		2.2. Aneuploidy and Polyploidy-Types, Importance, and Role in Evolutions.	**1**	
	Semesters 3 CC3/GE3: Practical	Cell Biology, Genetics and Microbiology. BOT-G-CC-3-3-P. 1. Cell Biology- Staining (Aceto-orcein) and Squash preparation of Onion Root Tips: Study of mitotic stages. 2. Determination of Mitotic Index from Onion root tips.	**3**	
	Semester 5 Theory	**DISCIPLINE SPECIFIC ELECTIVE COURSES-A PHYTOCHEMISTRY AND MEDICINAL BOTANY** 1. Medicinal Botany. History, scope & importance of	**12**	

		medicinal plants. A brief idea about indigenous medicinal science, Ayurveda, Siddha, Unani. Polyherbal Formulation.		
		3. Organoleptic Evolution of crude drugs.	**1**	
		4. PHARMACOLOGICALLY ACTIVE CONSTITUENTS Source Plants, parts used and uses of- 4.1Steroids(Diosgenin, Digitoxin)		
		4.2 Tanin(Catechin).	**1**	
		.3. Resins(Gingerol, Curcumnoids)	**1**	
		4.4 Alkaloids(Strychnine, Reserpine, Vinblastine)	**1**	
		4.5Phenols(Capsaicin)	**1**	
	Semester 5 **DSE A** **Practical**	**PHYTOCHEMISTRY AND MEDICINAL BOTANY** 5. Identification of Medicinal plants	**1**	
		PRACTICAL-PHYTOCHEMISTRY AND MEDICINAL BOTANY (BOT-G-DSE-A-5-1-P) 3. Qualitative test for proteins and carbohydrates, reducing and non reducing sugar (glucose, fructose and sucrose)	**2**	
		4. Tests (chemical) for tannin and alkaloid	**1**	
		DSE-A: Phytochemistry and Medicinal Botany. BOTG-DSE-A-5-1-P. Acquaintance with Laboratory instrument- Autoclave, Incubator, Clinical Centrifuge, Analytical Balance, PH meter. Colorimeter. Water bath, Distillation plan, Laminar air flow.	**2**	
	Semester 6. Theory	**BOT-G-DSE-B-6-3- TH (ECONOMIC BOTANY** **50 Marks:4 credits**	**2**	

		.		
		Origin of cultivated plants: Concepts of centres of origin and their importance with reference to Vavilov's work. Rice- origin, morphology and uses. Legumes: General account with special reference to Vigna. Beverages: Tea- morphology, processing and uses. Study of the following economically important plants (Scientific names, families, parts used and importance): 5.1 Cereals- Rice, wheat, 5.2 Pulses- Mong, gram, 5.3 SpicesGinger, cumin, 5.4 Beverages- Tea, coffee, 5.5 Medicinal plants- Cinchona, neem, Ipecac, Vasaka, 5.6 Oil yielding plants- Mustard, groundnut, coconut, 5.7 Vegetables- Potato, raddish, bottle groud, cabbage, 5.8 Fibre yielding plants- Cotton, jute, 5.9 Timber yielding plants-	**6**	

		Teak, Sal 5.10		

		BOT-G-DSE-B-6-3- P (ECONOMIC BOTANY **30 Marks:2 credits**		
		Study of economically important plants (rice/jute/ tea) through herbarium specimens and field study. Study of cultivation practices in field and submission of report. Study of local economically important plants and submission of report with photographs.		

RAIDIGHI COLLEGE

Department of Physics Session 2022-23

Teacher Name: **Dr. Amitava Moitra**

Sem ester	Course Type	Unit Name (Topic)	Paper	Sub Unit Name	Month	No. of Classes
VI	Hons	Solid State Physics (Theory & Practical)	CC 14	Whole	Whole Session	30 & 18
V	Hons	Statistical Mechanics (Theory & Practical)	CC 12	Whole	Whole Session	30 & 18
IV	Hons	Mathematical Physics - III	CC 8	Whole	Whole Session	30 & 18
III	Hons	Mathematical Physics - II	CC 5	Whole	Whole Session	30 & 18
III	Hons & General	Latex	SEC A1	Whole	Whole Session	20
II	Hons	Mathematical Physics - II	CC 5	Whole	Whole Session	30 & 18
I	Hons	Mathematical Physics - I	CC 5	Mathematical Physics	Whole Session	30 & 18

Teacher Name: **Dr. Shreyasi Pal**

Sem ester	Course Type	Unit Name (Topic)	Paper	Sub Unit Name	Month	No. of Classes
VI	Hons	Nanomaterials (Theory + Tutorial)	DSE-A2. 1	Whole	Whole Session	36TH+10TU
V	Hons	Laser and Fiber Optics (Theory + Tutorial)	DSE - A1.1	Whole	Whole Session	30 TH+ 10TU
IV	Hons	Quantum Mechanics (Theory)	CC10	Whole	Whole Session	36
III	Hons	Modern Physics	CC7	Whole	Whole	30 & 18

		(Theory+ Practical)			Session	
II	Hons	Wave and Optics (Theory + Practical)	CC4	Oscillations , Superposition of Harmonic Oscillations , Wave motion, Superposition of Harmonic waves	Whole Session	22 & 12
I	HONS & GEN	Mechanics (Theory +Practical)	CC2	Non Inertial System, Rotational Dynamics, Fluid Motion	Whole Session	28+12(HONS) AND 20+12(GEN)

Teacher Name: **Prof. Sankar Kumar Santra**

Semester	Course Type	Unit Name (Topic)	Paper	Sub Unit Name	Month	No. of Classes
VI	General	Nuclear physics	DSE-B	Nuclear Physics	Whole Session	15
V	Hons.	Nuclear Physics	DSE-B	Nuclear Physics	Whole Session	35
IV	General	Wave Optics (Theory + Practical)	GE-4	Wave Optics	Whole Session	25+ 20
III	Hons.& General	Thermal Physics (Theory + Practical) & Thermal physics & Statistical mechanics (Theory+Practical)	CC-6 & GE-3	Thermal Physics & Thermal Physics & Statistical Mechanics	Whole session & Aug,Sept,Nov & Nov,Dec	35+25 & 15 & 20
II	Hons.	Wave Optics	CC-4	Wave	Whole	35 + 25

		(Theory + Practical)		Optics	Session	
I	Hons.	Mathematical Physics-1	CC-1 & Ge-1	Vector Analysis & Mathemetical Methods	Whole Session & December	35

Teacher Name: **Prof. Chanchal Das**

Semester	Course Type	Unit Name (Topic)	Paper	Sub Unit Name	Month	No. of Classes
VI	HONS	Digital Electronics Theory +Practical	CC13	Whole	Whole Session	34+14
V	HONS	Electromagnetic Theory Theory +Practical	CC11	Whole	Whole Session	32+18
IV	HONS+ GEN	Electrical Circuits and Network skills	SEC B2	Whole	Whole Session	22+22
III	HONS	Mathematical Physics II Theory	CC5	4.Integrals Transform. 5.Probablity 6. Partial Differential Equations	Half Session	18
II	HONS And GEN	Electricity and Magnetism Theory +Practical	CC3	6.Magnetostatic Field 7. Magnetic Properties of Matter. 8.Electromagnetic Induction 9. Electrical Circuits And All for GEN	Whole Session	30+20(HONS) 40+20(GEN)
I	-	-	-	-	-	-

Teacher Name: **Prof. Swati Purkait**

Semester	Course Type	Unit Name	Paper	Sub Unit Name	Month	No of Classes
VI	HONS	Communication Electronics	DSE B2	Whole	Whole Session	36
V	HONS & GEN	Laser and Fiber Optics (HONS) & Analog Electronics (GEN)	DSE A1(HONS) & DSE A1(GEN)	Whole	Whole Session	32(HONS) + 32+18(GEN)
IV	HONS	Analog Electronics Theory +Practical	CC9	Whole	Whole Session	34+20
III	HONS	Modern Physics Theory +Practical	CC7	Laser(Theory)and All Practical	Whole Session	8+20
II	-	-	-	-	-	-
I	HONS & GEN	Mechanics Theory +Practical	CC2	Fundamental of Dynamics, Work and Energy, Gravitation and Central force Motion Practical: Half	Whole Session	24+12(HONS) AND 20+12(GEN)