AMITY UNIVERSITY MAHARASHTRA, MUMBAI

AMITY SCHOOL OF APPLIED SCIENCES

CURRICULUM

B.Sc. (Mathematics)
(Honours/Honours with Research)

DURATION: 4 YEARS
(NEP 2020)

(IMPLEMENTED FROM ACADEMIC YEAR 2023-24)

CERTIFICATE

It is hereby certified that the enclosed detailed syllabus has been presented before the Board of Studies of Amity University Maharashtra, Mumbai on September 28, 2023, and it is recommended for the approval by the Academic Council, Amity University Maharashtra, Mumbai.

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PREAMBLE

Amity University Maharashtra, Mumbai aims to achieve academic excellence by providing multi-faceted education to students and encourage them to reach the pinnacle of success. The University has designed a system that would provide rigorous academic Programme with necessary skills to enable them to excel in their careers.

This booklet contains the Programme Structure, the Detailed Curriculum and the Scheme of Examination. The Programme Structure includes the courses (Core and Elective), arranged semester wise. The importance of each course is defined in terms of credits attached to it. The credit units attached to each course has been further defined in terms of contact hours i.e. Lecture Hours (L), Tutorial Hours (T), Practical Hours (P). Towards earning credits in terms of contact hours, 1 Lecture and 1 Tutorial per week are rated as 1 credit each and 2 Practical hours per week are rated as 1 credit. Thus, for example, an L-T-P structure of 3-0-0 will have 3 credits, 3-1-0 will have 4 credits, and 3-1-2 will have 5 credits.

The Curriculum and Scheme of Examination of each course includes the course objectives, course contents, scheme of examination and the list of text and references. The scheme of examination defines the various components of evaluation and the weightage attached to each component. The different codes used for the components of evaluation and the weightage attached to them are:

Components	Codes	Weightage (%)
Case Discussion/ Presentation/ Analysis	C	05 - 10
Home Assignment	H	05 - 10
Project	P	05 - 10
Seminar	S	05 - 10
Viva	V	05 - 10
Quiz	Q	05 - 10
Class Test	CT	10 - 15
Attendance	A	05
End Semester Examination	EE	70

It is hoped that it will help the students study in a planned and a structured manner and promote effective learning. Wishing you an intellectually stimulating stay at Amity University.

VISION

To strengthen the conceptual and scientific understanding of the students in the field of basic sciences, applied sciences, technology and develop in them a sense of gratitude and responsibility towards society and Mother Nature.

MISSION

- To provide an academic environment where 'Modernity blends with tradition'.
- To develop analytical, logical and ethical skills to make the students industry ready.
- To include the skills of research, creativity and innovation among the students and faculty.
- To promote inter disciplinary research and trans departmental culture.
- To encourage collaborations with academic institutes, industries, research institutes at National and International level.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO 1: Prepare for successful careers as analysts, quality controllers, or research assistants locally, nationally, and internationally.

PEO 2: Exhibit leadership, lifelong learning, ethical behavior, and teamwork skills.

PEO 3: Formulate and analyze real-life problems scientifically with ethical integrity.

PEO 4: Engage in professional activities to enhance careers and contribute to society.

PEO 5: Achieve success in higher education in sciences or management if pursued.

PROGRAM OUTCOMES

PO 1: Utilize mathematical and computer science knowledge to excel globally.

PO 2: Analyze scientific problems using foundational mathematical principles.

PO 3: Design solutions for complex issues considering public and environmental factors.

PO 4: Apply research methods to solve complex problems and draw logical conclusions.

PO 5: Use statistical and computational tools to solve problems in various fields.

PO 6: Address societal and ethical issues in scientific practices.

PO 7: Understand and contribute to sustainable development and environmental impacts.

PO 8: Follow ethical principles and responsibilities in professional practices.

PO 9: Work effectively both independently and in diverse teams.

PO 10: Communicate scientific information clearly to various audiences.

PO 11: Improve employability through practical experiences and ongoing learning.

PO 12: Engage in lifelong learning to adapt to advances in mathematics and technology

B.Sc. Mathematics (Hons./Hons. with Research)

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	23	22	24	21	25	20	21	24	180

Semester - I						
	Course Code	Course Title	Lecture Credits	Tutorial Credits	Practical Credits	Total Credits
Discipline-I (Core)						**8**
Discipline-I	MTH2101N	Real Analysis	3	1	-	4
	MTH2102N	Calculus	3	1	-	4
Discipline-II (any one from the basket)						**4**
Discipline-II	PHY2108N PHY2109N	Physics-I Physics-I Lab	2 -	1 -	- 1	3 1
	CHY2108N CHY2109N	Chemistry-I Chemistry-I Lab	2 -	1 -	- 1	3 1
	STA2103N	Probability Theory-I	3	1	-	4
Discipline-III (any one from the basket)						**4**
Discipline-III	BMT2110N	Business Management	3	-	1	4
	HMR2110N	Human Rights-I	4	-	-	4
	ACW2110N	Academic and Creative Writing	4	-	-	4
	ECO2110N	Economics-I	3	-	1	4
	FST2110N	Fashion Technology-I	2	-	2	4
	IND2110N	Interior Design-I	1	-	3	4
Total (Discipline-I + II + III)						**16**
Foreign Language (any one from the basket)						**1**
Foreign Language	FLF2111N	French-I	1	-	-	1
	FLG2111N	German-I				
	FLS2111N	Spanish-I				
Communication Skills	CSE2112N	Effective Listening	1	-	-	1
Sub Total						**2**
Behavioural Science	BEH2113N	Behavioural Science-I	1	-	-	1
Sub Total						**1**
VAC-I	ENV2116N	Environmental Studies	3	1	-	4

Sub Total	**4**
Total	**7**
Grand Total	**23**

Semester - II						
	Course Code	**Course Title**	**Lecture Credits**	**Tutorial Credits**	**Practical Credits**	**Total Credits**
Discipline-I (Core)						**8**
Discipline-I	MTH2201N	Classical Algebra	3	1	-	4
	MTH2202N	Ordinary Differential Equations	3	1	-	4
Discipline-II (any one from the basket)						**4**
Discipline-II	PHY2208N PHY2209N	Physics-II Physics-II Lab	2 -	1 -	- 1	3 1
	CHY2208N CHY2209N	Chemistry-II Chemistry-II Lab	2 -	1 -	- 1	3 1
	STA2202N	Probability Theory-II	3	1	-	4
Discipline-III (any one from the basket)						**4**
Discipline-III	ABM2210N	Advances in Business Management	4	-	-	4
	HMR2210N	Human Rights-II	4	-	-	4
	CSW2210N	Technical and Literary Writing	4	-	-	4
	ECO2210N	Economics-II	3	-	1	4
	FST2210N	Fashion Technology-II	2	-	2	4
	IND2210N	Interior Design-II	1	-	3	4
Total (Discipline-I + II + III)						**16**
Foreign Language (any one from the basket)						**2**
Foreign Language	FLF2211N	French-II	2	-	-	2
	FLG2211N	German-II				
	FLS2211N	Spanish-II				
Communication Skills	CSE2212N	Presentation Skills	1	-	-	1
Sub Total						**3**
Behavioural	BEH2213N	Behavioural Science-II	1	-	-	1

Science						
					Sub Total	**1**
VAC-II (any one from the basket)						**2**
VAC-II	DSC2217N	Data Science & Computation: Basic Statistics	2	-	-	2
	ANM2217N	Animation-I				
	PHT2217N	Photography-I				
	POL2217N	Political Science-I				
	TSM2217N	Tourism Management-I				
	SCW2217N	Social Work-I				
					Sub Total	**2**
					Total	**6**
					Grand Total	**22**

Semester - III						
	Course Code	**Course Title**	**Lecture Credits**	**Tutorial Credits**	**Practical Credits**	**Total Credits**
Discipline-I (Core)						**8**
Discipline-I	MTH2301N	Abstract Algebra	3	1	-	4
	MTH2302N	Partial Differential Equations	3	1	-	4
Discipline-II (any one from the basket)						**4**
Discipline-II	PHY2308N PHY2309N	Physics-III Physics-III Lab	2 -	1 -	- 1	3 1
	CHY2308N CHY2309N	Chemistry-III Chemistry-III Lab	2 -	1 -	- 1	3 1
	STA2302N STA2303N	Statistical Inference Statistical Inference Lab	2 -	1 -	- 1	3 1
					Total (Discipline-I + II)	**12**
Foreign Language (any one from the basket)						**2**
Foreign Language	FLF2311N	French-III	2	-	-	2
	FLG2311N	German-III				
	FLS2311N	Spanish-III				
Communication	CSE2312N	Reading and	1	-	-	1

Skills		Comprehension				
					Sub Total	**3**
Behavioural Science	BEH2313N	Behavioural Science-III	1	-	-	1
Vocational Courses/ Entrepreneurship*/ Industry Led Courses	VOC2315N	Introduction to Programming with Python-I	2	-	1	3
					Sub Total	**4**
VAC-II (any one from the basket)						**2**
VAC-II	DSC2317N	Data Science & Computation: Statistical Inference	2	-	-	2
	ANM2317N	Animation-II				
	PHT2317N	Photography-II				
	POL2317N	Political Science-II				
	TSM2317N	Tourism Management-II				
	SCW2317N	Social Work-II				
					Sub Total	**2**
VAC-III	PHE2318N	Physical Education & Sports**	-	-	-	0
					Total	**9**
Community Engagement Services	CES2319N	Community Outreach	-	-	-	3
					Grand Total	**24**

** continued till SEM-VI

Semester - IV						
	Course Code	**Course Title**	**Lecture Credits**	**Tutorial Credits**	**Practical Credits**	**Total Credits**
Discipline-I (Core)						**8**
Discipline-I	MTH2401N	Functions of Several Variables	3	1	-	4
	MTH2402N	Linear Algebra	3	1	-	4
Discipline-II (any one from the basket)						**4**
Discipline-II	PHY2408N PHY2409N	Physics-IV Physics-IV Lab	2 -	1 -	- 1	3 1
	CHY2408N CHY2409N	Chemistry-IV Chemistry-IV Lab	2 -	1 -	- 1	3 1
	STA2403N	Operations Research	3	1	-	4
Total (Discipline-I + II)						**12**
Foreign Language (any one from the basket)						**2**
Foreign Language	FLF2411N	French-IV	2	-	-	2
	FLG2411N	German-IV				
	FLS2411N	Spanish-IV				
Communication Skills	CSE2412N	Effective Writing Skills	1	-	-	1
Sub Total						**3**
Behavioural Science	BEH2413N	Behavioural Science-IV	1	-	-	1
Vocational Courses/ Entrepreneurship*/ Industry Led Courses	VOC2415N	Introduction to Programming with Python-II	2	-	1	3
Sub Total						**4**
VAC-II (any one from the basket)						**2**
VAC-II	DSC2417N	Data Science & Computation: Basics of Machine Learning	2	-	-	2
	ANM2417N	Animation-III				
	PHT2417N	Photography-III				
	POL2417N	Political Science-III				
	TSM2417N	Tourism Management-III				
	SCW2417N	Social Work-III				

					Sub Total	**2**
VAC-III	PHE2318N	Physical Education & Sports**	-	-	-	0
					Total	**9**
					Grand Total	**21**

Semester - V						
	Course Code	**Course Title**	**Lecture Credits**	**Tutorial Credits**	**Practical Credits**	**Total Credits**
Discipline-I (Core)						**12**
Discipline-I	MTH2501N	Matric Spaces	3	1	-	4
	MTH2502N	Complex Analysis	3	1	-	4
	MTH2503N	Numerical Analysis	2	1	-	3
	MTH2504N	Numerical Analysis Lab	-	-	1	1
Discipline-II (any one from the basket)						**4**
Discipline-II	PHY2508N PHY2509N	Physics-V Physics-V Lab	2 -	1 -	- 1	3 1
	CHY2508N CHY2509N	Chemistry-V Chemistry-V Lab	2 -	1 -	- 1	3 1
	STA2504N	Advanced Operations Research	3	1	-	4
					Total (Discipline-I + II)	**16**
Foreign Language (any one from the basket)						**2**
Foreign Language	FLF2511N	French-V	2	-	-	2
	FLG2511N	German-V				
	FLS2511N	Spanish-V				
Communication Skills	CSE2512N	Employability Skill	1	-	-	1
					Sub Total	**3**
Behavioural Science	BEH2513N	Behavioural Science-V	1	-	-	1
					Sub Total	**1**
VAC-III	PHE2318N	Physical Education & Sports**	-	-	-	0
					Total	**4**

SIP/Internship/ Project/Dissertation/ Field Visit	MTH2521N	Summer Internship	-	-	-	5
					Total	**5**
					Grand Total	**25**

Semester - VI						
	Course Code	**Course Title**	**Lecture Credits**	**Tutorial Credits**	**Practical Credits**	**Total Credits**
Discipline-I (Core)						**16**
Discipline-I	MTH2601N	Discrete Mathematics	3	1	-	4
	MTH2602N	Number Theory	3	1	-	4
	MTH2603N	Topology	3	1	-	4
	MTH2604N	Transform Techniques and 2D 3D Geometry	3	1	-	4
Discipline-II (any one from the basket)						**4**
Discipline-II	PHY2608N PHY2609N	Physics-VI Physics-VI Lab	2 -	1 -	- 1	3 1
	CHY2609N CHY2610N	Chemistry-VI Chemistry-VI Lab	2 -	1 -	- 1	3 1
	STA2605N STA2606N	Data Analysis & Decision Making Data Analysis & Decision Making Lab	2 -	1 -	- 1	3 1
					Total (Discipline-I + II)	**20**
VAC-III	PHE2318N	Physical Education & Sports**	-	-	-	0
					Grand Total	**20**

Semester - VII						
	Course Code	**Course Title**	**Lecture Credits**	**Tutorial Credits**	**Practical Credits**	**Total Credits**
Discipline-I (Core)						**12**
Discipline-I	MTH2701N	Fractional Calculus	3	1	-	4
	MTH2702N	Lattice Theory	3	1	-	4

	MTH2703N	Introduction to Mathematical Biology	3	1	-	4
					Total (Discipline-I)	**12**
SIP/Internship/ Project/Dissertation/ Field Visit	MTH2704N	Research Project-I	-	-	-	9
					Total	**9**
					Grand Total	**21**

Semester - VIII						
	Course Code	**Course Title**	**Lecture Credits**	**Tutorial Credits**	**Practical Credits**	**Total Credits**
Discipline-I (Core)						**12**
Discipline-I	MTH2801N	Spectral Graph Theory	3	1	-	4
	MTH2802N	Special Functions	3	1	-	4
	MTH2803N	Dynamical Systems	3	1	-	4
					Total (Discipline-I)	**12**
SIP/Internship/ Project/Dissertation/ Field Visit	MTH2804N	Research Project-II	-	-	-	12
					Total	**12**
					Grand Total	**24**

EVALUATION SCHEME

Semester - I					
	Course Code	**Course Title**	**Total Credits**	**Internal Marks**	**External Marks**
Discipline-I (Core)	MTH2101N	Real Analysis	4	30	70
	MTH2102N	Calculus	4	30	70
Discipline-II (any one from the basket)	PHY2108N PHY2109N	Physics-I Physics-I Lab	3 1	30 30	70 70
	CHY2108N CHY2109N	Chemistry-I Chemistry-I Lab	3 1	30 30	70 70
	STA2103N	Probability Theory-I	4	30	70
Discipline-III (any one from the basket)	BMT2110N	Business Management	4	50	50
	HMR2110N	Human Rights-I			
	ACW2110N	Academic and Creative Writing			
	ECO2110N	Economics-I			
	FST2110N	Fashion Technology-I			
	IND2110N	Interior Design-I			
Foreign Language (any one from the basket)	FLF2111N	French-I	1	50	50
	FLG2111N	German-I			
	FLS2111N	Spanish-I			
Communication Skills	CSE2112N	Effective Listening	1	50	50
Behavioural Science	BEH2113N	Behavioural Science-I	1	100	0
VAC-I	ENV2116N	Environmental Studies	4	30	70

Semester - II					
	Course Code	**Course Title**	**Total Credits**	**Internal Marks**	**External Marks**
Discipline-I (Core)	MTH2201N	Classical Algebra	4	30	70
	MTH2202N	Ordinary Differential Equations	4	30	70
Discipline-II (any one from the basket)	PHY2208N PHY2209N	Physics-II Physics-II Lab	3 1	30 30	70 70
	CHY2208N CHY2209N	Chemistry-II Chemistry-II Lab	3 1	30 30	70 70
	STA2202N	Probability Theory-II	4	30	70
Discipline-III (any one from the basket)	ABM2210N	Advances in Business Management	4	50	50
	HMR2210N	Human Rights-II			
	CSW2210N	Technical and Literary Writing			
	ECO2210N	Economics-II			
	FST2210N	Fashion Technology-II			
	IND2210N	Interior Design-II			
Foreign Language (any one from the basket)	FLF2211N	French-II	2	50	50
	FLG2211N	German-II			
	FLS2211N	Spanish-II			
Communication Skills	CSE2212N	Presentation Skills	1	50	50
Behavioural Science	BEH2213N	Behavioural Science-II	1	100	0
VAC-II (any one from the basket)	DSC2217N	Data Science & Computation: Basic Statistics	2	50	50
	ANM2217N	Animation-I			
	PHT2217N	Photography-I			
	POL2217N	Political Science-I			
	TSM2217N	Tourism Management-I			
	SCW2217N	Social Work-I			

Semester - III					
	Course Code	**Course Title**	**Total Credits**	**Internal Marks**	**External Marks**
Discipline-I (Core)	MTH2301N	Abstract Algebra	4	30	70
	MTH2302N	Partial Differential Equations	4	30	70
Discipline-II (any one from the basket)	PHY2308N PHY2309N	Physics-III Physics-III Lab	3 1	30 30	70 70
	CHY2308N CHY2309N	Chemistry-III Chemistry-III Lab	3 1	30 30	70 70
	STA2302N STA2303N	Statistical Inference Statistical Inference Lab	3 1	30 30	70 70
Foreign Language (any one from the basket)	FLF2311N	French-III	2	50	50
	FLG2311N	German-III			
	FLS2311N	Spanish-III			
Communication Skills	CSE2312N	Reading and Comprehension	1	50	50
Behavioural Science	BEH2313N	Behavioural Science-III	1	100	0
Vocational Courses/ Entrepreneurship */ Industry Led Courses	VOC2315N	Introduction to Programming with Python-I	2	50	50
VAC-II (any one from the basket)	DSC2317N	Data Science & Computation: Statistical Inference	2	50	50
	ANM2317N	Animation-II			
	PHT2317N	Photography-II			
	POL2317N	Political Science-II			
	TSM2317N	Tourism Management-II			
	SCW2317N	Social Work-II			
VAC-III	PHE2318N	Physical Education & Sports**	0	0	0
Community Engagement Services	CES2319N	Community Outreach	3	100	0

** continued till SEM-VI

Semester - IV					
	Course Code	**Course Title**	**Total Credits**	**Internal Marks**	**External Marks**
Discipline-I (Core)	MTH2401N	Functions of Several Variables	4	30	70
	MTH2402N	Linear Algebra	4	30	70
Discipline-II (any one from the basket)	PHY2408N PHY2409N	Physics-IV Physics-IV Lab	3 1	30 30	70 70
	CHY2408N CHY2409N	Chemistry-IV Chemistry-IV Lab	3 1	30 30	70 70
	STA2403N	Operations Research	4	30	70
Foreign Language (any one from the basket)	FLF2411N	French-IV	2	50	50
	FLG2411N	German-IV			
	FLS2411N	Spanish-IV			
Communication Skills	CSE2412N	Effective Writing Skills	1	50	50
Behavioural Science	BEH2413N	Behavioural Science-IV	1	100	0
Vocational Courses/ Entrepreneurship */ Industry Led Courses	VOC2415N	Introduction to Programming with Python-II	2	50	50
VAC-II (any one from the basket)	DSC2417N	Data Science & Computation: Basics of Machine Learning	2	50	50
	ANM2417N	Animation-III			
	PHT2417N	Photography-III			
	POL2417N	Political Science-III			
	TSM2417N	Tourism Management-III			
	SCW2417N	Social Work-III			
VAC-III	PHE2318N	Physical Education & Sports**	0	0	0

Semester - V					
	Course Code	**Course Title**	**Total Credits**	**Internal Marks**	**External Marks**
Discipline-I (Core)	MTH2501N	Matric Spaces	4	30	70
	MTH2502N	Complex Analysis	4	30	70
	MTH2503N	Numerical Analysis	3	30	70
	MTH2504N	Numerical Analysis Lab	1	30	70
Discipline-II (any one from the basket)	PHY2508N PHY2509N	Physics-V Physics-V Lab	3 1	30 30	70 70
	CHY2508N CHY2509N	Chemistry-V Chemistry-V Lab	3 1	30 30	70 70
	STA2504N	Advanced Operations Research	4	30	70
Foreign Language (any one from the basket)	FLF2511N	French-V	2	50	50
	FLG2511N	German-V			
	FLS2511N	Spanish-V			
Communication Skills	CSE2512N	Employability Skill	1	50	50
Behavioural Science	BEH2513N	Behavioural Science-V	1	100	0
VAC-III	PHE2318N	Physical Education & Sports**	0	0	0
SIP/Internship/ Project/Dissertation/ Field Visit	MTH2521N	Summer Internship	5	100	0

Semester - VI					
	Course Code	**Course Title**	**Total Credits**	**Internal Marks**	**External Marks**
Discipline-I (Core)	MTH2601N	Discrete Mathematics	4	30	70
	MTH2602N	Number Theory	4	30	70
	MTH2603N	Topology	4	30	70
	MTH2604N	Transform Techniques and 2D 3D Geometry	4	30	70
Discipline-II ((any one from the basket)	PHY2608N PHY2609N	Physics-VI Physics-VI Lab	3 1	30 30	70 70
	CHY2609N CHY2610N	Chemistry-VI Chemistry-VI Lab	3 1	30 30	70 70
	STA2605N STA2606N	Data Analysis & Decision Making Data Analysis & Decision Making Lab	3 1	30 30	70 70
VAC-III	PHE2318N	Physical Education & Sports**	0	0	0

Semester - VII					
	Course Code	**Course Title**	**Total Credits**	**Internal Marks**	**External Marks**
Discipline-I (Core)	MTH2701N	Fractional Calculus	4	30	70
	MTH2702N	Lattice Theory	4	30	70
	MTH2703N	Introduction to Mathematical Biology	4	30	70
SIP/Internship/ Project/Dissertation/ Field Visit	MTH2704N	Research Project-I	9	100	0

Semester - VIII					
	Course Code	**Course Title**	**Total Credits**	**Internal Marks**	**External Marks**
Discipline-I (Core)	MTH2801N	Spectral Graph Theory	4	30	70
	MTH2802N	Special Functions	4	30	70
	MTH2803N	Dynamical Systems	4	30	70
SIP/Internship/ Project/Dissertation/ Field Visit	MTH2804N	Research Project-II	12	100	0

Semester - I						
	Course Code	**Course Title**	**Lecture Credits**	**Tutorial Credits**	**Practical Credits**	**Total Credits**
Discipline-I (Core)						**8**
Discipline-I	MTH2101N	Real Analysis	3	1	-	4
	MTH2102N	Calculus	3	1	-	4
Discipline-II (any one from the basket)						**4**
Discipline-II	PHY2108N PHY2109N	Physics-I Physics-I Lab	2 -	1 -	- 1	3 1
	CHY2108N CHY2109N	Chemistry-I Chemistry-I Lab	2 -	1 -	- 1	3 1
	STA2103N	Probability Theory-I	3	1	-	4
Discipline-III (any one from the basket)						**4**
Discipline-III	BMT2110N	Business Management	3	-	1	4
	HMR2110N	Human Rights-I	4	-	-	4
	ACW2110N	Academic and Creative Writing	4	-	-	4
	ECO2110N	Economics-I	3	-	1	4
	FST2110N	Fashion Technology-I	2	-	2	4
	IND2110N	Interior Design-I	1	-	3	4
Total (Discipline-I + II + III)						**16**
Foreign Language (any one from the basket)						**1**
Foreign Language	FLF2111N	French-I	1	-	-	1
	FLG2111N	German-I				
	FLS2111N	Spanish-I				
Communication Skills	CSE2112N	Effective Listening	1	-	-	1
Sub Total						**2**
Behavioural Science	BEH2113N	Behavioural Science-I	1	-	-	1
Sub Total						**1**
VAC-I	ENV2116N	Environmental Studies	3	1	-	4
Sub Total						**4**
Total						**7**
Grand Total						**23**

Semester-I

Course Code	Course Name	Credits
MTH2101N	REAL ANALYSIS	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Comprehend fundamental concepts in real numbers: bounded sets, infimum, supremum, countable sets, and order completeness.
2. Gain knowledge on convergence of sequences, properties of convergent sequences, and tests for infinite series convergence.
3. Explore limits, continuity of functions, and differentiation techniques, including key theorems.
4. Acquire skills in Riemann integration, integrability conditions, the fundamental theorem of calculus, and various integration techniques.
5. Grasp the convergence of sequences and series of functions, along with the implications of uniform convergence on continuity, integration, and differentiation.
6. Understand the effects of uniform convergence on continuity, integration, and differentiation.

Course Outcomes

1. Ability to analyze sets and understand concepts like infimum, supremum, and order completeness.
2. Proficiency in determining convergence of sequences.
3. Applying convergence tests for infinite series.
4. Capability to evaluate limits and determine continuity properties.
5. Applying differentiation techniques.
6. Ability to compute Riemann integrals, apply the fundamental theorem of calculus, and integration techniques.

Detailed Syllabus

Module		Content	Hours	Marks Weightage
1		**Fundamentals of Point-Set Theory**	9	17%
	1.1	Introduction (addition, multiplication, and order in the set of real numbers and their properties).		
	1.2	Bounded and unbounded sets. Infimum and supremum of a set and their properties.		
	1.3	Countable and uncountable sets. Order completeness in R. Open set. Neighborhood. Interior of a set. Limit point of a set. Closed set. Bolzano-Weierstrass theorem.		
2		**Real Sequences**	10	20%
	2.1	Sequence of real numbers, convergent and non-convergent sequences. Cauchy's general principle of convergence. Algebra of sequences. Theorems on limits of sequences. Monotone sequences.		
	2.2	Infinite series and its convergence. Tests for convergence of positive term series: Comparison Test, Ratio Test, Cauchy's Root Test, Raabe's Test, Logarithmic Test, Integral Test..		
	2.3	Uniform continuity, uniform continuity theorem.		
3		**Limits and continuity of real functions**	9	17%
	3.1	Limits of functions, sequential criterion for limits, divergence criteria. Review of limit theorems and one-sided limits.		
	3.2	Continuous functions, sequential criterion for continuity, discontinuity criterion. Combinations of continuous functions and compositions of continuous functions.		
	3.3	Continuous functions on intervals, boundedness theorem, maximum-minimum theorem. Bolzano's intermediate value theorem, intermediate value property.		
	3.4	Uniform continuity, uniform continuity theorem.		
4		**Differentiation and Intermediate Value Theorems**	7	13%
	4.1	Differentiation, derivative, combinations of differentiable functions, chain rule.		

	4.2	Derivative of inverse functions, interior extremum theorem.		
	4.3	Intermediate value property for derivatives (Darboux's theorem). Review of Rolle's theorem, mean value theorem, Cauchy's mean value theorem.		
5		**Riemann Integration**	**10**	20%
	5.1	Partition and refinement of a partition of a closed and bounded interval. Definition, existence, and properties of the Riemann integral of a bounded function.		
	5.2	Darboux's Theorem, condition of integrability. The integral as the limit of sums, properties of Riemann Integral.		
	5.3	Fundamental theorem of calculus, mean-value theorem of integral calculus. Integration by parts, change of variables, second mean-value theorem		
6		**Sequences and Series of Functions**	**7**	13%
	6.1	Definition of pointwise and uniform convergence of sequences and series of functions.		
	6.2	Cauchy's criterion for uniform convergence. Weierstrass M-test. Uniform convergence and continuity, uniform convergence and Riemann integration.		
	6.3	Uniform convergence and differentiation. Power series, radius of convergence, interval of convergence		
Total			**52**	**100%**

References:

1. R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis (3rd Edition), John Wiley and Sons (Asia) Pte. Ltd., Singapore, 2002.
2. Sudhir R. Ghorpade and Balmohan V. Limaye, A Course in Calculus and Real Analysis, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2006
3. K. A. Ross, Elementary analysis: the theory of calculus, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004
4. S.C, Mallick : Mathematical Analysis; Wiley Eastern Ltd (1991).
5. T.M. Apostal : Mathematical Analysis; Addison Wesley Series in Mathematics (1974)
6. C. Goffman : Introduction to Real Analysis; Harper International Edition, Harper and Row, York, Tokyo (1967).

Semester-I

Course Code	Course Name	Credits
MTH2102N	CALCULUS	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Grasp the properties and differentiation rules of hyperbolic functions.
2. Apply the Leibnitz rule to various functions, including exponentials, trigonometrics, and polynomials.
3. Understand the principles of Taylor's theorem and expansions of Maclaurin series.
4. Analyze curve curvature, ascertain concavity, and trace curves in Cartesian and polar coordinates.
5. Comprehend the concepts of definite and indefinite integrals, and their applications in computing areas, volumes, and solving mathematical problems.
6. Apply integral techniques to solve problems involving areas, volumes, and various mathematical scenarios.

Course Outcomes

1. Skill in differentiating hyperbolic functions and computing higher-order derivatives effectively.
2. Proficiency in applying the Leibnitz rule to solve problems with exponential, trigonometric, and polynomial functions.
3. Capability to derive Taylor series expansions and approximate functions accurately using Maclaurin series.
4. Ability to determine curvature, concavity, and accurately sketch curves in Cartesian and polar coordinates.
5. Proficiency in evaluating definite and indefinite integrals, computing areas, volumes, surface areas, and solving problems related to work and fluid pressure.
6. Skill in solving problems related to work and fluid pressure using integration techniques.

Detailed Syllabus

Module		Content	Hours	Marks Weightage
1		**Fundamentals of Differential Calculus**	9	17%
	1.1	Hyperbolic functions.		
	1.2	Leibnitz rule and its applications to problems of type eax+bsin x, eax+bcos x, (ax+b)nsin x, (ax+b)ncos x		
	1.3	Higher-order derivatives, successive differentiation.		
2		**Advanced Differential Calculus**	9	17%
	2.1	Taylor's theorem with Lagrange and Cauchy forms of remainders.		
	2.2	Taylor series, Maclaurin series, expansions of exponential, logarithmic, and trigonometric functions.		
	2.3	Indeterminate forms. Curvature: Cartesian, polar, and parametric formulae for the radius of curvature		
3		**Curve Analysis in Differential Calculus**	7	12%
	3.1	Test for concavity and convexity.		
	3.2	Points of inflexion, multiple points. Convergence of improper integrals.		
	3.3	Rectilinear asymptotes.		
	3.4	Curve tracing in polar coordinates of standard curves.		
	3.5	L'Hospital's rule		
4		**Integral Calculus**	9	17%
	4.1	Scalar triple product, vector triple product, vector equations,		
	4.2	application to geometry and mechanics-concurrent forces in a plane		
	4.3	theory of couples, system of parallel forces,		
	4.4	Introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions of one variable.		
5		**Applications of Integral Calculus**	7	12%
	5.1	Area under a curve. Volumes by slicing, disks, and washers methods.		

	5.2	Volumes by cylindrical shells. Volume and surface of revolution, surface area.		
	5.3	Work, modeling fluid pressure and force. Modeling the centroid of a plane region.		
6		**Improper Integrals and Vector Calculus**	11	25%
	6.1	Definition and convergence of improper integrals. Comparison test, Cauchy's test for convergence, absolute convergence. Beta and Gamma functions and their properties.		
	6.2	Scalar triple product, vector triple product, vector equations. Applications to geometry and mechanics: concurrent forces in a plane, theory of couples, system of parallel forces.		
	6.3	Introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions of one variable.		
Total			**52**	**100%**

References:

1. G. B. Thomas and R. L. Finney, Calculus, 9th Edition, Pearson Education, Delsi, 2005
2. R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis (3rd Edition), John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.
3. K. A. Ross, Elementary Analysis: The Theory of Calculus, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004
4. T. Apostol, Calculus, Volumes I and II
5. M. R. Spigel, Schaums Outlines of Vector Analysis.
6. An introduction to Calculus (Differential Calculus):Part I, Ghosh and Maity, New Central Book Agency(P) Limited, 2012.
7. Integral Calculus, Ghosh and Maity, New Central Book Agency(P) Limited, 1999.
8. Vector Analysis, Ghosh and Maity, New Central Book Agency(P) Limited, 2013.

Semester-I

Course Code	Course Name	Credits
PHY2108N	PHYSICS-I	03

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	01	02	-	01	03

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

This course is designed to provide

1. fundamental and conceptual knowledge of solar system,
2. introduction to astronomical scales, dimensions and coordinate systems,
3. introduction to various observational tools,
4. introduction to various astronomical observations,
5. introduction to various renewable energy resources, and
6. information about technology to harness energy from renewable resources.

Course Outcomes

On completion of this course, student will be able to:

1. understand basic concepts of solar system
2. explain astronomical scales, dimensions and coordinate systems,
3. explain basic concepts of astronomical observational tools,
4. distinguish between various astronomical observations and associated optical concepts,
5. understand different types of renewable energy resources, and
6. explain related technology to harness renewable resources.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
Solar System			
1	Formation of solar system; Sun and its properties; Solar Atmosphere; Planetary orbits; Planetary properties: mass, density, rotation period, temperature; Planetary atmospheres; Planets of the solar system.	06	17%
2	Scales and Dimensions; the celestial sphere and stellar magnitudes; the celestial coordinate system; Time: local solar time, Greenwich mean time, Universal time, Sidereal time, Cosmic time. Coordinate Systems: Horizontal, Equatorial, and Ecliptic Systems; Space Velocity and Proper Motion of Stars.	07	17%
Observing the Universe			
3	Electromagnetic Waves; Electromagnetic Spectrum. Refractor & Refracting Telescopes (brief overview); Magnification of Telescope; Observations at Visible Frequencies; Mounting of Telescope.	07	17%
4	Optical Telescopes: SALT, VST, HST, Gemini North and South telescopes, the Keck Telescope; future of optical astronomy. Observations at other wavelengths. Observations without using electromagnetic radiation. Active and adaptive optics.	06	16%
Renewable Energy			
5	Renewable and non-renewable energies, Solar energy and its importance, Source of solar energy, storage of solar energy - (solar pond, non-plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning). Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, sun tracking systems.	08	16%
6	Hydro energy, wind energy, ocean thermal energy, tidal energy, geothermal energy.	05	17%
Total		**39**	**100%**

References:

1. *Introduction to Astronomy and Cosmology* by Ian Morison, John Wiley & Sons Ltd. Publications, ISBN: 978-0470033340.
2. *An Introduction to Astronomy and Astrophysics* by Pankaj Jain, CRC Press (Taylor & Francis Group) (2015) ISBN: 978-1439885901.
3. *Solar Energy: Principles of Thermal Collection and Storage* by S. P. Sukhatme and J. K. Nayak, Tata McGraw Hill (2015), ISBN: 978-0070142961.
4. *Solar Energy: Fundamentals and Applications* by H. P. Garg and J. Prakash, Tata McGraw Hill (2017), ISBN: 978-0074636312.
5. *Solar energy* by M P Agarwal, S Chand and Co. Ltd., ISBN: 4000001092.
6. *Non-conventional energy sources* by G.D Rai, Khanna Publishers, New Delhi (2004), ISBN: 978-8174090737.

Semester-I

Course Code	Course Name	Credits
PHY2109N	PHYSICS-I LAB	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
-	02	-	-	01	-	01

Practical						Total
Internal Assessment				External		
Lab Journal	**Performance**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

The laboratory course is designed to provide:

1. the understanding of basic lab skills like measuring least count, error analysis, graph plotting and identifying and quantifying electronic instruments.
2. the understanding of the concepts of stellar distances and its measurement,
3. the measurement of acceleration due to gravity by various methods,
4. the understanding of magnifying and resolving powers of telescope,
5. the understanding of solar irradiance, and
6. the understanding and comparison of performance of solar cell in various conditions.

Course Outcomes

On completion of this course, student will be able to:

1. estimate least count and perform error analysis, graph plotting and identifying and quantifying electronic instruments,
2. understand and measure the stellar distances,
3. measure acceleration due to gravity by various methods,
4. calculate magnifying and resolving power of telescope,
5. measure and analysis solar radiance, and
6. compare performance of solar cell in various conditions.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
	Minor experiments (*Not to be included in end semester exam*) • Measuring the least count of instruments. • Error analysis. • Graph plotting. • Identifying and quantifying electronic instruments.	26	100%
1	The measurement of the acceleration due to gravity using bar pendulum.		
2	To discover the relationship between the distance of an object and the viewing perspective.		
3	To measure the distances of planets in our Solar System.		
4	Resolving and magnifying powers of telescope.		
5	To measure the performance of a solar cell using sun light.		
6	To compare the performance of solar cell under visible light and different colour light (using filters).		
7	The study and measurement of solar irradiance.		
Total		**26**	**100%**

References:

1. A complete course in practical physics by B. B. Swain, Kalyani Publisher.
2. B.Sc. Practical Physics by C. L. Arora, S. Chand publications.
3. https://www.vlab.co.in/
4. https://va-iitk.vlabs.ac.in/

Semester-I

Course Code	Course Name	Credits
CHY2108N	CHEMISTRY-I	03

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	01	02	-	01	03

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. To provide knowledge of Atomic Structure
2. To provide knowledge of Periodicity of Elements
3. To provide knowledge of Ionization enthalpy and Electronegativity
4. To provide knowledge of Acid and Bases
5. To provide knowledge of Oxidation-Reduction Chemistry
6. To provide knowledge of the basic concept chemistry and laws of combinations

Course Outcomes

On completion of this course, student must be able to:

1. Understand the concept of Atomic Structure
2. Learn the concept of Periodicity of Elements
3. Understand the concept of Ionization enthalpy and Electronegativity
4. Learn the concept of acid and bases
5. Understand the concept of Oxidation-Reduction Chemistry
6. Understand the basic concept chemistry and laws of combinations

Detailed Syllabus

Module	Contents	Hours	Marks Weightage
1	**Atomic Structure** Bohr's theory, its limitations, and the atomic spectrum of hydrogen atom. Quantum numbers and their significance. Wave mechanics: de Broglie equation, Heisenberg's uncertainty principle and its significance. Pauli's exclusion principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.	8	17
2	**Periodicity of Elements** s, p, d, f block elements, the long form of the periodic table. Detailed discussion of the following properties of the elements, with reference to s & p- block. Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table. Atomic radii (van der Waals), Ionic and crystal radii, Covalent radii (octahedral and tetrahedral).	7	18
3	**Ionization enthalpy and Electronegativity** Ionization enthalpy, Successive ionization enthalpies, and factors affecting ionization energy. Applications of ionization enthalpy; Electron gain enthalpy, trends of electron gain enthalpy; Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffe's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity	6	18
4	**Acids and Bases** Arrhenius Theory, Bronsted- Lowry concept of acid-base reaction, solvated proton, relative strength of acids, types of acid-base reactions, leveling solvents. Lewis acid-base concept. Classification of Lewis acids, Hard and Soft Acids and Bases (HSAB) Application of HSAB principle	6	16
5	**Oxidation-Reduction Chemistry** Reduction potential, Redox potentials: half reactions, balancing redox equations; Redox stability in water: Latimer and Frost Diagram, pH dependence of redox potentials. Applications of redox chemistry: Extraction of elements, Redox reactions in Volumetric analysis, titration curves.	6	16
6	**Basic Concept of Chemistry**	6	15

	Laws of chemical combination, Dalton's atomic theory, Avogadro's hypothesis Atomic and molecular masses, Mole concept.		
Total		**39**	**100%**

References:

1. Lee, J.D. Concise Inorganic Chemistry, ELBS, 1991.
2. Catherine Housecroft and Alan G. Sharpe, Fifth Edition.
3. Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry, Oxford, 1970.
4. Atkins, P.W. & Paula, J. Physical Chemistry, Oxford Press, 2006.
5. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications 196.

Semester-I

Course Code	Course Name	Credits
CHY2109N	CHEMISTRY-I LAB	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
-	02	-	-	01	-	01

Practical						Total
Internal Assessment				External		
Lab Journal	**Performance**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. To provide concept of Normality and Molarity
2. To provide hands on experience of estimation of hydroxide and carbonate together
3. To provide hands on experience of estimation of alkali present different soaps
4. To provide hands on experience of estimation of oxalate and oxalic acid in mixture
5. To provide hands on experience of estimation of Fe(II) using internal indicator
6. To provide hands on experience of estimation of Fe(II) using external indicator

Course Outcomes

On completion of this course, student must be able to:

1. Understand the concept of Normality and Molarity
2. Gain knowledge on estimation of hydroxide and carbonate together
3. Gain knowledge on estimation of alkali present different soaps
4. Gain knowledge on estimation oxalate and oxalic acid in mixture
5. Gain knowledge of Fe(II) estimation using internal indicator
6. Gain knowledge of Fe(II) estimation using external indicator

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	Calibration and use of apparatus.	26	100%
2	Preparation of solutions of different Molarity/Normality of titrants.		
3	Estimation of carbonate and hydroxide present together in a mixture.		
4	Estimation of carbonate and bicarbonate present together in a mixture.		
5	Estimation of free alkali present in different soaps/detergents.		
6	Estimation of oxalic acid and sodium oxalate in a given mixture.		
7	Estimation of Fe(II) with $K_2Cr_2O_7$ using internal (diphenylamine, anthranilic acid) indicator.		
8	Estimation of Fe(II) using $K_2Cr_2O_7$ using potassium ferricyanide as an external indicator.		
9	Viva, and journal writing for Exp. No. 1 & 2.		
10	Viva, and journal writing for Exp. No. 3 & 4.		
11	Viva, and journal writing for Exp. No. 5.		
12	Viva, and journal writing for Exp. No. 6.		
13	Viva, and journal writing for Exp. No. 7 & 8.		
Total		**26**	**100%**

References:

1. Basic Concept of Analytical Chemistry- S. M. Khopkar.
2. Analytical Chemistry, G.R. Chatwal, Sham Anand.
3. Analytical Chemistry, G. D. Christian, P. K. Dasgupta, K. A. Schug, 7th Ed, Wily, 2004
4. Fundamentals of Analytical Chemistry- Skoog, west, Holler, Crouch, 9th Ed. Brooks / Cole, 2014/2004.
5. Vogel's Textbook of Quantitative Chemical Analysis, 5th Ed. G. H. Jeffry, J. Basset, J. Mendham, R. C. Denney, Longman Scientific and Technical, 1989.

Semester-I

Course Code	Course Name	Credits
STA2103N	PROBABILITY THEORY-I	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Grasp basic probability concepts and calculation methods.
2. Understand random variables, distribution functions, and their properties.
3. Develop statistical analysis skills, including presentation and bivariate analysis.
4. Learn various statistical measures for accurate dataset description.
5. Explore attribute data analysis, covering consistency, independence, and association.
6. Apply statistical techniques for effective data interpretation and decision-making.

Course Outcomes

1. Analyze random experiments, calculate probabilities effectively.
2. Analyze random variables, compute expected values, understand distribution properties.
3. Present data, analyze variable relationships, fit curves to datasets proficiently.
4. Calculate and interpret measures of central tendency, dispersion.
5. Assess attributes data consistency, independence, association, utilize relevant measures.
6. Utilize statistical techniques for deriving insights, making informed decisions from data.

Detailed Syllabus

Module		Contents	Hours	Marks Weightage
1		**Probability**	**10**	20%
	1.1	Probability Theory: Random experiments, sample point and sample space, event, algebra of events.		
	1.2	Definition of Probability – classical and relative frequency approach to probability; Richard Von-Mises, and Kolmogorov's approach to probability, merits, and demerits of these approaches (only general ideas to be given).		
	1.3	Theorems on probability, conditional probability, independent events, Bayes theorem and its applications.		
2		**Random Variables**	**06**	15%
	2.1	Random Variables, Distribution Functions, Discrete Random Variables, Expected Value, Expectation of a Function of a Random Variable, Variance.		
3		**Distributions**	**10**	20%
	3.1	Discrete distributions, Continuous distributions Joint Distribution Functions, Independent Random Variables, Sums of Independent Random Variables, Conditional Distributions: Discrete Case and Continuous Case, Joint Probability Distribution of Functions of Random Variables.		
	3.2	Expectation of Sums of Random Variables, Covariance, Variance of Sums, and Correlations, Conditional Expectation, Moment Generating Functions, Joint Moment Generating Functions.		
4		**Statistical Methods**	**10**	15%
	4.1	Concepts of statistical population and sample from a population, quantitative and qualitative data, Nominal, ordinal and time series data, discrete and continuous data.		
	4.2	Presentation of data by table and by diagrams, frequency distributions by histogram and frequency polygon, cumulative frequency distributions (inclusive and exclusive methods) and ogive.		

5		**Basic Curve Fitting**	**06**	15%
	5.1	Bivariate data-scatter diagram, principle of least squares and fitting of polynomials and exponential curves.		
6		**Basic Statistics**	**10**	15%
	6.1	Measures of location (or central tendency) and dispersion. Moments.		
	6.2	Measures of skewness and kurtosis, absolute moments and factorial moments, Inequalities concerning moments, Sheppard's corrections.		
Total			**52**	**100%**

References:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2005): Fundamentals of Statistics, Vol. I, 8th Edn. World Press, Kolkata.
2. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2003): An Outline of Statistical Theory, Vol. I, 4th Edn. World Press, Kolkata.
3. Gupta, S.C. and Kapoor, V.K. (2007): Fundamentals of Mathematical Statistics, 11th Edn. (Reprint), Sultan Chand and Sons.
4. Miller, Irwin and Miller, Marylees (2006): John E. Freund‟s Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
5. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd
6. Rohatgi, V. K. and Saleh, A. K. Md. E. (2009): An Introduction to Probability and Statistics, 2nd Edn. (Reprint). John Wiley and Sons

Semester-I

Course Code	Course Name	Credits
BMT2110N	BUSINESS MANAGEMENT	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
20	25	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. Familiarize students with the key concepts, functions, and levels of management, and the evolution of management theories.
2. To effectively plan, set objectives, forecast, and make informed decisions within an organization.
3. Provide students with an understanding of how organizations are structured, including departmentalization, span of control, and the principles of authority and delegation.
4. Enable students to conduct job analysis, manpower planning, recruitment, and training, and understand the importance of employee development and recognition.
5. Teach students the processes and objectives of management control.
6. The importance of coordination, communication, and motivation in directing organizational efforts.

Course Outcomes

1. Identify and explain the basic concepts, nature, and scope of management, and recognize its significance in organizational success.
2. Analyze various management theories, including classical and modern approaches, and apply these frameworks to solve organizational challenges.
3. Demonstrate the ability to carry out the management planning process, set objectives, and use forecasting and decision-making techniques to guide organizational planning.
4. Evaluate different types of organizational structures and understand the principles of authority, delegation, departmentalization, and staffing processes.
5. Develop and apply techniques for management control, motivation, coordination.
6. Communication to improve organizational effectiveness.

Detailed Syllabus

Module	Contents	Hours	Marks Weightage
1	**Introduction**	09	17%
	Concept, Nature, Scope and Functions of Management		
	Functions of Management, Levels of Management, Evolution and Foundations of Management Theories - Classical		
	Systems Approach to organization, Modern Organization Theory.		
2	**Management Planning Process**	09	17%
	Planning objectives and characteristics		
	Hierarchies of planning, the concept and techniques of forecasting		
	Decision making – concepts & process, MBO, concept and relevance		
3	**Organization**	09	17%
	Meaning, Importance and Principles, Departmentalization		
	Span of Control, Types of Organization		
	Authority, Delegation of Authority		
4	**Staffing**	09	17%
	Meaning, Job analysis, Manpower planning		
	Recruitment, Transfers and Promotions, Appraisals		
	Management Development, Job Rotation, Training, Rewards and Recognition.		
5	**Directing**	09	17%
	Motivation, Co-ordination, Communication		
	Directing and Management Control, Decision Making		
6	**Management Control**		

	Coordination, Meaning, Nature, Features	**07**	15%
	Objectives and Process of Management Control		
Total		**52**	**100%**

References:

1. Stoner, Freeman and Gilbert Jr. (2010), Management, 8th Edition, Pearson Education
2. Robbins, (2009), Fundamentals of Management: Essential concepts and Applications, 6th edition, Pearson Education
3. Prasad, L.M. Principles & Practice of Management, 1st Edition, Tata McGrew Hills
4. "Principles of Management" by Richard L. Daft,12th Edition (2018),Cengage Learning
5. "Principles of Management" by Charles W. L. Hill and Steven McShane, 1st Edition (2008), McGraw-Hill/Irwin

Semester-I

Course Code	Course Name	Credits
HMR2110N	HUMAN RIGHTS-I	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
04	-	-	04	-	-	04

Theory							Total
Internal Assessment					External		
Test	**Assignment**	**Viva**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
20	15	10	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. Critically analyze different spheres of human rights.
2. Effectively communicate on socio-legal aspects of human rights.
3. Enhance analytical thinking on international human rights law application.
4. Assess specific human rights laws with legal instruments and contemporary cases.
5. Analyze contemporary challenges and trends in human rights theory and practice.
6. Understand divergences in human rights across international, regional, and domestic contexts.

Course Outcomes

1. Promote human dignity and individual self-respect.
2. Ensure gender equality and equal opportunities for all.
3. Foster respect and appreciation for diversity.
4. Support the rights of national, ethnic, religious, and linguistic minorities.
5. Empower students for active citizenship and democratic participation.
6. Promote social justice, communal harmony, and solidarity.

Detailed Syllabus

Module	Contents	Hours	Marks Weightage
1	**Historical Development and Basic Concepts**	8	15%
	Historical Development of Human Rights		
	Concepts of Justice		
	Concepts of Dignity		
	Concepts of Liberty and Equality		
	Concepts of Unity in Diversity		
	Concepts of Ethics and Morality		
2	**Understanding of the Concept of Rights and Duties**	8	15%
	Meaning of Human Rights		
	Significance of Human Rights Education.		
	Rights: Inherent-Inalienable-Universal- Individual and Groups		
	Nature and concept of Duties		
	Interrelationship of Rights and Duties		
	Classification of Rights and Duties: Moral, Social, Cultural, Economic, Civil and Political		
3	**Human Duties and Responsibilities**	8	16%
	Identification of Human Duties and Responsibilities.		
	The Relationship Between Human Rights and Human Duties.		
	Ethical Obligations of Individuals in upholding Human Rights.		
	Social Responsibilities in Promoting Equality and Justice.		
	Environmental Duties and the Role of Sustainable Practices.		
	Global and Cultural Variations in the Concept of Human Responsibilities.		
4	**General Problems of Human Rights**	10	18%

	Challenges in Defining and Universally Applying Human Rights.		
	Conflict Between National Sovereignty and International Human Rights Standards.		
	Cultural Relativism and its Impact on Human Rights Implementation.		
	Economic Inequality as a Barrier to Human Rights Realization.		
	Political Repression and the Violation of Civil Liberties.		
5	**Important Convention on Human Rights-I**	9	18%
	Universal Declaration of Human Rights (UDHR) (1948)		
	International Covenant on Civil and Political Rights (ICCPR) (1966)		
	International Covenant on Economic, Social and Cultural Rights (ICESCR) (1966)		
	Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) (1979)		
	Convention on the Rights of the Child (CRC) (1989)		
	Convention on the Rights of Persons with Disabilities (CRPD) (2006)		
6	**Important Convention on Human Rights-II**	9	18%
	International Convention on the Elimination of All Forms of Racial Discrimination (ICERD) (1965)		
	Convention Against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment (CAT) (1984)		
	Convention Relating to the Status of Refugees (1951) and its 1967 Protocol		
	Convention on the Prevention and Punishment of the Crime of Genocide (1948)		
	International Convention for the Protection of All Persons from Enforced Disappearance (2006)		
	Rome Statute of the International Criminal Court (1998)		
Total		**52**	**100%**

References:

1. An introduction to the Political Theory by O.P. Gauba;
2. Human Rights by S. Subrahmanyam;

3. Human Rights and Constitutional Law by D.D. Basu;
4. The United Nations Structure and Functions of an International Organization by Rumki Basu;
5. Human Rights in India Historical, Social and Political Perspective by Chiranjivi J. Nirmal.
6. Manoj Kumar Sinha, Implementation of Basic Human Rights, (Lexis Nexis)

Semester-I

Course Code	Course Name	Credits
ACW2110N	ACADEMIC AND CREATIVE WRITING	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
04	-	-	04	-	-	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
30	15	05	**50**	**50**	2 Hours	**100**

Course Objectives

The course is designed:
1. To introduce the concepts of academic and creative writing.
2. To familiarize students with the different genres and process of writing.
3. To train students to write in various forms and formats.
4. To encourage students to write for self-development and publication.
5. To teach the various ways of ideating and writing creatively.

Course Outcomes

After completion of this course students will be able to:
1. Demonstrate effective ways of ideation.
2. Identify various writing techniques.
3. Acquire academic and idiomatic vocabulary.
4. Comprehend the principles of effective paragraph structure and content.
5. Analyse and evaluate own and other's works.

Detailed Syllabus

Module	Contents	Hours	Marks Weightage
1	**Fundamentals of Writing**	8	15%
	Significance of Writing as a Skill		

	Categories of Writing		
	Types of writing		
2	**Academic and Creative Writing**	8	15%
	Features of Academic and Creative Writing		
	Differences Between Academic and Creative Writing		
	Illustrations of Between Academic and Creative Writing		
3	**Creative Writing**	10	20%
	Ideation		
	Writing for target audience		
	Employ the various stages of the writing process - pre-writing, writing and re-writing		
	Employ descriptive, narrative and expository modes		
4	**Academic Writing**	8	15%
	Planning and Making the Outline		
	Refining Paragraph Structure		
	Proofreading and editing		
5	**Stylistics of Writing**	10	20%
	Planning and Making the Outline		
	Refining Paragraph Structure		
	Proofreading and editing		
6	**Putting to Practice**	8	15%
	Analyzing short stories of famous foreign and Indian writers: Kate Chopin & Ruskin Bond		
	Producing samples of Various Writing Types		
	Peer review		
Total		**52**	**100%**

References:

1. Brohaugh, William. Write Tight: Say Exactly What You Mean with Precision and Power.
2. Dev, Anjana Neira, ed. A Handbook of Academic Writing and Composition, Pinnacle, 2016.
3. Eckert, Kenneth. Writing Academic Research Papers. Moldy Rutabaga, 2021.
4. Goins, Jeff. You Are a Writer (So Start Acting Like One). Tribe Press
5. Gupta, Renu. A Course in Academic Writing. Orient BlackSwan, 2010.
6. Pinker, Steven. The Sense of Style: The Thinking Person's Guide to Writing in the 21st Century . Penguin Books, Reprint edition ,2015
7. Seely, John. Oxford Guide to Effective Writing and Speaking. OUP 2nd edition, 2005
8. Turk, Christopher and John Kirkman. Effective Writing. London and New York: Chapman & Hall. Indian Reprint 2003.

Semester-I

Course Code	Course Name	Credits
ECO2110N	ECONOMICS-I	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory							Total
Internal Assessment					External		
Test	**Assignment**	**Viva**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
20	15	10	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. Students are able to compare the different elasticities and their usefulness
2. Students are able to calculate the elasticities
3. Students are able to find the profit maximization equilibrium level
4. Students are able to understand the importance of kinky demand curve in stabilizing prices
5. Students are able to understand the pricing in the factor market
6. Students understand the importance of Pareto equilibrium

Course Outcomes

1. The knowledge of this subject is essential to understand facts, concepts of microeconomics, which deals with economics at individual level.
2. Students understand the basic theories behind decision making process of households and the firms and their interaction in establishing equilibrium prices.
3. Students understand the firms decision making process.
4. Students understand the importance of equilibrium in welfare objective.
5. Students understand the impact of microeconomic decisions at macroeconomic level.
6. Promote social justice, communal harmony, and solidarity.

Detailed Syllabus

Module	Contents	Hours	Marks Weightage
1	**Exploring the Subject Matter of Economics**	7	15%
	Definition of Economics. Why study economics?The scope and method of economics		
	scarcity and choice; questions of what, how and for whom to produce and how to distribute output.		
	Questions of what, how and for whom to produce		
	Question of how to distribute the profit		
	Concept of stable, unstable, static and dynamic equilibrium		
	Partial and general equilibrium, positive and normative economics		
2	**Supply and Demand: How Markets Work, Markets andWelfare**	7	15%
	Equi marginal utility.		
	Individual demand and supply schedule		
	Derivation of market demand supply		
	Consumer's surplus		
	Shifts in demand and supply curve		
	The role of prices in resource allocation		
	Elasticity of demand -price, income and cross elasticity		
	Law of supply, elasticity of supply		
3	**Consumer's Behavior**	8	16%
	Utility-cardinal and ordinal approaches,		
	Indifference curves and budget constraint		
	Consumer 's equilibrium (Hicks and Slutsky		
	Giffen goods		

	Compensated demand curve		
	Revealed preference		
	Engel curve		
4	**Theory of Production**	10	18%
	Technology, Isoquants, Iso costs		
	Production with one and more variables		
	Cobb-Douglass production function		
	Returns to Scale		
5	**Theory of Cost**	10	18%
	Short run and long run costs, cost curves in theshort run and long run, total, average, and marginal product, cost minimization and expansion path, elasticity of substitution.		
	Total, average and marginal product		
	Cost minimization, envelope curve		
	Law of variable proportion		
6	**Markets**	10	18%
	Perfect Competition		
	Assumptions of Perfect Competition		
	Short run equilibrium of perfect competition		
	Long run equilibrium of perfect competition		
Total		**52**	**100%**

References:

1. C. Snyder and W. Nicholson, Fundamentals of Microeconomics, Cengage Learning (India), 2010.
2. B. Douglas Bernheim and Michael D. Whinston, Microeconomics, Tata McGraw-Hill (India), 2009
3. Ahuja H.L. (2010) Principles of Microeconomics, 18th Edition, S. Chand& Co. Ltd.
4. Robert S. Pindyk and D.L. Ru Microeconomics

5. A.Koutsoyiannis ‘Modern Microeconomics

Semester-I

Course Code	Course Name	Credits
FST2110N	FASHION TECHNOLOGY-I	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	02	02	-	02	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	30	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. The course aims to deepen students' grasp of fashion theories, terminologies, and vocabulary, fostering their analytical skills for interpreting design and trends.
2. The course also provides a comprehensive overview of the fashion industry's evolution, current trends, and key players while offering insights into the intricacies of design, manufacturing, and distribution processes.
3. By exploring diverse fashion subcultures, students will recognize their role in reshaping aesthetics and challenging conventional norms, enhancing their ability to engage thoughtfully with the multifaceted realm of fashion.

Course Outcomes

1. Have a deeper understanding of fashion theories, fashion terminologies, and vocabulary.
2. Understand the workings of the fashion industry, including its historical development, current trends, and key players.
3. Gain insights into the fashion production, including design, manufacturing, and distribution.
4. Analyze various fashion subcultures, recognizing their role in challenging mainstream norms and shaping aesthetic trends.

Detailed Syllabus

Module	Contents	Hours	Marks Weightage
1	**Fashion Terminology & Etymology**	9	20%
	Clothes, costumes, fashion, Social Identity, feel-good, unique identity, designer jeans, perfect look, branded cosmetics, branded shoes, eyewear, watches, etc.		
	Elements and principles of design in context to fashion (point, line, shape- [silhouette, motifs, repeats], colour [hue, value, intensity], texture) (balance, proportion, emphasis, rhythm, harmony)		
	Style, Types of Fashion Avante Garde, haute couture/high fashion, mass-market, bridge/prêt-a- porter/ready-to-wear fashion Classics, fads, knock off.		
2	**Factors Influencing Fashion and Fashion Theories**	9	15%
	Accelerating and Retarding factors influenced by social, cultural, economic, political, technological, sports, music, etc.		
	Fashion Theories- Trickle-up, Trickle-down and Mass dissemination		
3	**Fashion Cycles and Fashion Consumers**	8	15%
	Five stages of the fashion cycle and the various types of cycles.		
	Fashion consumers at each stage		
4	**Introduction to the Fashion Industry**	8	15%
	A brief global overview of the textile and apparel industry. Sectoral overview of the fashion industry in India		
	Fashion capitals of the world: Paris, Milan, New York, London, Tokyo (Uniqueness and 5 top designers/brands from each capital)		
5	**Fashion Details**	9	20%
	Component details of necklines, collars, sleeves, cuffs, belts, pockets, drapes, yokes, gathers, frills, pleats, and tucks.		

	Understanding and Identification of applique, patchwork, embroideries, beadwork, fringes, tassels, quilting, smocking, shearing,		
	Types of hemlines, trims, fasteners, laces, zippers, buttons, rouleau, drawstrings, vents, and rivets.		
	Jewelry, handbags, hats, headgear, footwear, watches, scarves, sunglasses, pins.		
6	**Regional Styles, Culture and Fashion**	9	15%
	Mediterranean, Latino, and Scandinavian styles- history, culture and society, lifestyle, textiles and clothing, accessories, home furnishings.		
	Fashion in relation to sports, movies, and music- types of styles and trends, textiles and fabrics.		
Total		**52**	**100%**

References:

1. Fashion: From concept to consumer, Gini Stephens Frings (1999), Prentice-Hill Inc.
2. The Fairchild's Dictionary of Fashion, Phyllis Tortora,
3. Variety- Fashion for Freedom, S. A Hussain
4. Beyond Design, Sandra J. Keiser & Myrna B. Garner, Fairchild publication.
5. Elements of Fashion & Apparel Design, G. J Sumathi,
6. Consumer Behavior: In Fashion, Solomon, Pearson Education India.

Semester-I

Course Code	Course Name	Credits
IND2110N	INTERIOR DESIGN-I	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	03	01	-	03	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	30	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. To enable students to understand the design aspects and constraints of residential interiors.
2. To appraise the students about the role and complexity in interior design.

Course Outcomes

1. Understand the field of Interior Design as a profession
2. Familiarization with Colours, textures and materials used in the interior spaces
3. Awareness of drawing at scale, lettering and dimensioning
4. Understanding basics of technical drawing
5. Familiarize with Anthropometry of interior space
6. Designing of residential interior space

Detailed Syllabus

Module	Contents	Hours	Marks Weightage
1	**Introduction to Interior Design**	12	20%
	Introduction to the profession of Interior Design. Difference between design & decoration.		
	Basics of sheet formats		

	Introduction to elements and principles of design and Interior Design as a profession.		
	Basics of Sketching		
2	**Basics of colors, textures, and materials**	8	12%
	To enable the students to understand the basics of Colors in form of colour wheel and colour schemes		
	Understanding of materials and textures		
3	**Introduction to basics of lettering, and scales**	8	12%
	Basics of lettering		
	Basics of scales		
	Basics of Dimensioning		
4	**Basics of Drawing and Technical Drafting**	8	13%
	Understanding 2D drafting		
	Understanding plans and elevations of basic objects		
5	**Study of Anthropometry, human proportions and required spaces**	8	13%
	Anthropometric study of various residential spaces.		
	Discussion of various activities in a residence		
	Studying circulation in residential interior spaces		
6	**Layout of residential interior space**	16	30%
	Making final layout plan with suggested design		
	Understanding Interior Design from reference images		
	Preparing a final portfolio		
Total		**60**	**100%**

References:

1. Ernst Neufert, Neuferts Architects Data
2. Francis D.K. Ching, Architecture: Form, Space and Order
3. Joseph Chiara and John Callend, Time Saver Standards for Building Types
4. Ramsey Sleeper, Architectural Graphic Standards

5. Drew Plunkett, Drawing for Interior Design

Semester-I

Course Code	Course Name	Credits
FLF2111N	FRENCH-I	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	-	01	-	-	01

Theory							Total
Internal Assessment					External		
Test	**Viva**	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	20	10	05	**50**	**50**	75 mins	**100**

Course Objectives

The course is designed:

1. To familiarize students with the French language, with its phonetic system and its accents.
2. To make the students understand simple spoken French, including greetings, introductions, and basic conversational phrases.
3. To engage the students in basic conversations, introduce yourself, ask and answer simple questions, and use common expressions.
4. To familiarize the students to write simple sentences and paragraphs about familiar topics, such as daily activities, personal information, and immediate needs.
5. To compare cultural differences and similarities between French-speaking countries and the student's own culture.

Course Outcomes

After the completion of this course students will be able to:

1. Read French language, with its phonetic system and its accents and greet someone in French.
2. Understand simple spoken French, including greetings, introductions, and basic conversational phrases.
3. Introduce themselves, ask and answer simple questions, and use common expressions.
4. Write simple sentences and paragraphs about familiar topics, such as daily activities, personal information, and immediate needs.
5. Compare cultural differences and similarities between French-speaking countries and the student's own culture.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**Module I**		6	50%
	Leçon 1	Bienvenue !		
	Leçon 2	Le français de A à Z		
	Leçon 3	Le monde en français		
	Leçon 4	La classe et nous		
2	**Module II**		3	20%
	Leçon 1	Bonjour !		
	Leçon 2	Ça se passe où ?		
	Leçon 3	Ils sont francophones.		
	Module III		4	30%
3	Leçon 1	Portraits		
	Leçon 2	En classe		
	Leçon 3	Je parle français pour …		
	Total		**13**	**100%**

References:

1. Berthet, Hugot et al. Alter Ego - Méthode de Français, A1: Hachette,2012.
2. Bruno Girardeau et Nelly Mous. Réussir le DELF A1. Paris : Didier, 2011.
3. Loiseau Y.,Mérieux R. Connexions 1, cahier d'exercices. Didier, Paris, 2017.
4. Loiseau Y. & Mérieux R. Connexions 1, Guide pédagogique. Didier, Paris, 2017.
5. Connexions 1, livre de l'élève – Loiseau Y. & Mérieux R., éd. Didier, Paris,2017.
6. Latitudes 1, cahier d'exercices – Loiseau Y. & Mérieux R., éd. Didier, Paris,2018.
7. Latitudes 1, Guide pédagogique – Loiseau Y. & Mérieux R., éd. Didier, Paris,2018.
8. Latitudes 1, Guide pédagogique téléchargeable – Loiseau Y. & Mérieux R., éd. Didier,2018.
9. Latitudes 1, livre d'élève + CD – Loiseau Y. & Mérieux R., éd. Didier, Paris,2018.
10. Nathalie Hirschsprung, Tony Tricot, Cosmopolite 1 Méthode de Français A1. Hachette, 2017.
11. Nathalie Hirschsprung, Tony Tricot. Cosmopolite 1 Cahier d'activités A1. Hachette, 2017.

Semester-I

Course Code	Course Name	Credits
FLG2111N	GERMAN-I	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	-	01	-	-	01

Theory							Total
Internal Assessment					External		
Test	**Viva**	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	20	10	05	**50**	**50**	75 mins	**100**

Course Objectives

The course is designed:
1. To introduce oneself and others
2. To greet and have a basic conversation in German
3. To frame and understand simple sentences in present tense
4. To ask and answer basic questions pertaining to one's and other's name, residence, or similar topics from one's direct surroundings
5. To pronounce and read known names, words, and simple sentences

Course Outcomes

After the completion of this course students will be able to:
1. Introduce themselves and others.
2. Greet each other.
3. Frame and understand simple sentences in present tense.
4. Ask and answer basic questions pertaining to one's and other's name, residence, or similar topics from one's direct surroundings.
5. Correctly pronounce and read known names, words, and simple sentences.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**Kapitel 1**		05	34%
	Grammatischer Aspekt	• Verben für Vorstellung - heißen, kommen, wohnen (Vorstellung) + Personalpronomen Sie, ich, er, sie • Verben für Vorstellung+ sprechen und sein + Personalpronomen du, ihr, wir, es, sie (pl.) • W-Fragen u. Aussagen		
	Thematischer Aspekt	• grüßen und verabschieden • sich und andere vorstellen • über sich und andere sprechen • Zahlen bis 20, Telefonummer und E- Mail-Adresse nennen • Buchstabieren über Länder und Sprachen sprechen		
2	**Kapitel 2**		04	33%
	Grammatischer Aspekt	• Verbstamm mit ‚d' oder ‚t', z.B. arbeiten, unterrichten, schneiden • Unregelmäßige Verben, z.B. fahren, lesen, sein, haben • Ja-Nein Frage • Bestimmter Artikel		
	Thematischer Aspekt	• Wochentage benennen • über Arbeit, Berufe und Arbeitszeiten sprechen • Zahlen ab 20 nennen • über Jahreszeiten sprechen • ein Profil im • Internet erstellen		
3	**Kapitel 3**		04	33%
	Grammatischer Aspekt	• Unregelmäßige Verben, z.B. fahren, geben, sprechen, sehen, nehmen • Unbestimmter Artikel: Ein, eine, ein und Bestimmter Artikel		
	Thematischer Aspekt	• Texte einer Bildergeschichte zuordnen • Verkehrsmittel benennen • Artikel lernen		
	Total		**13**	**100%**

References:

1. Aufderstraße, Hartmut. *Lagune 1. Deutsch als Fremdsprache: Kursbuch und Arbeitsbuch*. Ismaning: Max Hueber Verlag 2012.
2. Braun, Anna, and Daniela Wimmer. *Schritte Plus A1/1: Arbeitsbuch*. Hueber Verlag, 2020.
3. Dengler, Stefanie. *Netzwerk A1. Teil2. Kurs- Und Arbeitsbuch: Deutsch Als Fremdsprache*. Langenscheidt, 2012.
4. Funk, Hermann, et al. *studio d A1: Deutsch als Fremdsprache*. Cornelsen Verlag, 2015.
5. Langenscheidt. *Langenscheidt Pocket Dictionary German: German-English, English-German*. Langenscheidt Publishing Group, 2022.
6. Niebisch, Daniela, et al. *Lagune A1: Kursbuch*. Hueber Verlag, 2016.

Semester-I

Course Code	Course Name	Credits
FLS2111N	SPANISH-I	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	-	01	-	-	01

Theory							Total
Internal Assessment					External		
Test	**Viva**	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	20	10	05	**50**	**50**	75 mins	**100**

Course Objectives

The course is designed:
1. To enable the student present and describe oneself and people.
2. To enable to enter in contact and begin a conversation.
3. To enable to talk about one's family, tastes, and preferences.
4. To familiarize students with the Spanish language, with its phonetic system and its accents.
5. To enable the student to read and understand texts in Spanish adapted for the level.

Course Outcomes

After the completion of this course students will be able to:
1. Present himself/herself to people.
2. Initiate conversation and formal talk with fellow native speakers.
3. Talk about his/her tastes, preferences, and choices.
4. Pronounce Spanish words and dictions in the correct form.
5. Read Spanish texts, stories, newspapers, and magazines and comprehend them.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**Quiero aprender español.**		4	30%
	1.1	Los saludos y las despedidas		

	1.2	Los alfabetos		30%
	1.3	Las reglas de pronunciaciones		
	1.4	Los números en español (0-100)		
2	**Gramática y nosotros**		4	30%
	2.1	Los artículos		
	2.2	Los sustantivos, adjetivos y los géneros		
	2.3	Las profesiones y las nacionalidades		
	2.4	Vocabulario de la familia.		
3	**Quiero aprender los verbos**		5	40%
	3.1	El sujeto en español.		
	3.2	Los verbos en español (el verbo en SER)		
	3.3	Los verbos regulares (AR, ER, IR)		
	Total		**13**	**100%**

References:

1. Garcia, Jaime. Garmendia Corpas. *AULA INTERNACIONAL PLUS*. 2020.
2. Hidalgo, Andrea Fabiana. *PREPARACION DELE*. 2020.
3. Hollis, Maria Rosario. *Essential Spanish Verbs*. Teach Yourself, 2010.
4. Moya, Felipe, and Leslie Pérez. *Spanish Short Stories For Beginners*. 2019.
5. Nissenberg, Gilda. *Practice Makes Perfect: Complete Spanish Grammar, Premium Fourth Edition*. McGraw-Hill Education, 2020.
6. Prisma, Equipo Nuevo, and Evelyn Aixalà I. Pozas. *Nuevo prisma A2*. 2014.
7. Richards, Olly. *Short Stories in Spanish for Beginners*. Teach Yourself, 2018.
8. Simpson, Brandon. *Spanish Verb Tenses*. 2008.
9. Soriano, Jaime. Garmendia Corpas.*AULA INTERNACIONAL PLUS*. 2020.
10. Verblix, and Marta Torres Sánchez.*Spanish Short Stories for Beginners*. 2018.

Semester-I

Course Code	Course Name	Credits
CSE2112N	EFFECTIVE LISTENING	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	-	01	-	-	01

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	30	05	**50**	**50**	2 Hours	**100**

Course Objectives

The course is designed:
1. To familiarize students with the fundamentals, types and barriers to communication.
2. To provide guidelines and improve the student's communication skills.
3. To enable students to learn the principles of listening.
4. To guide the students about different types of listening.
5. To make the students better listeners and make listening the most important source of knowledge.

Course Outcomes

After completion of this course students will be able to:
1. Recognize the importance of basic communication and barriers in professional arenas.
2. Participate in and develop listening skills through Group discussion and extempore.
3. Enhance proficiency in speaking and active listening.
4. Decipher as to which type of listening; they should practice according to the situation.
5. Practice and perfect their listening skills and thus will become better communicators.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**Fundamentals of Communication**		6	46%
	1.1	Communication: Definition, Meaning, Process, Cycle, Purpose of communication		

	1.2	7 Cs of communication: Clear, concise, concrete, correct, coherent, complete, and courteous.		
	1.3	Barriers to effective communication: Language/semantic barriers, Physical barriers, physiological barriers, psychological barriers, cross-cultural barriers & organizational barriers.		
	1.4	Types of Communication: Depending on Method (Verbal & Non-verbal), Business (Internal & External), Individuals Involved (Intrapersonal & Interpersonal), Rules (Formal & Informal).		
2	**Communication Skills**		5	39%
	2.1	The process of listening, importance of listening		
	2.2	Types of listening: Informative/comprehensive, attentive, appreciative, discriminative, emphatic, active, selective & critical/evaluative.		
	2.3	Effective Listening: Principles and Barriers		
3	**Enhancing Listening Skills**		2	15%
	3.1	Guidelines to improve listening & avoiding common barriers		
	3.2	Activities to enhance listening; Listening exercise for main idea- vocabulary, Phrases & idioms, (news debate/conversations, audio scripts to draw conclusion based on context).		
	Total		**13**	**100%**

References:

1. Apple, Sienna. *Active Listening Techniques: The 10 Steps to Effective Listening for Better Relationships and More Productivity*. Notion Press, 2022.
2. Beck, Joan. *The Art of Effective Listening: How to Communicate Better with Others*. HarperCollins, 2022.
3. Brown, David. *Effective Communication: Mastering the Art of Listening*. Wiley, 2021.
4. Chaturvedi, Mukesh. *Fundamentals of Business Communication*. Pearson Education India, 2012.
5. Raman, Meenakshi, and Sangeeta Sharma. *Technical Communication: Principles and Practice*. Oxford University Press, 2009.
6. Raman, Meenakshi, and Prakash Singh. *Business Communication*. Oxford University Press, 2012.
7. Rizvi, Ashraf. *Effective Technical Communication*. McGraw Hill Education, 2017.
8. "Tips for Effective Listening." *MindTools*, MindTools Ltd, 2023,
9. "The Psychology of Listening: What It Is and How to Improve It." *Psychology Today*, Sussex Publishers, 2023, www.psychologytoday.com/articles/psychology-listening.
10. www.mindtools.com/pages/article/newLDR_66.htm.

Semester-I

Course Code	Course Name	Credits
BEH2113N	BEHAVIOURAL SCIENCE-I	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	-	01	-	-	01

Theory				
Internal Assessment				
Activity	**Assignment**	**Viva**	**Attendance**	**Total**
20	40	35	05	**100**

Course Objectives

1. To introduce the student to the variety of principles influencing human behaviour.
2. To take students, step by step, through an interactive understanding of each of these principles.
3. To gain a clear understanding of your abilities and limitations. Understand what motivates you and drives your decisions.
4. To identifying development areas encourages ongoing self-improvement.
5. To make choices that align with your values and goals.
6. To understand how your style affects interactions with others.

Course Outcomes

1. Understanding oneself aids in making informed, value-aligned decisions.
2. Self-awareness leads to clearer and more empathetic communication.
3. Knowing personal strengths and weaknesses helps set realistic goals.
4. Authenticity from self-awareness fosters deeper connections with others.
5. Self-understanding enhances resilience and adaptability to change.
6. Identifying development areas encourages ongoing self-improvement.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**Core Competency & Techniques of self-awareness**		4	15%
	1.1	Understanding of Self, Components of Self – Self-identity		
	1.2	Self-concept, Self-confidence, Self-image, self-awareness, self-acceptance, and self-realization		
	1.3	Self-concept, Self-confidence, Self-image, self-awareness, self-acceptance, and self-realization		
	1.4	Mapping the key characteristics of self and framing a character for self		
2	**Self Esteem & Effectiveness**		2	15%
	2.1	Meaning and Importance of self-esteem and self-effectiveness		
	2.2	Process of Attitude formation, Factors that influence Attitude formation.		
	2.3	Components and Types of attitudes		
	2.4	Components and Types of attitudes		
3	**Building Positive Attitude**		2	15%
	3.1	Meaning and nature of attitude		
	3.2	Common myths related to mental health		
	3.3	Strategies to improve mental health: Robert Plutchik's Feeling wheel.		
4	**Building Emotional Competence**		2	18%
	4.1	Emotional Intelligence – Meaning, components, Importance and Relevance		
	4.2	Techniques of improving emotional intelligence		
	4.3	Types of emotions, Healthy and Unhealthy expression of emotions		
	4.4	Theories & Models of emotions		
	Total		**13**	**100%**

References:

1. Bradberry, T., & Greaves, J. (2009). Self-Awareness (The Enneagram of Emotional Intelligence). TalentSmart.
2. Tanner, J. L., Arnett, J. J., & Leis, J. (2009). Self-awareness and identity in emerging adulthood: Timing mechanisms and contexts. Emerging Adulthood, 37(2), 55-74.
3. McKay, M., & Fanning, P. (2016). Self-Esteem: A Proven Program of Cognitive Techniques for Assessing, Improving, and Maintaining Your Self-Esteem. New Harbinger Publications.
4. Maio, G. R., & Haddock, G. (2015). Attitudes and Attitude Change. Sage.
5. Zuboff, S. (2019). The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power. PublicAffairs.
6. Pankhurst, D. A., & White, K. A. H. (2020). The impact of social media on self-esteem: The mediating role of body image and perceived social support. Computers in Human Behavior, 112, 106441.

Semester-I

Course Code	Course Name	Credits
ENV2116N	ENVIRONMENTAL STUDIES	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						TermWork/Practical/Oral			Total
Internal Assessment				End Sem Exam	Duration of End Sem Exam	Term Work	Pract.	Oral	
Test	Continuous Assessment	Attendance	Total						
15	10	05	**30**	**70**	3 Hours	-	-	-	**100**

Course Objectives

1. To identify and address environmental issues at local, regional, and global level.
2. To impart basic knowledge about the environment and its allied problems.
3. To develop an attitude of concern for the environment.
4. To motivate learners to participate in environment protection and environment improvement.
5. To acquire skills to help the concerned individuals in solving environmental problems.
6. Strive to attain harmony with Nature.

Course Outcomes

1. The course educates students in various waste management techniques and effective pollution control strategies.
2. The course covers sustainable use of natural resources and biodiversity conservation. Students will learn how to balance resource utilization.
3. This course equipped students with the ability to apply their knowledge, skills, values to mitigate environmental challenges and foster sustainable development.
4. Students will learn about international efforts taken to safeguard the Earth’s environment and resources.
5. This course enables students to sensitize themselves to adverse health impacts of pollution and develop an understanding of the broad aspects of environmental management systems.
6. Students will learn about Environmental legal framework to protect and conserve environment

Detailed Syllabus

Module	Content	Hours	Marks Weightage
I	**Multidisciplinary nature of environmental studies**	06	10%
	Definition, scope, and importance, need for public awareness.		
	Origin of agriculture, Industrial revolution, and its impact on the environment, water conflicts.		
	Sustainable Development Goals (SDGs)- Targets, challenges, and strategies.		
	Natural Resources: Types, Use and Exploitation.		
II	**Ecosystem and Conservation of Biodiversity**	10	20%
	Ecosystem: Definition, Structure, and function		
	Ecosystem types, significance, and ecosystem services		
	Biodiversity: Definition, types, and values of Biodiversity		
	Biogeographical zones and Hot spots in India and convention on Biological Diversity (CBD)		
	Conservation of Biodiversity, Biodiversity Laws, and Regulations		
III	**Environmental Pollution and Control**	08	15%
	Definition, types, sources, effects, and control of pollution:		
	Air & Noise Pollution		
	Water Pollution		
	Soil Pollution & Solid waste		
IV	**Environment Quality Standards and Management**	06	10%
	An introduction of Environment Management System (EMS)		
	circular economy, eco Lebling, eco mark scheme.		
	Brief introduction of Environmental Impact Assessment: Concept and application		
V	**IPR & Biosafety**	10	20%

	Introduction and Concept of IPR, Advantages and		
	disadvantages of IPR		
	Introduction and concepts of biosafety, its levels in terms of environment and Human protection.		
VI	**Environmental Treaties and Legislation**	12	25%
	Introduction to Environmental laws and Regulation. National Green Tribunal: Landmark Supreme court Judgements.		
	Salient Features of following Acts:		
	The Environment Protection Act-1986, an Umbrella Act		
	The Water (P & CP) Act-1974.		
	The Air (P & CP) Act-1981, Noise pollution (regulation & control) Rules		
	E-waste, Biomedical waste and Plastic waste management and handling rules.		
	Factories Act		
Total		**52**	**100%**

References:

1. Environmental Studies-Chauhan B. S University Science Press
2. Textbook Of Environmental Studies Dava Katewa Cengage Learning Ptd Ltd
3. Perspectives In Environmental studies Kaushik, Anubha Kaushik C.P New age International Pvt Ltd
4. Environmental Sciences: A students Companion Gregory & Others Sage Publication
5. Environmental Pollution Control Engineering Rao, C.S New Age International Pvt Ltd
6. Textbook Of Environmental Studies for Undergraduate Courses Bharucha Erach Universities Press.
7. Environment Law & Policy in India- Shyam Divan

Semester - II						
	Course Code	**Course Title**	**Lecture Credits**	**Tutorial Credits**	**Practical Credits**	**Total Credits**
Discipline-I (Core)						**8**
Discipline-I	MTH2201N	Classical Algebra	3	1	-	4
	MTH2202N	Ordinary Differential Equations	3	1	-	4
Discipline-II (any one from the basket)						**4**
Discipline-II	PHY2208N PHY2209N	Physics-II Physics-II Lab	2 -	1 -	- 1	3 1
	CHY2208N CHY2209N	Chemistry-II Chemistry-II Lab	2 -	1 -	- 1	3 1
	STA2202N	Probability Theory-II	3	1	-	4
Discipline-III (any one from the basket)						**4**
Discipline-III	ABM2210N	Advances in Business Management	3	-	1	4
	HMR2210N	Human Rights-II	4	-	-	4
	CSW2210N	Technical and Literary Writing	4	-	-	4
	ECO2210N	Economics-II	3	-	1	4
	FST2210N	Fashion Technology-II	2	-	2	4
	IND2210N	Interior Design-II	1	-	3	4
Total (Discipline-I + II + III)						**16**
Foreign Language (any one from the basket)						**2**
Foreign Language	FLF2211N	French-II	2	-	-	2
	FLG2211N	German-II				
	FLS2211N	Spanish-II				
Communication Skills	CSE2212N	Presentation Skills	1	-	-	1
Sub Total						**3**
Behavioural Science	BEH2213N	Behavioural Science-II	1	-	-	1
Sub Total						**1**
VAC-II (any one from the basket)						**2**
VAC-II	DSC2217N	Data Science &	2	-	-	2

		Computation: Basic Statistics				
	ANM2217N	Animation-I				
	PHT2217N	Photography-I				
	POL2217N	Political Science-I				
	TSM2217N	Tourism Management-I				
	SCW2217N	Social Work-I				
					Sub Total	**2**
					Total	**6**
					Grand Total	**22**

Semester-II

Course Code	Course Name	Credits
MTH2201N	CLASSICAL ALGEBRA	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Understand and apply the Division Algorithm for integers.
2. Learn the concepts of greatest common divisor and its properties.
3. Master principles of mathematical induction for proving mathematical results.
4. Explore divisibility properties and relatively prime integers.
5. Study polynomial equations with real coefficients and their properties.
6. Investigate inequalities and their applications, including weighted means and Cauchy's inequality.

Course Outcomes

1. Apply the Division Algorithm to divide integers and find remainders.
2. Determine greatest common divisors and understand their uniqueness.
3. Use mathematical induction to prove statements and solve problems.
4. Apply divisibility concepts to solve equations and understand prime integers.
5. Solve polynomial equations with real coefficients using appropriate methods.
6. Utilize inequality theorems to solve problems involving weighted means and Cauchy's inequality.

Detailed Syllabus

Module		Content	Hours	Marks Weightage
1		**Introduction to Division Algorithm**	8	15%
	1.1	Well-ordering principle. First principle of mathematical induction.		
	1.2	Second principle of mathematical induction. Proofs of simple mathematical results by induction.		
	1.3	Divisibility of integers. The division algorithm $a=gb+r$, $b\neq 0$, $0\leq r<b$		
2		**Greatest Common Divisor and Prime Integers**	8	15%
	2.1	Greatest common divisor (gcd) of two integers a and b, denoted as (a, b). Existence and uniqueness of (a, b).		
	2.2	Relatively prime integers. The equation $ax+by=c$ has an integral solution if and only if gcd(a,b) divides c		
	2.3	Prime integers. Euclid's first and second theorems.		
3		**Advanced Number Theory**	9	17%
	3.1	Unique factorization theorem. Congruence and linear congruences.		
	3.2	Statement of Chinese remainder theorem and simple problems.		
	3.3	Fermat's little theorem. Multiplicative function $\varphi(n)$.		
4		**Polynomials and Roots**	9	17%
	4.1	Polynomials with real coefficients. Fundamental theorem of Classical Algebra (statement only).		
	4.2	The n-th degree polynomial equation has exactly n roots.		
	4.3	Nature of roots of an equation (surd or complex roots occur in pairs). Statements of Descartes' rule of signs, Sturm's Theorem, and their applications.		
5		**Polynomial Equations and Transformations**	11	21%
	5.1	Rolle's theorem and its applications.		

		Multiple roots and their implications.		
	5.2	Relation between roots and coefficients. Symmetric functions of roots.		
	5.3	Reciprocal equations. Cardan's method for solving a cubic equation. Ferrari's method for solving a biquadratic equation.		
6		**Inequalities**	7	15%
	6.1	Transformation of equations. Binomial equation.		
	6.2	Inequalities AM≥GM≥HM and their generalizations. Power theorem.		
	6.3	The theorem of weighted means and m-th. Cauchy's inequality and its applications.		
Total			**52**	**100%**

References:

1. Willam J. Gilbert, Scott A. Vanstone, *Classical Algebra*, Waterloo Mathematics Foundation, Third edition.
2. Roger Cooke, *Classical Algebra, Its Nature, Origins and Uses*, Wiley Inter Science, A John Wiley & Sons, INC., Publication
3. S. K. Mapa, *Higher Algebra (Classical),* Sarat Book Distributors, 2009.
4. Graham, R. L., Knuth, D. E., & Patashnik, O. (1994). *Concrete Mathematics: A Foundation for Computer Science* (2nd ed.). Addison-Wesley. **ISBN**: 978-0201558029
5. Hardy, G. H., & Wright, E. M. (2008). *An Introduction to the Theory of Numbers* (6th ed.). Oxford University Press. **ISBN**: 978-0199219865
6. Apostol, T. M. (1976). *Introduction to Analytic Number Theory*. Springer-Verlag. **ISBN**: 978-0387901633
7. Burton, D. M. (2010). *Elementary Number Theory* (7th ed.). McGraw-Hill Education. **ISBN**: 978-0073383149

Semester-II

Course Code	Course Name	Credits
MTH2202N	ORDINARY DIFFERENTIAL EQUATION	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Master solving differential equations and understand their classification.
2. Learn approximate methods for challenging equations.
3. Gain proficiency in solving first-order equations and applying them to real-world models.
4. Understand solution techniques for second and higher-order linear equations.
5. Explore simultaneous equations and their solutions in multiple variables.
6. Study advanced methods like series solutions and Sturm-Liouville theory.

Course Outcomes

1. Solve first-order equations using integrating factors and application-based models.
2. Classify and solve differential equations based on their linearity and order.
3. Solve second and higher-order linear equations with constant coefficients.
4. Use simultaneous equations to solve problems with multiple dependent variables.
5. Apply series solutions to second-order equations, including boundary value problems.
6. Analyze and solve advanced problems involving orthogonal sets of functions and eigenvalues.

Detailed Syllabus

Module		Content	Hours	Marks Weightage
1		**Introduction to Differential equations**	**7**	13%
	1.1	Solution and Classification.		
	1.2	Approximate Methods for solving differential equations.		
	1.3	order and degree of a differential equation.		
2		**Exact Differential Equations and Applications**	**6**	12%
	2.1	Exact differential equations and integrating factors of first-order differential equations.		
	2.2	Application of first-order differential equations to acceleration-velocity models.		
	2.3	Growth and decay models.		
3		**Second-Order Linear Differential Equations**	**8**	15%
	3.1	Two linearly independent solutions of second-order linear differential equations and Wronskian.		
	3.2	General solution of second-order linear differential equations.		
	3.3	Solutions with constant coefficients.		
4		**Particular Integrals and Methods of Solution**	**9**	17%
	4.1	Solutions when values of y and x are given at a point. Particular integrals for second-order linear differential equations with constant coefficients.		
	4.2	Method of variation of parameters for particular integrals. Homogeneous linear equations of n-th order with constant coefficients.		
	4.3	Reduction of order for second-order linear differential equations.		
5		**Simultaneous Linear Ordinary Differential Equations**	11	21%
	5.1	Simultaneous linear ordinary differential equations in two dependent variables.		

		Solutions of simultaneous equations of the form dx/P=dy/Q=dz/R.		
	5.2	Equations in Paffian form Pdx+Qdy+Rdz=0, Necessary and sufficient conditions for the existence of integrals.		
	5.3	Total differential equations.		
6		**Series Solutions and Boundary Value Problems**	11	22%
	6.1	Series solutions of second-order linear ODEs. Review of power series and power series solutions.		
	6.2	Singular points and convergence of series solutions. Boundary value problems of second-order linear differential equations.		
	6.3	Orthogonal and orthonormal sets of functions. Eigenvalues and eigenfunctions, the Sturm-Liouville problem, orthogonality of eigenfunctions, and complete orthonormal systems.		
Total			**52**	**100%**

References:

1. Belinda Barnes and Glenn R. Fulford, *Mathematical Modeling with Case Studies, A Differential Equation Approach Using Maple*, Taylor and Francis, London and New York
2. C. H. Edwards and D. E. Penny, *Differential Equations and Boundary Value Problems: Computing and Modeling*, Pearson Education, India, 2005.
3. S. L. Ross, *Differential Equations*, John Wiley and Sons, India, 2004.
4. M.D. Raisinghania, *Advanced Differential Equations*, S. Chand & Company Limited.
5. Boyce, W. E., & DiPrima, R. C. (2017). *Elementary Differential Equations and Boundary Value Problems* (10th ed.). Wiley. **ISBN**: 978-1119320630
6. Tenenbaum, M**.** (1985). *Ordinary Differential Equations*. Dover Publications. **ISBN**: 978-0486649405
7. Simmons, G. F. (1991). *Differential Equations with Applications and Historical Notes* (2nd ed.). McGraw-Hill. **ISBN**: 978-0070575400
8. Zill, D. G. (2012). *A First Course in Differential Equations with Modeling Applications* (10th ed.). Cengage Learning. **ISBN**: 978-1111827052

Semester-II

Course Code	Course Name	Credits
PHY2208N	PHYSICS-II	03

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	01	02	-	01	03

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. To provide fundamental properties of vectors.
2. To provide knowledge of vector applications.
3. To understand the concept of simple harmonic motion.
4. To understand the applications of concept of simple harmonic motions to specific cases.
5. To understand the physics of surface tension.
6. To understand the physics of viscosity.

Course Outcomes

1. Student will learn basics of vector algebra like Dot Product, Cross Product, Triple Products, Ordinary and partial derivatives of vector.
2. Student will be able to perform vector applications such as gradient, divergence, curl, Laplacian and vector integration in the Cartesian coordinate system and understand their physical significance, and also learn cylindrical and spherical polar coordinates.
3. Student will be able to understand physics of simple harmonic motion and its characteristics.
4. Student will be able to apply the concept of simple harmonic motion to damped and forced vibrations.
5. Student will be able to understand the basic properties of matter: surface tension, its molecular theory, surface energy, pressure inside a curved liquid surface, theory of capillary rise.
6. Student will be able to understand the basic properties of matter: viscosity, coefficient, types of flow, critical velocity and Poiseuille's formula for flow of a liquid through tube.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Review of Vector Algebra** Dot or Scalar Product, Cross Product, Triple Products. Ordinary derivatives of vector-valued functions, partial derivative of vectors.	4	10%
2	**Vectors – with Application** Gradient, Divergence, Curl, Laplacian, Formulae involving del operator. Line integral, surface integral and volume integral. Gauss divergence theorem and Stokes theorem. Cylindrical and spherical polar coordinates.	9	23%
3	**Differential Equation & Simple Harmonic Motion** Introduction, oscillations, Harmonic motions, Simple harmonic motions, Solution of differential equation of simple harmonic motion, Characteristics of simple harmonic motion, Energy in simple harmonic motion, Average values of kinetic energy and potential energy, Applications of simple harmonic motion.	9	23%
4	**Application of Simple Harmonic Motion** Damped vibrations – analytical treatment, Theory of forced vibrations.	4	10%
5	**Surface Tension** Surface Tension, Derivation of relation between surface tension and surface energy. Expression for excess of pressure inside a curved liquid surface-special case. Theory of capillary rise, angel of contact, Factors affecting surface tension.	8	21%
6	**Viscosity** Viscosity of a liquid, Viscous force, Co-efficient of viscosity of a liquid by Poiseuille's formula, expression for terminal velocity, factors affecting viscosity.	5	13%
Total		**39**	**100%**

References:

1. *Vector Analysis* by Murray Spiegel, Seymour Lipschutz), and Dennis Spellman, Schaum's Outline Series, McGraw Hill Education, 2nd edition, ISBN-13: 978-0070682580 (2017).
2. *Higher Engineering Mathematics* by H. K. Dass, S Chand & Co Ltd., New Delhi, ISBN: 9788121938907 (2014).
3. *Concepts of Physics-1* by H. C. Verma, Bharati Bhawan (Publishers & Distributors), ISBN-13: 978-8177091878 (2021).
4. *Concepts of Physics-2* by H.C. Verma, Bharati Bhavan, ISBN: 9788177091878, (2020).
5. *Engineering Physics* by M Singh, D Tripathi, H Kumar, JBC Press, ISBN: 9789386000316, 9386000318 (2018).
6. *A Textbook of Engineering Physics* by M. N. Avadhanulu and P. G. Kshirsagar, S. Chand and Company Private Ltd. New Delhi, ISBN: 9789352833993, 9352833996 (2019).
7. *Applied Physics-II* by Alpana Goel and| J. P. Agarwal, A Pragati Prakashan, 3rd Edition, ISBN: 978-93-5006-897-7 (2013).

Semester-II

Course Code	Course Name	Credits
PHY2209N	PHYSICS-II LAB	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
-	02	-	-	01	-	01

Practical						Total
Internal Assessment				External		
Lab Journal	**Performance**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. To understand the physics of moment of inertia of a fly wheel.
2. To learn the physics of moment of inertia of a metallic cylinder.
3. To understand the physics of moment of inertia of a rectangular bar.
4. To understand the physics of modulus of rigidity.
5. To understand the basics of refractive index of material and its measurements.
6. To learn the physics of Coefficient of Viscosity.

Course Outcomes

1. Perform and understand the basic concept of measurement of moment of inertia of a fly wheel.
2. Perform and understand the basic concept of measurement of moment of inertia of a metallic cylinder.
3. Perform and understand the basic concept of measurement of moment of inertia of a rectangular bar.
4. Perform and understand the basic concept of measurement of modulus of rigidity using Maxwell's needle.
5. Perform and understand the basic concept of measurement of modulus of rigidity using torsional pendulum
6. Perform and understand the basic concept of Coefficient of Viscosity of unknown liquid by Poiseuille's method.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	To determine the Moment of Inertia of a Flywheel.	26	100%
2	To determination of moment of inertia of metallic cylinder about an axis passing through its C.G. and to determine the rigidity modulus of the material of the suspension wire.		
3	To determination of moment of inertia rectangular bar about an axis passing through its C.G. and to determine the rigidity modulus of the material of the suspension wire.		
4	To determine the modulus of rigidity using Maxwell's needle.		
5	To determine the modulus of rigidity using torsional pendulum.		
6	To determine the Coefficient of Viscosity of unknown liquid by Poiseuille's method.		
Total		**26**	**100%**

References:

1. *B.Sc. Practical physics* by Harnam Singh and P. S. Hemne, S. Chand Publications, ISBN : 9789355010940 (2022).
2. *B.Sc. Practical Physics* by C. L. Arora, S. Chand & Company, ISBN-13: 978-8121909099 (2010).
3. *A complete course in practical physics* by B. B. Swain, Kalyani Publisher, ISBN -10: 8127211575 (2003).
4. *A complete course in practical physics* by B. B. Swain, Kalyani Publisher.
5. *B.Sc. Practical Physics Main* by M. N. Shrinivasan, S. Chand Publications, ISBN-13 : 978-8180547447 (2013).
6. *https://www.vlab.co.in/*

Semester-II

Course Code	Course Name	Credits
CHY2208N	CHEMISTRY-II	03

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	01	02	-	01	03

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. To learn the general basics of organic chemistry, like the idea of bond formation, and interactions between molecules and stability concepts.
2. To learn the mechanism of organic reactions and various reaction intermediates.
3. To learn about the concept of the three-dimensional structure of molecules, reason and explanation of chirality.
4. To learn the synthesis, physical and chemical properties of alkanes, alkenes, alkynes and cycloalkanes.
5. To learn intermolecular forces in organic compounds.
6. To learn different types of chirality in organic molecules.

Course Outcomes

1. Learning this course will provide students with knowledge of some fundamentals of organic chemistry reaction mechanisms.
2. Students will learn the concept of nucleophiles and electrophiles.
3. Students will learn the types of reagents used in the synthesis of organic compounds.
4. Student will learn Stereochemistry and the structure of various hydrocarbons and their derivatives.
5. Student will learn aromaticity.
6. Student will be able to identify chirality in organic compounds.

Detailed Syllabus

Module		Contents	Hours	Marks Weightage
	General Organic Chemistry		**5**	15%
1	1.1	**Localized Chemical Bonding** Covalent Bonding, Covalency of Carbon, Valence Bond Theory, Molecular Orbital Theory, Bond Lengths, Bond Strengths, Bond Angles, Hybridization.		
	1.2	**Delocalized Chemical Bonding** Resonance, Resonance Energy, Cross-conjugation, Steric Inhibition of Resonance, Hyperconjugation, Inductive and Field Effects, Dipole Moment, Electromeric Effect.		
2	**Aromaticity**		**5**	15%
	2.1	**Intermolecular Forces** Van der Waals Forces, Dipole-Dipole Interactions, Hydrogen Bonding.		
	2.2	**Aromaticity** Structure of benzene: molecular formula and Kekule structure, Stability of benzene, Resonance structure, MO picture, Aromaticity: The Huckel rule, Aromatic ions.		
3	**Mechanism of substitution reactions**		**6**	15%
	3.1	Electrophiles and nucleophiles, Reactive intermediates- carbocations, carbanions, free radicals and carbenes, Kinetic and Thermodynamic control of Reactions.		
	3.2	Substitution Reaction: Aliphatic Nucleophilic substitution, Aliphatic electrophilic substitution, Aromatic electrophilic substitution, Aromatic nucleophilic substitution.		
4	**Mechanism of addition and free radical reactions**		**5**	15%
	4.1	Addition Reaction: Addition to Carbon-Carbon multiple bonds, Addition to Carbon-hetero multiple bonds.		
	4.2	Free Radical Reaction: Free radical reaction mechanism, Reactivity, neighbouring group participation, Free radical oxidation, coupling, Hunsdiecker reaction, Reed reaction.		
5	**Stereochemistry**		**9**	20%
	5.1	**Representation of three-dimensional molecules:** Newman projection and Sawhorse formula, Fischer		

		projection and Flying wedge representation, conversion wedge formula into Fischer projection and vice-versa.		
	5.2	**Concept of isomerism:** Isomerism, Constitutional and stereoisomerism		
	5.3	**Nomenclature:** D, L Nomenclature, R, S Nomenclature, Sequence Rule, Comparison between D, Land R, S Nomenclature, Erythro and Threo Nomenclature.		
	5.4	**Molecules with one Chiral Centre**: Enantiomers, Stereogenic centres, Optical activity, Properties of enantiomers, chiral and achiral molecules with two stereogenic centres diastereoisomers, mesocompounds, resolution of enantiomers, inversion, retention and racemization.		
6	**Alkanes, alkenes and alkynes**		**9**	20%
	6.1	**Alkanes:** IUPAC nomenclature of alkanes, Isomerism in alkanes, General methods of preparation, Physical properties and chemical reactions of alkanes.		
	6.2	**Alkenes:** IUPAC nomenclature of alkenes, General methods of preparation (Wittig Reaction, Kolbe Hydrocarbon Synthesis), Physical properties and relative stabilities of alkenes, Chemical reactions of alkenes.		
	6.3	**Dienes:** Nomenclature and Classification, Methods of Preparation of Conjugated Dienes, Structure and Stability of 1, 3-butadiene, Chemical Reactions of Dienes		
	6.4	**Alkynes:** Nomenclature, Methods of preparation of alkynes, Acidity, Chemical reactions of alkynes.		
Total			**39**	**100%**

References:

1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products),
4. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994.
6. Organic Chemistry by O.P. Agarwal, Himalaya Publishing House.

Semester-II

Course Code	Course Name	Credits
CHY2209N	CHEMISTRY-II LAB	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
-	02	-	-	01	-	01

Practical						Total
Internal Assessment				External		
Lab Journal	**Performance**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. To provide practical experience in qualitative analysis of unknown organic compounds
2. To detect functional groups in an organic compound.
3. To detect additional elements.
4. To perform saturation test.
5. To study tests for phenols, alcohols, aldehydes, etc.
6. To study tests for neutral, phenol, acid, or base.

Course Outcomes

1. Students will have expertise in the qualitative chemical analysis of a given unknown organic compound.
2. Students will be able to do qualitative elemental analysis.
3. Students will be able to detect the functional groups.
4. Students will be able to find out the unsaturation in given compounds.
5. Students will be able to perform preliminary tests.
6. Students will be able to perform systematic analysis.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	Systematic analysis of extra elements in the given unknown compounds	26	100%
2	Flame Test, Tests for unsaturation.		
3	Qualitative analysis of the following types of unknown organic compounds: a. Carboxylic acids b. Phenols c. Alcohols d. Aldehydes e. Ketones f. Carbohydrates g. Primary, secondary and tertiary amines h. Nitro compounds i. Amides		
4	Systematic analysis of the given unknown organic compounds: Additional element test, Flame test, Test for unsaturation, Functional group determination		
Total		**26**	**100%**

References:

1. Vogel's Textbook of Quantitative Chemical Analysis (Latest ed.), Revised by G. H. Jeffery, J. Bassett.
2. Practical Organic Chemistry by V. K. Ahluwalia, Sunita Dhingra, and N. K. Vishnoi, Viva Books.
3. Organic Chemistry Laboratory Manual by R. K. Bansal, New Age International Publishers.
4. Practical Organic Chemistry by S. C. Kundu, Books & Allied (P) Ltd.
5. Laboratory Manual of Organic Chemistry by J. B. Yadav, Krishna Prakashan Media.
6. Practical Chemistry: For B.Sc. I, II- and III-Year Students by Dr. O.P. Pandey, Dr. D.N. Bajpai, and Dr. S. Giri. S Chand Publication.

Semester-II

Course Code	Course Name	Credits
STA2202N	PROBABILITY THEORY-II	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Learn discrete probability distributions (e.g., Bernoulli, binomial) and their mean/variance.
2. Understand moment generating functions (mgf) and probability generating functions (pgf).
3. Compute mean and variance of distributions using mgf and pgf.
4. Study continuous distributions (e.g., uniform, normal) and their properties.
5. Analyze bivariate normal distribution and its characteristics.
6. Explore inequalities in probability theory and convergence concepts.

Course Outcomes

1. Compute mean and variance of discrete distributions.
2. Apply mgf and pgf in analyzing distributions.
3. Utilize mgf to find mean and variance.
4. Calculate mean and variance of continuous distributions.
5. Analyze properties of bivariate normal distribution.
6. Apply inequalities and understand convergence, including the central limit theorem

Detailed Syllabus

Module		Contents	Hours	Marks Weightage
1		**Discrete Probability distributions**	12	30%
	1.1	Bernoulli, binomial, Poisson, geometric, negative binomial, and hypergeometric distributions and their mean and variance.		
	1.2	Moment generating function (mgf) and probability generating function (pgf).		
	1.3	Some properties of mgf. Mean and variance of above discrete distributions through mgf and pgf		
2		**Continuous Distributions**	12	30%
	2.1	Uniform (rectangle), exponential, gamma and normal, their mean and variance.		
	2.2	Moments & mgf of the above distributions and also their mean and variance through mgf.		
3		**Bivariate normal distribution**	10	15%
	3.1	Bivariate normal distribution and its pdf, marginal and conditional distributions.		
	3.2	Expectation and conditional mean, variance of the bivariate normal distribution		
4		**Inequalities**	06	15%
	4.1	Markov's inequality, Jensen's inequality, Chebyshev's inequality		
5		**Convergence**	06	05%
	5.1	Convergence in probability, convergence of binomial to Poisson and to normal distribution.		
6		**CLT**	06	05%
	6.1	Statement and application of central limit theorem (CLT).		
Total			**52**	**100%**

References:

1. Chung K.L. (1983): Elementary Probability Theory with Stochastic Process, Springer / Narosa
2. Feller W. (1968): An Introduction to Probability Theory & its Applications, John Wiley
3. Goon A.M., Gupta M.K. & Dasgupta B. (1994): An Outline of Statistical Theory(Vol-1), World Press
4. Rohatgi V.K. (1984): An Intro. to Probability Theory & Math. Statistics, John Wiley
5. Hoel P.J., Port S.C. & Stone C.J. ( ): Introduction to Probability Theory (Vol-1), Mifflin & UBS
6. Cramer H. (1954): The Elements of Probability Theory, John Wiley
7. Parzen E. (1972): Modern Probability Theory and its Applications, John Wiley
8. Uspesky J.V. (1937): Introduction to Mathematical Probability,McGraw Hill
9. Cacoullos T. (1973): Exercises in Probability. Narosa
10. Rahman N.A. (1983): Practical Exercises in Probability and Statistics, Griffen
11. Pitman J. (1993): Probability, Narosa
12. Stirzaker D. (1994): Elementary Probability, Cambridge University Press
13. Chandra T.K. & Chatterjee D. (2001): A First Course in Probability, Narosa
14. Bhat B.R. (1999): Modern Probability Theory, New Age International

Semester-II

Course Code	Course Name	Credits
ABM2210N	ADVANCES IN BUSINESS MANAGEMENT	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
20	25	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. Provide students with a deep understanding of the qualities, characteristics, and challenges faced by entrepreneurs, with a focus on venture idea generation and preliminary screening.
2. Equip students with the ability to conduct project appraisals, including preparing pre-feasibility reports, comparing product ideas, and identifying suitable financing options.
3. Teach students to analyze financial options for entrepreneurial ventures, including venture capital, and understand the key components of a successful investment proposal.
4. Educate students on the essentials of market and materials management, focusing on vendor development, selection processes, pricing strategies, and cost management.
5. Provide students with practical knowledge of the steps and procedures involved in setting up and managing small-scale enterprises, including the use of e-commerce and addressing project management challenges.
6. Introduce students to the MSMED Act, reasons for entrepreneurial failure, and the organizational forms available to small enterprises, including the role of SMERA in enterprise rating.

Course Outcomes

1. Identify and analyze the key qualities, characteristics, and challenges of entrepreneurs, including women entrepreneurs, and evaluate the process of venture idea generation and screening.
2. Develop skills to prepare pre-feasibility and project reports, compare product ideas, and identify appropriate sources of finance for entrepreneurial ventures.
3. Assess various financing options, including venture capital, and understand what investors look for in investment proposals, as well as outline effective venture capital proposals.
4. Evaluate vendor development processes, vendor selection criteria, pricing methods, and understand the direct and hidden costs associated with material management.
5. Apply the steps and procedures necessary for setting up small-scale enterprises, and address challenges in project management, including e-commerce and cluster development.

6. Gain insights into the reasons for entrepreneurial failure, understand the organizational forms under the MSMED Act, and evaluate the implications of the SMERA rating on small enterprises.

Detailed Syllabus

Module	Contents	Hours	Marks Weightage
1	**Introduction to Entrepreneurship** Qualities, Characteristics of an entrepreneur, Venture idea generation, Ideas and the entrepreneurship, Women entrepreneurs, Preliminary Screening, Drawbacks or Problems of entrepreneurship	**09**	17%
2	**Project Appraisal** Pre-feasibility Report, Project Report, Comparative Rating of Product ideas, Sources of Finance Stages of Project Feasibility Analysis-Market, Technical,	**09**	17%
3	**Financial Analysis** Financing the project, Sources of finance, Venture Capital Sources, What Investor looks in the Investment Proposal Outline for a Venture Capital Proposal, Sources of finance from different banks	**09**	17%
4	**Market and Materials Management Analysis** Vendor development, vendor selection decision factors, methods of price determination, direct and hidden cost in material management	**09**	17%
5	**Project Management** Steps and procedure for setting up small scale E-Commerce, E-Business, E-Auction, Project management problems. SEZ, Cluster Development.	**09**	17%
6	**MSMED Act 2006** Reasons of failure, Overview of setting up an enterprise with organizational forms – MSMED Act and SMERA Overview.	**07**	15%

Total	**52**	**100%**

References:

1. "Innovation and Entrepreneurship" by Peter F. Drucker,Reprint Edition (2015), Harper Business
2. Developing Entrepreneurship, Udai Pareek Sanjeev & Rao T.V, Printers, Ahmedabad
3. A Issues and Problems: Small: 1, Sharma, S.V.S., Industry Extension Training Institute, Hyderabad
4. A Practical Guide to Industrial Entrepreneurs; Srivastava, S.B., Sultan Chand & Sons
5. Entrepreneurship Development; Bhansali, Himalaya Publishing, Bombay.
6. "Entrepreneurship Development and Management" by Vasant Desai,6th Edition (2019),Himalaya Publishing House

Semester-II

Course Code	Course Name	Credits
HMR2210N	HUMAN RIGHTS-II	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
04	-	-	04	-	-	04

Theory							Total
Internal Assessment					External		
Test	**Assignment**	**Viva**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
20	15	10	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. Describe and critically analyze various spheres of human rights in India.
2. Communicate effectively on socio-legal aspects of human rights in India.
3. Assess specific areas of human rights law with reference to legal instruments and cases.
4. Analyze contemporary challenges and trends in human rights theory and practice.
5. Understand affinities and divergences in rights across international, regional, and domestic contexts.
6. Examine the sources, substance, and application of human rights in different legal frameworks.

Course Outcomes

1. Foster respect for human dignity and individual self-respect.
2. Ensure genuine gender equality and equal opportunities for all.
3. Promote understanding and appreciation of diverse communities.
4. Empower students towards active citizenship and social engagement.
5. Support the values of democracy, development, and social justice.
6. Encourage communal harmony and solidarity among diverse groups.

Detailed Syllabus

Module	Contents	Hours	Marks Weightage
1	**Indian Constitutional Perspectives- Fundamental Rights I**	8	15%
	Right to Equality: Equality before law and prohibition of discrimination.		
	Right to Freedom: Freedom of speech, assembly, and movement.		
	Right to Protection in Respect of Conviction: Safeguards against arbitrary arrest and detention.		
	Right to Constitutional Remedies: Access to judicial recourse for the enforcement of rights.		
	Right to Education: Right to free and compulsory education for children.		
	Right to Life and Personal Liberty: Protection of life and personal freedom**.**		
2	**Indian Constitutional Perspectives- Fundamental Rights II**	8	15%
	Right against Exploitation: Prohibition of human trafficking and forced labor.		
	Right to Privacy: Protection of personal privacy and confidentiality.		
	Right to Freedom of Religion: Freedom to practice, profess, and propagate religion.		
	Cultural and Educational Rights: Protection of cultural and educational rights of minorities.		
	Directive Principles of State Policy: Guidelines for state policy and governance**.**		
	Judicial Review: Power of the judiciary to review laws and protect fundamental rights.		
3	**Constitutional perspectives III- Directive Perspectives of State Policy**	8	16%
	Promotion of Social Welfare: Ensuring the welfare of individuals and communities.		
	Economic Justice: Achieving fair distribution of wealth and resources.		
	Education and Health: Ensuring access to quality education and healthcare for all.		

	Protection of Marginalized Groups: Safeguarding the rights of disadvantaged and marginalized communities.		
	Environmental Sustainability: Promoting environmental protection and sustainable development.		
	Labor Rights: Ensuring fair working conditions and the rights of workers.		
4	**General Problems of Human Rights**	10	18%
	National Human Rights Commission (NHRC)		
	National Commission for Women (NCW)		
	National Commission for Scheduled Castes (NCSC)**.**		
	National Commission for Scheduled Tribes (NCST)		
	National Commission for Protection of Child Rights (NCPCR)		
5	**National Human Rights Commission and State Human Rights Commission**	9	18%
	Establishment and Structure: NHRC and SHRC		
	Jurisdiction and Functions		
	Powers of NHRC and SHRC		
	Composition of NHRC and SHRC		
	Investigation and Redressal Mechanism		
	Role in Policy and Advocacy		
6	**Different Scheme of the Govt to Promote Equality to Human beings**	9	18%
	Pradhan Mantri Jan Arogya Yojana (PMJAY)		
	Integrated Child Development Services (ICDS)		
	National Rural Employment Guarantee Act (MGNREGA)		
	National Action Plan for Children (NAPC)		
	Swachh Bharat Mission (SBM)		

	Pradhan Mantri Awas Yojana (PMAY)te of the International Criminal Court (1998)		
Total		**52**	**100%**

References:

1. Legal Aid as Human Rights (Dharwad : Jagrut Bharut, 1985)
2. Diwan, Paras, Human Rights and the Law: Universal and Indian (New Delhi Deep and Publishers 1985)
3. Mohanti M. , Peoples Rights (New Delhi: Sage Publications 1998) Basu;
4. Pal R. M. ed. Human Rights Education (New Delhi , PUDR 1995)
5. Pandey J. and R.K. Dubey, Civil Liberty under Indian Constitution (New Delhi – Deep and Deep 1995)
6. Legal Aid as Human Rights (Dharwad : Jagrut Bharut, 1985)

Semester-II

Course Code	Course Name	Credits
CSW2210N	TECHNICAL AND LITERARY WRITING	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
04	-	-	04	-	-	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
30	15	05	**50**	**50**	2 Hours	**100**

Course Objectives

The course is designed:
1. To understand the basic tenets of Technical Writing
2. To seek the writer within
3. To learn how to critique constructively.
4. To understand the basic tenets of Literary Writing
5. To prepare a portfolio of original work

Course Outcomes

After completion of this course students will be able to:
1. Understand practical skills for writing and appreciating written work.
2. Master different writing styles and techniques
3. Enhance vocabulary to improve communication skills and be more prepared to take English based proficiency exams like IELTS, SAT
4. Empower oneself as a writer and improve creativity.
5. Produce original work of research.

Detailed Syllabus

Module	Contents	Hours	Marks Weightage
1	**Basics of Technical Writing**	8	15%
	Introduction to technical writing		

	Types of technical writing and reader mapping		
	Developing argumentation and critical thinking for writing		
2	**Structure of Technical Writing**	8	15%
	Instructions and procedures		
	Writing technical reports		
	Document design and visuals		
3	**Writing a Research Paper**	10	20%
	Writing process and strategies		
	Research and planning		
	Summarizing and organizing		
	Employing correct citation styles and avoiding plagiarism		
4	**Basics of Literary Writing**	10	20%
	Introduction to literary writing		
	Mechanics of literary writing		
	Adapting writing style and tone according to context and purpose		
5	**New Trends in Literary Writing**	8	15%
	Gender-neutral terms, avoiding ableist language, and being mindful of cultural sensitivity		
	Micro Fiction and Flash Fiction		
	AI based Writing		
	Travelogues and Memoirs		
6	**Writing for Media**	8	15%
	Journalistic Writing		
	Basics of copywriting		
	Web Content Writing		

	Blogging skills		
Total		**52**	**100%**

References:

1. Baiely, Stephen. Academic Writing: A Handbook for International Students. Routledge, 2011.
2. Blogging for beginners: Learn how to start and maintain a successful blog the simple way Terence Lawfield
3. Bloom, Wayne C. The Craft of Research. 3" ed. UCP, 2008.
4. Dev, Anjana Neira, ed. A Handbook of Academic Writing and Composition. Pinnacle, 2016.
5. Eckert, Kenneth. Writing Academic Research Papers. Moldy Rutabaga, 2021.
6. Gupta, Renu. A Course in Academic Writing. Orient BlackSwan, 2010.
7. Hal Zina Bennet. *Write from the Heart: Unleashing the power of Your Creativity.* California, New World Library,2001.
8. Online Journalism - Reporting, Writing and Editing for New Media - Richard Craig Broadcast News Handbook - Writing, Reporting, Producing in a converging Media - C.A. Juggle, Forrest Carr and Suzanne Huffman
9. Writing for the media- Sunny Thomas
   The Language of New Media - Lev Manovich
10. Writing New media -Theory and Applications for expanding the teaching of composition -Anne Wysocki.

Semester-II

Course Code	Course Name	Credits
ECO2210N	ECONOMICS-II	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory							Total
Internal Assessment					External		
Test	**Assignment**	**Viva**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
20	15	10	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. Students are able to describe the objective macroeconomics
2. Students are able understand classical and Keynesian models
3. Students are able compare the different GDP Growths, inflation levels and per capita income of different countries
4. Students are able to understand the different types of inflation
5. Students are able to understand the Philips curve

Course Outcomes

1. Knowledge of this subject is essential to understand facts, concepts of macroeconomics.
2. Students understand the basic theories behind decision making process of the Govt.
3. Students understand the short run and the long run theories of Macroeconomics
4. Students understand the importance of moderating the inflation
5. Students understand the impact of microeconomic decisions at macroeconomic level.

Detailed Syllabus

Module	Contents	Hours	Marks Weightage
1	**Introduction to Macroeconomics**	7	15%
	The roots of Macroeconomics		

	Macroeconomic concerns		
	Objectives of Macroeconomics		
	The role of government in the macro economy		
	Components of Macroeconomy		
	Methodology of Macroeconomics		
2	**Introduction to National Income Accounting**	7	15%
	Concepts of GDP and national income.		
	Approaches to calculating GDP, GDP and personal income		
	Nominal and real GDP,		
	Limitations of the GDP concept.		
3	**Schools of Macroeconomic Thoughts**	8	16%
	Classical Model		
	Neo Classical Model		
	Keynesian Models		
	Say's Law of Market		
4	**Keynesian Model**	10	18%
	Keynes theory of income and employment; Consumption function; theory of investment marginal efficiency of capital; saving and investment		
	Consumption Function		
	Theory of Investment		
	Marginal Efficiency of Capital		
	Saving and Investment		
	The Investment Multiplier and its application toLDC's		
5	**Money in the Modern Economy**	10	18%
	Theories of Demand for Money: Quantity Theory of Money and Keynes approach;		

	Keynes's approach to QTM		
	Characteristics of a monetary economy		
	The supplyof money and overall liquidity position; credit creation		
6	**Inflation**	10	18%
	Inflation: types, causes, consequences		
	Impact of Inflation on Indian Economy		
	Remedial Measures		
	Philips Curve		
Total		**52**	**100%**

References:

1. Dornbusch, Fischer and Startz, Macroeconomics, McGraw Hill, 11th edition, 2010
2. N. Gregory Mankiw. Macroeconomics, Worth Publishers, 7th edition, 2010.
3. Errol D'Souza, Macroeconomics, Pearson Education, 2009.
4. Olivier Blanchard, Macroeconomics, Pearson Education, Inc., 5th edition, 2009.
5. Richard T. Froyen, Macroeconomics, Pearson Education Asia, 2nd edition, 2005.

Semester-II

Course Code	Course Name	Credits
FST2210N	FASHION TECHNOLOGY-II	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	02	02	-	02	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	30	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. The course aims to provide students with a comprehensive understanding of trend forecasting and its significance in the fashion industry, to develop skills in trend analysis, prediction, and research methods to identify emerging fashion trends and predict future directions.
2. The course emphasizes the utilization of forecasting tools and technologies, such as data analysis software and trend forecasting platforms.

Course Outcomes

1. Understand the concept and importance of trend analysis and fashion forecasting, including its impact on product development, marketing strategies, and overall business success.
2. Develop trend analysis and prediction skills by learning to interpret cultural, social, economic, and technological influences on fashion trends.
3. Master research methods for fashion forecasting, including effective data gathering, market trend analysis, and forecasting techniques.
4. Enhance creativity and innovation in trend interpretation to translate fashion trends into innovative design concepts and adapt them to various market segments.

Detailed Syllabus

Module	Contents	Hours	Marks Weightage
1	**Fundamentals of Design Thinking.**	8	15%
	Stages of Thinking-Define, Research Ideate, Prototype, Implement, Learn.		
	Research- Identifying drivers, Information gathering, Target Groups, Samples and feedback;		
	Idea generation- Basic design directions, Themes for thinking, Inspiration and reference, Brainstorming, Value, Inclusion, Sketching, Presenting Ideas; Creative Thinking Methods - Innovation through Design Thinking - The Need for Creative and Design Thinking.		
2	**The Research Method and Design Process.**	9	20%
	Research -Nature and Definition; Research Process – Preparation, Information Gathering-Goal, Identification of Problems and Hypothesis, Exposition of facts and interpretation, Presentation of result and findings;		
	Research Methods – Literature review, Collection of preliminary field data, Define the problem, Analysis and Modification, Presentation of findings;		
	Design Process – Study historical and contemporary examples, Experimentation with materials and visual Ideas, Visual analysis and identification of design problems, Create the work series and explore in subsequent work, Board presentation.		
3	**Concept of Fashion Forecasting**	8	15%
	Awareness of fashion fairs and fashion centers, Knowledge of creative writing		
	Reading of fashion forecast magazine, Sources of information		
	Role of Exhibitions and Fashion Shows		
4	**Fashion Forecasting Process**	9	15%
	Market Research- Consumer research, Shopping, Sales records.		
	Evaluating the collections- Similar Ideas indicate fashion trends, Trends for the target market;		

	Fashion services – Collection reports, Trend books, consulting, Color services, Television/Video services, Newsletter services, Websites, Directories and References, Fashion Magazines and newspapers, and Catalogs.		
	Design Sources- Historic inspirations, Folk influences, Vintage clothing shops, Museums, Libraries and bookstores, Arts, Fabrics/Textiles, Travel, Form follows function, The street scene, The turn of the century, innovations, and technologies.		
5	**Fashion Forecasting Report and Trend Analysis**	9	20%
	Market Research - On-site visits to fashion retailers and cloth markets to study market trends and collect various cloth samples, catalogues, etc.		
	Forecasting Exploration through sources like - Magazines, Newspapers, Internet sites to become familiar with apparel, textile, colour, style, and general culture and consumer forecasting resources.		
	Preparation of storyboards - Students will prepare storyboards for specific targets.		
	Presentation of designs - Students will prepare a fashion forecast for different seasons.		
6	**Fashion Product Development.**	9	15%
	Introduction to Product development process – Target market, Merchandising, Season; Design – Concept boards, knockoffs, Fakes, Design elements – Color and Fabric selection, Design principles, Sketching Ideas – Style boards. Sample Development – Draping, Flat pattern, Prototype, Fit;		
	Tech packs – Designer worksheets, Line selection-Editing, Reassessment of merchandising plan, Line presentation; Manufacturing- Duplicates the samples.		
Total		**52**	**100%**

References:

1. Fashion: From concept to consumer, Gini Stephens Frings (1999), Prentice-Hill Inc.
2. Design Thinking, Gavin Ambrose & Paul Harris, AVA Publishing, Switzerland.
3. New Product Planning, Harry B. Watton, Prentice Hall Inc..
4. Design Research: Methods and Perspectives, edited by Brenda Laurel
5. Lateral Thinking: Creativity Step by Step, Edward De Bono.
6. How Customers Think: Essential Insights into the Mind of the Market – Gerald Zaltman

Semester-II

Course Code	Course Name	Credits
IND2210N	INTERIOR DESIGN-II	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	03	01	-	03	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	30	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. To encourage the students to develop visual thinking of the designed space.
2. To familiarize the students with the design process and the aspects and constraints to be considered while designing interior spaces.
3. To evolve concept and designs for a complete project like an office space.

Course Outcomes

1. Introduction of Interior Design of Office spaces
2. Understanding requirements of office spaces
3. Developed ability to identify colors, materials and lighting fixtures for office spaces
4. Develop understanding of ancillary services
5. Design of an office interior

Detailed Syllabus

Module	Contents	Hours	Marks Weightage
1	**Introduction to commercial interiors** Introduction to Interiors of other spaces such as hospitality spaces, shopping areas, salons, spa, gymnasiums, healthcare facilities, specialty stores, etc.	8	10%

	Understanding of common spaces in commercial building		
	Introduction to Interiors of Office spaces		
2	**Office Interiors**	12	20%
	Identifying the requirements for the office spaces		
	Study of anthropometry of office furniture		
	Understanding the circulation		
	Introduction to furniture		
3	**Materials and color scheme**	12	20%
	Identifying Materials for walls, flooring and ceiling		
	Identifying color schemes		
	Discussion on lighting fixtures		
4	**Ancillary services**	12	20%
	Pantry		
	Toilets		
5	**False ceiling, Airconditioning, sprinkles, smoke detectors**	16	30%
	Interior Design Project		
	Design drawings, plans, elevations, with furniture layout to given scale		
	Presentation in the given format		
Total		**60**	**100%**

References:

1. Joseph Chiara and John Callend, Time Saver Standards for Building Types
2. Panero, Human Dimensions and Interior Space: A Source Book of Design Reference Standards
3. Drew Plunkett, Drawing for Interior Design

Semester-II

Course Code	Course Name	Credits
FLF2211N	FRENCH-II	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	-	02	-	-	02

Theory							Total
Internal Assessment					External		
Test	**Viva**	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	20	10	05	**50**	**50**	75 mins	**100**

Course Objectives

The course is designed:

1. To develop the ability to engage in detailed conversations, expressing opinions, narrating events, and describing experiences.
2. To master complex grammatical structures, including past and future tenses, relative pronouns, and compound sentences.
3. To explore cultural practices and social norms more deeply to understand their impact on communication and behavior.
4. To enquire about products and place orders in shops or restaurants.
5. To enhance speaking fluency and confidence, reducing hesitation and errors.

Course Outcomes

After the completion of this course students will be able to:

1. Engage in meaningful conversations in the target language, demonstrating a solid understanding of its nuances.
2. Exhibit advanced grammar skills that encompass a wide range of tenses.
3. Well-informed about the culture, societal norms and civilization related to the language, enriching the conversational experience.
4. Demonstrate conversational proficiency across various real-life scenarios, including but not limited to dining in restaurants and making hotel reservations, thus enhancing everyday communication.
5. Speak fluently, conveying thoughts and ideas with confidence, accuracy, and an enjoyable ease, making interactions both effective and pleasant.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**Module I**		6	20%
	Leçon 1	Aller voir ailleurs		
	Leçon 2	Balade autoguidée		
	Leçon 3	Week-end à Aoste		
2	**Module II**		7	30%
	Leçon 1	Parle avec moi		
	Leçon 2	Nous couchsurfons		
	Leçon 3	En route !		
3	**Module III**		6	20%
	Leçon 1	En route !		
	Leçon 2	Concours de selfies		
	Leçon 3	La France et nous		
4	**Module IV**		7	30%
	Leçon 1	Vive le speak dating !		
	Leçon 2	Quartier Libre		
	Leçon 3	Vous avez mal où ?		
	Total		**26**	**100%**

References:

1. Berthet, Hugot et al. Alter Ego - Méthode de Français, A1: Hachette,2012.
2. Bruno Girardeau et Nelly Mous. Réussir le DELF A1. Paris : Didier, 2011.
3. Loiseau Y.,Mérieux R. Connexions 1, cahier d'exercices. Didier, Paris, 2017.
4. Loiseau Y. & Mérieux R. Connexions 1, Guide pédagogique. Didier, Paris, 2017.
5. Connexions 1, livre de l'élève – Loiseau Y. & Mérieux R., éd. Didier, Paris,2017.
6. Latitudes 1, cahier d'exercices – Loiseau Y. & Mérieux R., éd. Didier, Paris,2018.
7. Latitudes 1, Guide pédagogique – Loiseau Y. & Mérieux R., éd. Didier, Paris,2018.
8. Latitudes 1, Guide pédagogique téléchargeable – Loiseau Y. & Mérieux R., éd. Didier,2018.
9. Latitudes 1, livre d'élève + CD – Loiseau Y. & Mérieux R., éd. Didier, Paris,2018.
10. Nathalie Hirschsprung, Tony Tricot, Cosmopolite 1 Méthode de Français A1. Hachette, 2017.
11. Nathalie Hirschsprung, Tony Tricot. Cosmopolite 1 Cahier d'activités A1. Hachette, 2017.

Semester-II

Course Code	Course Name	Credits
FLG2211N	GERMAN-II	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	-	02	-	-	02

Theory							Total
Internal Assessment					External		
Test	**Viva**	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	20	10	05	**50**	**50**	75 mins	**100**

Course Objectives

The course is designed:
1. To understand basic language structures when applied in authentic situations.
2. To build and understand simple sentences pertaining to concrete necessities.
3. To read and enhance comprehension skills with special focus on vocabulary and syntax.
4. To have a global and fine understanding of written texts.
5. To have a basic understanding of vocabulary related to food and beverages.

Course Outcomes

After the completion of this course students will be able to:
1. Understand basic language structures when applied in authentic situations.
2. Build and understand simple sentences pertaining to concrete necessities.
3. Read and enhance comprehension skills with special focus on vocabulary and syntax.
4. Have a global and fine understanding of written texts.
5. Have a basic conversation using the vocabulary related to food and beverages.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**Kapitel 4**		05	20%
	Grammatischer Aspekt	• Unregelmäßige Verbformen, z.B. essen, mögen, möchten • Unbestimmter Artikel und Bestimmter Artikel im Akkusativ • Verben mit Akkusativkel		
2	**Kapitel 4**		05	20%
	Thematischer Aspekt	• über Essen sprechen • einen Einkauf planen • Gespräche beim Einkauf und Essen führen • mit W-Fragen Texte verstehen • Wörter ordnen und lernen		
3	**Kapitel 5**		10	35%
	Grammatischer Aspekt	• Modalverben, z.B. müssen, wollen, können • Possessivartikel im Nominativ • Zeitangaben: am, um, von...bis, W- Fragenel		
	Thematischer Aspekt	• die Uhrzeit verstehen und nennen • Zeitangaben machen • über die Familie sprechen • sich verabreden • einen Termin telefonisch vereinbaren		
4	**Kapitel 6**		06	25%
	Grammatischer Aspekt	• Datumsangaben: wann, am Ordinalzahlen • Trennbare Verben: Thema Tagesablauf • Personalpronomen im Akkusativ • Präposition für+Akku.		
	Thematischer Aspekt	• etwas gemeinsam planen • über Geburtstage sprechen • eine Einladung verstehen und schreiben • im Restaurant bestellen und bezahlen		

	Total	**26**	**100%**

References:

1. Aufderstraße, Hartmut. *Lagune 1. Deutsch als Fremdsprache: Kursbuch und Arbeitsbuch*. Ismaning: Max Hueber Verlag 2012.
2. Braun, Anna, and Daniela Wimmer. *Schritte Plus A1/1: Arbeitsbuch*. Hueber Verlag, 2020.
3. Dengler, Stefanie. *Netzwerk A1. Teil2. Kurs- Und Arbeitsbuch: Deutsch Als Fremdsprache*. Langenscheidt, 2012.
4. Funk, Hermann, et al. *studio d A1: Deutsch als Fremdsprache*. Cornelsen Verlag, 2015.
5. Langenscheidt. *Langenscheidt Pocket Dictionary German: German-English, English-German*. Langenscheidt Publishing Group, 2022.
6. Niebisch, Daniela, et al. *Lagune A1: Kursbuch*. Hueber Verlag, 2016.

Semester-II

Course Code	Course Name	Credits
FLS2211N	SPANISH-II	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	-	02	-	-	02

Theory							Total
Internal Assessment					External		
Test	**Viva**	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	20	10	05	**50**	**50**	75 mins	**100**

Course Objectives

The course is designed:

1. To enable the student to use future tense to express his/her plans.
2. To enable the student to use prepositions and directions to locate people, things and places.
3. To enhance the vocabulary of the students about house, body parts, city.
4. To enhance the listening ability of students.
5. To enable the students to express their likes, dislikes, tastes and preferences and of others.

Course Outcomes

After the completion of this course students will be able to:

1. use future tense with the correct conjugation and use of the verbs which will enable the students to express their future plans.
2. use prepositions and will be able to locate people, places and things.
3. use the vocabulary in a proficient way and incorporate it with prepositions.
4. understand and comprehend basic Spanish conversations and songs.
5. express his/her likes, dislikes, tastes and preferences and of others.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**¿Cúal preferís? Ser O estar**		**7**	**25 %**
	1.1	El verbo SER e introducción del verbo ESTAR		
	1.2	Diferencias entre SER y ESTAR		
	1.3	Los números (hasta un millon)		
2	**¿Dónde está Santiago?**		**6**	**25 %**
	2.1	Las preposiciones de lugar		
	2.2	La forma impersonal del verbo HABER		
	2.3	El vocabulario basado en casa.		
3	**Quiero expresar mis gustos**		**7**	**25 %**
	3.1	El verbo GUSTAR		
	3.2	Los verbos como GUSTAR (Encantar y doler)		
	3.3	Vocabulario de cuerpo.		
4	**Entra el mundo del futuro**		**6**	**25 %**
	4.1	El futuro inmediato (Ir + a + infinitivo)		
	4.2	Un ensayo basado en el futuro inmediato		
	Total		**26**	**100%**

References:

1. Blanco, Begoña. *Nuevo avance. Con CD Audio*. 2011.
2. Bregstein, Barbara. *Easy Spanish Step-By-Step*. McGraw Hill Professional, 2005.
3. García, Concha Moreno, et al. *Nuevo avance. Con CD Audio.*2011.
4. Hutchinson, Sam. *Los Numeros - Numbers*. Find and Speak Spanish, 2022.
5. Meredith, Susan. *Spanish for Beginners Flashcards*. 2010.
6. Moreno, Concha, et al. *Nuevo Avance Básico alumno +CD*. 2010.
7. Richmond, Dorothy. *Practice Makes Perfect Spanish Verb Tenses, Second Edition*. McGraw Hill Professional, 2010.
8. Richmond, Dorothy. *Practice Makes Perfect: Spanish Pronouns and Prepositions, Premium Fourth Edition*. McGraw-Hill Education, 2020.
9. Rivano, Emilio. *El verbo gustar y otros así. 2022.*
10. Rivas, Celestino. *Daily Spanish For Beginners*. 2019.
11. Thomas, Scott. *The Big Red Book of Spanish Vocabulary*. NTC Foreign Language, 2006.
12. Velarde, J. Gutierrez. *Los Verbos Ser y Estar En Español*. 2018.
13. Weibel, Peter. *The Big Red Book of Spanish Idioms : 4,000 Idiomatic Expressions*. McGraw Hill Professional, 2004.

Semester-II

Course Code	Course Name	Credits
CSE2212N	PRESENTATION SKILLS	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	-	01	-	-	01

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	30	05	**50**	**50**	2 Hours	**100**

Course Objectives

The course is designed:
1. To explain the utility of Presentation Skills and incorporate it with career advancement.
2. To discuss and explore important steps of business presentation.
3. To enhance the knowledge of linguistics aspect of oral presentation.
4. To teach the nuances of non-verbal communication
5. To guide the students to become better communicators in social gatherings.

Course Outcomes

After completion of this course students will be able to:
1. Identify the importance of presentation skills in career advancement.
2. Comprehend the steps for planning and preparing professional presentations.
3. Use proficiency in delivering well prepared and articulated presentations effectively.
4. Understand and demonstrate the nuances of non-verbal communication.
5. Practice the socially appropriate behavior and communication.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**Introduction Non-Verbal Communication**		5	39%
	1.1	Define Non-Verbal Communication, importance of Non-Verbal communication, characteristics of		

		Non-Verbal communication, relevance, and significance.		
	1.2	Types of Non-Verbal communication: Kinesics (Body Language), proxemics, chronemics, haptics, paralinguistics, artifacts, audio-visual & olfactics.		
2	**Business Presentation**		4	31%
	2.1	What is a business presentation? 3 Ps of Presentation Importance of business presentation Stages of presentation: Planning- (Purpose audience analysis, occasion, & select title), Preparation, Practice/rehearsal Performing/delivery.		
	2.2	Preparing effective Power Point presentation		
	2.3	Delivering of presentation Handling questions, Corrections		
3	**Social Communication Skills**		2	15%
	3.1	Appropriateness: Define social communication, appropriateness in social communication & developing social communication skills.		
	3.2	Building rapport: what is building rapport? Principles of rapport building, rapport building in online & face to face to communication, rapport building with employees, customers, higher authorities & colleagues.		
4	**Context Based Speaking**		2	15%
	4.1	In general situations: Conversation between people		
	4.2	In specific professional situations: Meetings, seminars, interviews, public speeches.		
	4.3	Simulations/Role Play		
	Total		**13**	**100%**

References:

1. Adair, John. *Effective Communication*. Pan Macmillan Ltd, 2003.
2. Ajmani, J. C. *Good English: Getting It Right*. Rupa Publications, 2012.
3. Anderson, Marilyn. *Critical Thinking, Academic Writing and Presentation Skills*. Pearson Education, 2010.
4. Carnegie, Dale. *The Quick and Easy Way to Effective Speaking*. New York: Pocket Books, 1977.
5. Collins, Patrick. *Speak with Power and Confidence*. New York: Sterling, 2009.
6. Hargie, Owen, editor. *The Handbook of Communication Skills*. Routledge, 2006.
7. Mackall, Joe, editor. *Career Skills Library: Communication Skills*. Ferguson Publishing, 2009.
8. Raman, Meenakshi, and Sangeeta Sharma. *Technical Communication: Principles and Practice.*

Oxford University Press, 2009.
9. Raman, Meenakshi, and Prakash Singh. *Business Communication.* Oxford University Press, 2012.
10. Rizvi, Ashraf. *Effective Technical Communication*. McGraw Hill Education, 2017.
11. Smith, John. *Effective Presentation Skills*. Academic Press, 2020.

Semester-II

Course Code	Course Name	Credits
BEH2213N	BEHAVIOURAL SCIENCE-II	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	-	01	-	-	01

Theory				
Internal Assessment				
Activity	**Assignment**	**Viva**	**Attendance**	**Total**
20	40	35	05	**100**

Course Objectives

1. To introduce the student to the variety of principles influencing problem solving behavior
2. To take students, step by step, through an interactive understanding of each of the principles related to problem solving behavior and creative thinking.
3. To give the student a basic understanding of these principles that he/she has a better understanding of problem-solving behavior and creative thinking.
4. To give the student a basic understanding which will act as a foundation problem solving behavior and creative thinking.
5. To develop an understanding of problem-solving behavior and creative thinking so that they can boost their problem-solving behavior and creative thinking
6. To Develop logical and practical solutions.

Course Outcomes

1. The knowledge of this subject is essential to understand problem solving behavior as a human is very important concept to understand self and other human behavior
2. Variety of principles related to problem solving behavior and creative thinking influencing human behavior,
3. To give students to understand aspects related how to solve problem in their student and personal life so that they can have a batter point of view about themselves and society.
4. Authenticity from self-awareness fosters deeper connections with others.
5. Self-understanding enhances resilience and adaptability to change.
6. Foster an open-minded and flexible mindset.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**Thinking as a tool for Problem Solving**		4	15%
	1.1	What is thinking: The Mind/Brain/behavior		
	1.2	Critical Thinking and Learning		
	1.3	Making Predictions and Reasoning		
	1.4	Memory and Critical Thinking, Emotions and Critical Thinking and thinking skills.		
2	**Hindrances to Problem Solving Process**		2	15%
	2.1	Recognizing and defining a problem, Analyzing the problem (potential causes)		
	2.2	Developing possible alternatives		
	2.3	Evaluating solution and resolution of problem and implementation		
	2.4	Barriers of problem solving perception, expression, Perception, emotion, intellect & work environment, Perception Expression, Emotion Intellect and Work environment		
3	**Plan of Action**		2	16%
	3.1	Construction of POA		
	3.2	Monitoring		
	3.3	Reviewing and analyzing the outcome		
	3.4	Implications of Plan of action in students' life		
4	**Critical Thinking**		2	18%
	4.1	Definition, Nature and meaning of creativity.		
	4.2	Convergent and Divergent thinking		
	4.3	Idea generation and evaluation (Brainstorming) Image generation and evaluation Debating		
	4.4	The six-phase model of Creative Thinking: ICEDIP model		

5	**Problem Solving Process**		2	
	5.1	Recognizing and defining a problem		
	5.2	Analyzing the problem (potential causes)		
	5.3	Developing possible alternatives		
	5.4	Evaluating Solutions and Resolution of problem		
	Total		**13**	**100%**

References:

1. De Bono, E. (2015). Serious Creativity: Using the Power of Lateral Thinking to Create New Ideas. HarperCollins.
2. Kahneman, D. (2011). Thinking, Fast and Slow. Farrar, Straus, and Giroux.
3. Mayer, R. E. (2013). Thinking, Problem Solving, Cognition. Cambridge University Press.
4. Runco, M. A., & Acar, S. (2012). Divergent thinking as an indicator of creative potential. Creativity Research Journal, 24(1), 66-75.
5. Schunk, D. H. (2012). Learning Theories: An Educational Perspective. Pearson.
6. Jonassen, D. H. (2000). Toward a design theory of problem solving. Educational Technology Research and Development, 48(4), 63-85.

Semester-II

Course Code	Course Name	Credits
DSC2217N	DATA SCIENCE AND COMPUTATION: BASIC STATISTICS	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	-	02	-	-	02

Theory						Total
Internal Assessment				External		
Assignment	**Coding Report**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
20	25	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. Introduce fundamental concepts of data, data collection methods, and data types.
2. Teach scales of measurement and diagrammatic representation of data.
3. Provide understanding of measures of central tendency and dispersion with coding.
4. Introduce basics of probability, Bayes' Theorem, and expectation, integrated with coding.
5. Familiarize students with discrete and continuous distributions, and their properties, through coding.

Course Outcomes

1. Students will effectively collect, classify, represent data.
2. Students will understand and apply probability concepts, including Bayes' Theorem.
3. Students will explain and apply properties of discrete distributions.
4. Students will apply Normal distribution properties and code related analyses.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Basic Statisitcs**	7	25%

	Data and its types, Methods of collecting data, primary data and secondary data, Scale of measurement, Diagrammatic representation of data. Measures of CentralTendency, Measures of Dispersion. (Coding of above concepts).		
2	**Basic Probability** Fundamentals of Probability, Bayes' Theorem, and concepts of expectation.(Coding of above concepts).	6	25%
3	**Discrete Distributions** Binomial and Poisson their properties. (Coding of above concepts).	7	25%
4	**Continuous Distribution** Normal Distribution and their properties. (Coding of above concepts).	6	25%
Total		**26**	**100%**

References:

1. **Fundamentals of Mathematical Statistics**
   S.C. Gupta, V.K. Kapoor, 12th Revised Edition (2020), S. Chand & Co., ISBN-13: 978-9351611738
2. **Introductory Statistics**
   Neil A. Weiss, 10th Edition (2017), Pearson, ISBN-13: 9780321989178
3. **Statistical Analysis for Decision Making**
   T.L. Kaushal, 8th Edition (2018), Kalyani Publishers, ISBN-13: 9789327290691
4. **Statistical Analysis**
   T.L. Kaushal, Kalyani Publishers, ISBN-13: 9789327234190
5. **Think Stats: Exploratory Data Analysis in Python**
   Allen B. Downey, 2nd Edition (2014), O'Reilly Media, ISBN-13: 978-1491907337
6. **Statistics for Data Science with Python**
   Peter Bruce, Andrew Bruce, 1st Edition (2017), O'Reilly Media, ISBN-13: 978-1491952962
7. **Python for Data Analysis**
   Wes McKinney, 2nd Edition (2017), O'Reilly Media, ISBN-13: 978-14919576604
8. **Hands-On Data Science with Anaconda: Utilize the right mix of tools to create high-performance data science applications**
   Dr. Yuxing Yan, 1st Edition (2018), Packt Publishing, ISBN-13: 978-1788831192

Semester-II

Course Code	Course Name	Credits
ANM2217N	ANIMATION-I	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	02	-	01	01	-	02

Theory						Total
Internal Assessment				External		
Test	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
35	10	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. To introduce students to the foundational concepts and principles of animation, including its historical evolution, core principles, and various animation techniques.
2. To equip students with practical skills in 3D modeling using industry-standard software, enabling them to create and manipulate digital models effectively.
3. To provide students with a comprehensive understanding of rotoscoping techniques in visual effects (VFX), emphasizing the role of rotoscope artists and the importance of accurate roto work in compositing.
4. To enable students to explore advanced UV unwrapping and texturing techniques, including complex geometry, texture channels, and procedural texturing, enhancing their proficiency in 3D modelling and animation production.

Course Outcomes

1. Upon completion of the course, students will demonstrate a thorough understanding of the historical and theoretical foundations of animation, as evidenced by their ability to analyze and discuss the evolution of animation techniques and their applications.
2. Students will acquire practical skills in 3D modeling, evidenced by their ability to create and manipulate 3D models using industry-standard software, effectively translating conceptual ideas into digital representations.
3. By the end of the course, students will be proficient in rotoscoping techniques, capable of producing accurate roto work for integration into visual effects sequences, demonstrating an understanding of the collaborative nature of rotoscope work within the VFX pipeline.
4. Upon successful completion of the program, students will demonstrate advanced proficiency in UV unwrapping and texturing techniques, as evidenced by their ability to unwrap complex

geometry, optimize texture distribution, and apply procedural textures to enhance the visual quality of 3D models.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Foundations of Animation**	6	20%
	Overview of Early Animation Techniques Introduction to pre-cinematic animation forms such as zoetrope's and flipbooks.		
	Milestones in Animation History Examination of key developments in animation, including the invention of the multiplane camera and the release of iconic animated films.		
	Impact of Animation on Contemporary Media Analysis of animation's influence on modern media, exploring its role in advertising, education, and visual storytelling		
	Cultural Impact of Animation Discussion on how animation has shaped cultural narratives and influenced global perspectives.		
2	**Principles of Animation**	6	20%
	Understanding Squash and Stretch Explanation of how squash and stretch principles create fluid and lifelike motion in animated characters and objects.		
	Mastering Timing and Spacing Exploration of timing and spacing principles to convey weight, emotion, and realism in animation sequences.		
	Exploring Anticipation and Follow-through Examination of anticipation and follow-through principles to enhance the believability and impact of animated actions.		
	Secondary Animation Principles Analysis of secondary animation principles such as overlapping action and exaggeration in creating dynamic and expressive characters.		
3	**Types of Animation Techniques**		
	Hand-Drawn Animation: Techniques and Examples		

	Overview of traditional hand-drawn animation methods and analysis of classic hand-drawn animated films.	6	30%
	Computer-Generated Animation: Processes and Applications Introduction to computer-generated animation techniques, including 3D modeling, rigging, and rendering, and exploration of its applications in film, gaming, and virtual reality.		
	Stop-Motion Animation: Methods and Innovations Investigation of stop-motion animation techniques, including claymation and puppet animation, and examination of innovative stop-motion films and commercials.		
	Experimental Animation Forms Exploration of experimental animation techniques and avant-garde animation movements in the context of artistic expression and creative exploration.		
4	**Fundamentals of Animation**	8	30%
	Character Development: Character Design: Techniques for designing characters with unique features and personalities.		
	Storyboarding and Planning: Storyboarding Techniques: Fundamentals of creating storyboards to plan and visualize animation sequences.		
	Introduction to Animation Software: Software Training: Basics of using popular animation software such as Adobe Animate or Blender. Tool Utilization: Learning key tools and features necessary for creating and editing animations.		
	Project Creation and Review: Animation Projects: Development of short animation projects that incorporate learned techniques and principles. Feedback and Refinement: Presentation of projects for peer and instructor feedback, with focus on refining and improving the final output.		
Total		**26**	**100%**

References:

1. Williams, R. (2012). The animator's survival kit. Faber & Faber.
2. Hooks, E. (2017). Acting for animators: 4th edition. Routledge.
3. Vaughan, W. (2012). Digital modeling. New Riders.
4. Kerlow, I. V. (2017). The art of 3D computer animation and effects (4th ed.). Wiley.
5. Goldberg, E. (2008). Character animation crash course! Silman-James Press.

6. Osipa, J. (2013). Stop staring: Facial modeling and animation done right (3rd ed.). Wiley.

Semester-II

Course Code	Course Name	Credits
PHT2217N	PHOTOGRAPHY-I	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	02	-	01	01	-	02

Theory						Total
Internal Assessment				External		
Test	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
35	10	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. Develop proficiency in composition techniques, enabling students to capture compelling photographs across diverse subjects such as people and nature.
2. Master the principles of lighting and colour in photography to effectively manipulate mood, atmosphere, and visual impact within images.
3. Acquire skills in displaying and presenting photographs, encompassing various formats and platforms to communicate messages effectively.
4. Gain a deep understanding of the mechanics of imaging, including technical aspects such as exposure, focus, and image processing, to achieve desired photographic outcomes.

Course Outcomes

1. Develop a comprehensive understanding of digital photography techniques.
2. Acquire foundational knowledge of the principles governing light and its application in photography.
3. Demonstrate proficiency in operating cameras, including an understanding of their components and functionality.
4. Explore the intricacies of camera lenses, encompassing their types, functions, and optimal usage in various photographic contexts.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Understanding Digital Photography**	6	20%
	Inside the Digital Camera: Exploring the internal mechanisms and components of digital cameras.		
	Principles of Photography: Introduction to the fundamental principles governing the art and science of photography.		
	General Principles of Photography: Understanding key concepts such as exposure, focus, and composition.		
	Types of Cameras: Overview of different camera types and their respective functionalities.		
2	**Camera Varieties and Comparative Analysis**	6	20%
	Camera Types: Exploring a range of cameras including medium format, large format, and digital cameras.		
	Comparative Study: Analyzing the differences between digital and analogue (SLR) cameras, along with their advantages and applications.		
	Lens Types: Overview of normal, wide, telephoto, zoom, PC (Perspective Control), and TS (Tilt-Shift) lenses.		
	SLR & DSLR		
3	**Camera Controls and Composition Techniques**	6	30%
	Camera Controls: Exploring shutter speed, aperture, exposure control, depth of field, and selective focus.		
	Exposure Metering and Filters: Understanding exposure meters, metering systems, and various filters such as UV, polarizing, and special effect filters. Introduction to tripods.		
	Composition Techniques: Learning creative composition techniques including the rule of thirds and the Golden section. Managing digital assets and image printouts.		
	Camera Accessories and Maintenance: Overview of camera mounts, accessories, and maintenance practices. Understanding the differences between multicamera and single camera setups.		
4	**Assignment: Outdoor Photography**	8	30%

	Lens Selection		
	Use of Aperture		
	Use of shutter speed		
	Use of white balance		
Total		**26**	**100%**

References:

1. Langford, M. (2015). Langford's Basic Photography: The Guide for Serious Photographers (10th ed.). Focal Press.
2. Freeman, M. (2017). The Photographer's Eye: Composition and Design for Better Digital Photos (The Photographer's Guide) (2nd ed.). Focal Press.
3. London, B. (2016). Photography (12th ed.). Pearson.
4. Hunter, F., Biver, S., & Fuqua, P. (2012). Light: Science and Magic: An Introduction to Photographic Lighting (5th ed.). Routledge.
5. Peterson, B. (2016). Understanding exposure: How to shoot great photographs with any camera (5th ed.). Amphoto Books.
6. Kelby, S. (2017). The digital photography book: Part 1 (6th ed.). Peachpit Press.

Semester-II

Course Code	Course Name	Credits
POL2217N	POLITICAL SCIENCE-I	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	01	01	-	01	02

Theory						Total
Internal Assessment				External		
Mid Sem	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	30	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. To develop a comprehensive understanding of the Indian Constitution's foundational principles, structure, and key provisions, including its historical context and evolution.
2. To explore different perspectives and evaluate the implications of various interpretations of Indian Constitution.
3. To examine the intersections between constitutional law, political philosophy, and social dynamics to gain a deeper appreciation of the constitution's role in shaping society.

Course Outcomes

1. Upon completion of this course, students will possess a comprehensive understanding of the Indian Constitution, including its historical background, structure, key provisions, fundamental rights, duties, directive principles of state policy, Schedules, and the process of amending the Constitution.
2. After completing this course, students will be able to actively engage in constitutional debates, drawing on their comprehensive understanding of the Indian Constitution. They will demonstrate the ability to analyse and articulate the core principles and concepts embedded in the Constitution.
3. Through participation in discussions and case studies, students will foster an understanding of the importance of secularism in the Indian context. They will be able to apply their knowledge to real-world scenarios, demonstrating how constitutional principles shape and influence issues related to secularism in India.
4. By the end of this course, students will contribute to the promotion of an inclusive and equitable democracy through their knowledge and analysis of the Indian Constitution. They will critically evaluate the impact of constitutional provisions on democratic principles and formulate informed perspectives on how to enhance inclusivity and equity within the democratic framework.

5. After completing the course, students will critically assess historical events' impact on the Indian Constitution's evolution. They will analyse framers' decisions, evaluate constitutional provisions' relevance, and construct well-reasoned judgments on the strengths and weaknesses of the constitutional framework.
6. Upon course completion, students will creatively apply their understanding of the Indian Constitution. They will propose innovative solutions to constitutional dilemmas and recommend policy changes, showcasing their ability to contribute constructively to constitutional discourse and development.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Introduction to Indian Constitution**	7	25%
	Definition of Constitution & Need for Constitution		
	Historical background of the Indian constitution		
	Constitutionalism and Indian Constitution		
2	**Division of Constitution**	7	30%
	Concepts of Fundamental Rights, Fundamental Rights in India, Safeguards of Fundamental Rights		
	Fundamental Duties in India: Objectives and Purpose, Relation between Fundamental Rights and Directive Principles of State Policy		
3	**Secularism & Indian Constitution**	5	15%
	Secularism and Religious Pluralism in India, Constitutional Rights and Religious Minorities		
4	**Structure of Government - Legislature, Executive, Judiciary**	7	30%
	The Legislature: Power and Functions of Parliament		
	The Executive: Election, Power, Functions, and the changing role of President and Prime Minister.		
	The Judiciary: Appointment of Judges in High Courts and the Supreme Court, Power and Functions of High Courts and the Supreme Court.		
Total		**26**	**100%**

References:

1. M. P. Jain, Indian Constitutional Law, 8th ed., LexisNexis, New Delhi (2018).
2. D.D. Basu, Shorter Constitution of India, 6th ed., Prentice – Hall of India, New Delhi (1981).
3. V.N. Shukla, Constitution of India, 11th ed., Eastern Book Company, Lucknow (2018).
4. H.M. Sreevai, Constitutional Law of India: a critical commentary, 4th ed., N.M. Tripathi, Bombay (1991).

Semester-II

Course Code	Course Name	Credits
TSM2217N	TOURISM MANAGEMENT-I	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	01	01	-	01	02

Theory						Total
Internal Assessment				External		
Mid Sem	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	30	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. To gain knowledge about the characteristics of tourist attractions across the globe.
2. To study the Earth's physical features, climate, natural resources, human populations, and their interactions according to tourism Industry.
3. To understand major destinations & accessibility of the world.
4. To gain knowledge on case studies & broad information about the continents.

Course Outcomes

1. Students will recall and describe the importance of geography in tourism, providing an overview of continents and oceans, and understanding the concepts of latitudes, longitudes, climatic zones, and vegetation.
2. Students will demonstrate an understanding of the general geographical features of Asia, Oceania, Europe, Africa, North America, and South America. They will comprehend the physiographic units, climate, vegetation, main countries, capitals, and key tourist attractions of each region.
3. Given specific countries from Asia, Oceania, Europe, Africa, North America, and South America, students will apply their knowledge to complete assignments. They will identify and analyze the geographical features, capitals, and tourist attractions of assigned countries.
4. Students will analyze the relationships between physiography, climate, and vegetation in each region. They will critically evaluate how these geographical features influence tourism and identify patterns or trends that emerge across continents.
5. Students will evaluate the tourism potential of specific countries in each region, considering factors such as geographical features, climate, and key attractions. They will critically assess the impact of these factors on tourism development and make informed judgments about the attractiveness of destinations.

6. Students will synthesize information to create comprehensive summaries of the general geographical features, climate, vegetation, and tourist attractions of Asia, Oceania, Europe, Africa, North America, and South America. They will integrate knowledge from different modules to develop a holistic understanding of world geography in the context of tourism.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Introduction to Tourism Geography**	7	25%
	Brief Introduction of Geography and Tourism Geography		
	Continents & Oceans		
	Elements of Weather & Climate. Climatic Zones of the World.		
	Natural Vegetation of the World.		
2	**Asia and Europe**	7	30%
	General Geographical Features: Physiographic Units, Climate, Vegetation Main Countries, Capitals &their Tourist Attractions.		
3	**America and Other Countries**	7	30%
	General Geographical Features; Physiography, Climate, Vegetation. Main Countries, Capitals &Their Tourist Attractions.		
4	**Case Study**	5	15%
	Case Studies/Assignments/Presentations on the tourist attractions of one continent/country/climatic region		
Total		**26**	**100%**

References:

1. Tourism Geography: Critical Understandings of Place, Space and Experience by Stephen Williams and Alan A. Lew (2017)
2. World Regional Geography: Global Patterns, Local Lives by Lydia Mihelic Pulsipher and Alex Pulsipher (2019)
3. Geography of Travel and Tourism by Lloyd Hudman and Richard Jackson (2018)
4. Contemporary World Regional Geography by Michael Bradshaw, Joseph Dymond, and George F. Carney (2016)
5. Global Tourism: Cultural Heritage and Economic Encounters edited by Sarah M. Lyon and Christian Wells (2017)

Semester-II

Course Code	Course Name	Credits
SCW2217N	SOCAL WORK-I	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	01	-	01	01	-	02

Theory						Total
Internal Assessment				External		
Mid Sem	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	30	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. To study the basic concepts of social entrepreneurship.
2. To understand various social entrepreneurship processes.
3. To understand role and responsibilities in the management of social entrepreneurship.

Course Outcomes

1. Students will understand conceptual and theoretical aspects of social entrepreneurship in India.
2. Student will be aware about the challenges of social entrepreneurship.
3. Students will be able to understand the process to start a social entrepreneurship project.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Social entrepreneurship**	7	25%
	Introduction and basics of Social Entrepreneurship		
	Approaches to social development		
	Strategic venture design, resource management and social sector marketing.		
2	Funding and legal framework for social ventures	7	30%

	Introduction and basics of Social Entrepreneurship		
3	**Social entrepreneurship in India**	7	30%
	Social impact assessment		
	Sustainable development		
4	Case-studies	5	15%
Total		**26**	**100%**

References:

1. Bornstein, D., & Davis, S. (2010). Social entrepreneurship: What Everyone Needs to Know? New York: Oxford University Press.
2. Bornstein, D. (2007). How to change the world: Social entrepreneurs and the power of new ideas. New York: Oxford University Press.
3. Kickull, Jill and Lyons, S. Thomas. (2012). Understanding Social Entrepreneurship. Routledge: New York
4. Kramer, M. R. (2005). Measuring innovation: Evaluation in the field of social entrepreneurship.

Semester - III						
	Course Code	**Course Title**	**Lecture Credits**	**Tutorial Credits**	**Practical Credits**	**Total Credits**
Discipline-I (Core)						**8**
Discipline-I	MTH2301N	Abstract Algebra	3	1	-	4
	MTH2302N	Partial Differential Equations	3	1	-	4
Discipline-II (any one from the basket)						**4**
Discipline-II	PHY2308N PHY2309N	Physics-III Physics-III Lab	2 -	1 -	- 1	3 1
	CHY2308N CHY2309N	Chemistry-III Chemistry-III Lab	2 -	1 -	- 1	3 1
	STA2302N STA2303N	Statistical Inference Statistical Inference Lab	2 -	1 -	- 1	3 1
Total (Discipline-I + II)						**12**
Foreign Language (any one from the basket)						**2**
Foreign Language	FLF2311N	French-III	2	-	-	2
	FLG2311N	German-III				
	FLS2311N	Spanish-III				
Communication Skills	CSE2312N	Reading and Comprehension	1	-	-	1
Sub Total						**3**
Behavioural Science	BEH2313N	Behavioural Science-III	1	-	-	1
Vocational Courses/ Entrepreneurship*/ Industry Led Courses	VOC2315N	Introduction to Programming with Python-I	2	-	1	3
Sub Total						**4**
VAC-II (any one from the basket)						**2**
VAC-II	DSC2317N	Data Science & Computation: Statistical Inference	2	-	-	2
	ANM2317N	Animation-II				
	PHT2317N	Photography-II				
	POL2317N	Political Science-II				
	TSM2317N	Tourism Management-II				

	SCW2317N	Social Work-II				
					Sub Total	**2**
VAC-III	PHE2318N	Physical Education & Sports**	-	-	-	0
					Total	**9**
Community Engagement Services	CES2319N	Community Outreach	-	-	-	3
					Grand Total	**24**

** continued till SEM-VI

Semester-III

Course Code	Course Name	Credits
MTH2301N	ABSTRACT ALGEBRA	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Introduce the fundamental concepts of sets, relations, and mappings.
2. Explore the properties and operations on mappings, including surjective, injective, and bijective mappings.
3. Understand the structure and properties of groups and subgroups.
4. Analyze permutation groups, including cycles, transpositions, and alternating groups.
5. Examine specific groups like Klein-Four groups, and understand cosets, Lagrange's theorem, and normal subgroups.
6. Study group homomorphisms, isomorphisms, automorphisms, and related theorems.

Course Outcomes

2. Define and illustrate sets, relations, and mappings, and classify mappings based on their properties.
3. Perform composition, extension, and restriction of mappings, and understand equivalence relations and partitions.
4. Identify and analyze different types of groups, subgroups, and their elementary properties.
5. Understand and work with permutation groups, including cycles, transpositions, and alternating groups.
6. Apply Lagrange's theorem, and understand the concepts of normal subgroups and quotient groups.
7. Demonstrate knowledge of group homomorphisms, isomorphisms, automorphisms, and apply Cayley's theorem and the class equation in problem-solving.

Detailed Syllabus

Module		Content	Hours	Marks Weightage
1	**Sets, relations and functions**		8	15%
	1.1	Definitions and examples of sets, Relations between sets, Mappings: Surjective (onto), Injective (one-to-one), and Bijective (one-to-one correspondence)		
	1.2	Composition of functions, Extension and restriction of mappings, Equivalence Relations and Partitions		
2	**Basics of Group Theory**		10	20%
	2.1	Definition of a group and examples		
	2.2	Elementary properties of groups		
	2.3	Subgroups, order of a group, and order of an element		
	2.4	Abelian groups		
3	**Advanced Group Structures**		10	20%
	3.1	Subgroups and examples		
	3.2	Permutation groups		
	3.3	Cycles and cycle length		
	3.4	Transpositions, even and odd permutations		
	3.5	Alternating group and important examples		
4	**Group Theory Applications**		8	15%
	4.1	Klein-Four group		
	4.2	Cosets and Lagrange's theorem		
	4.3	Normal subgroups and Quotient groups		
5	**Homomorphisms and Isomorphisms**		8	15%
	5.1	Definition and examples of homomorphisms, Properties of homomorphisms		
	5.2	Definition of isomorphisms, Fundamental theorem of homomorphisms, Automorphisms and inner automorphisms		
	5.3	Cayley's theorem, Conjugacy classes and the class equation		
6	**Sylow Theorems**		8	15%
	6.1	Statements of Sylow theorems, Proofs of Sylow theorems		

	6.2	Applications and consequences of Sylow theorems in group theory		
Total			**52**	**100%**

References:

1. D. S. Malik, J. N. Mordeson, M. K. Sen, Fundamentals of Abstract Algebra, WCB/McGraw Hill Edition, 1997.
2. T. W. Hungerford, Abstract Algebra (3rd Ed.), Cengage Publishing House, 2014.
3. Joseph A. Gallian, Contemporary Abstract Algebra (4th Ed.), Narosa Publishing House, 1999.
4. David S. Dummit and Richard M. Foote, Abstract Algebra (2nd Edition), John Wiley and Sons (Asia) Pvt. Ltd, Singapore, 2003.

Semester-III

Course Code	Course Name	Credits
MTH2302N	PARTIAL DIFFERENTIAL EQUATION	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Understand the foundational concepts of first-order partial differential equations (PDEs) and their classifications.
2. Learn and apply methods for solving first-order PDEs, including the method of characteristics and separation of variables.
3. Explore advanced techniques such as Charpit's and Jacobi's methods for nonlinear first-order PDEs.
4. Analyze linear PDEs with constant coefficients and solve both homogeneous and non-homogeneous equations.
5. Study second-order PDEs, including the Cauchy problem, wave equations, and boundary value problems.
6. Apply the method of separation of variables to second-order PDEs and understand the existence and uniqueness of solutions for physical problems.

Course Outcomes

1. Classify and interpret various types of first-order PDEs and their geometrical implications.
2. Solve first-order PDEs using the method of characteristics, separation of variables, and canonical forms.
3. Employ Charpit's and Jacobi's methods to find solutions for nonlinear first-order PDEs.
4. Formulate and solve linear PDEs with constant coefficients, addressing both homogeneous and non-homogeneous cases.
5. Address second-order PDEs by tackling initial and boundary value problems in wave equations and related scenarios.
6. Apply separation of variables to solve second-order PDEs and evaluate solutions for problems in heat conduction and vibrating strings.

Detailed Syllabus

Module		Content	Hours	Marks Weightage
1	**Introduction to First Order PDEs**		10	20%
	1.1	Basic concepts and definitions, Classification of first-order PDEs, Construction and geometrical interpretation		
	1.2	Method of characteristics, General solution of first-order PDEs, Canonical form of first-order PDEs		
	1.3	Method of separation of variables for first-order PDEs, Charpit's Method, Jacobian Method, Jacobi method for non-linear first-order PDEs		
2	**Linear PDEs with Constant Coefficients**		8	15%
	2.1	Solutions of homogeneous linear PDEs with constant coefficients		
	2.2	Solutions of non-homogeneous PDEs with constant coefficients, Introduction to irreducible PDEs		
	2.3	Classification and solution methods		
3	**Second Order PDEs – Basic Theory and Problems**		8	15%
	3.1	Definition and formulation, Homogeneous wave equation and initial boundary value problems		
	3.2	Non-homogeneous boundary conditions, Finite strings with fixed ends		
	3.3	Riemann and Goursat Problems**:** Formulation and solutions		
4	**Wave Equations and Methods**		8	15%
	4.1	Spherical wave equation, Cylindrical wave equation		
	4.2	Monge’s Method and Application to second-order PDEs with variable coefficients		
5	**Separation of Variables – Second Order PDEs**		8	15%
	5.1	Vibrating String Problem: Method of separation of variables, Existence and uniqueness of solution		

	5.2	Heat Conduction Problem: Formulation and solution using separation of variables, Existence and uniqueness of solution		
6	**Laplace's and Beam Equations**		10	20%
	6.1	Laplace Equation: General solutions, Nonhomogeneous problems		
	6.2	Beam Equation: Formulation and solution techniques, Nonhomogeneous problems		
Total			**52**	**100%**

References:

1. Rao, K.S., Introduction to Partial Differential Equations, Third Edition, PHI Learning Private Limited, 2011.
2. Gockenbach, M. S., Partial Differential Equations: Analytical and Numerical Methods, 2002.
3. Courant, R. and D. Hilbert, Methods of Mathematical Physics, Volume I, 1991.
4. Strang, G., Introduction to Applied Mathematics, 1986.
5. S. J. Farlow, Partial Differential Equations for Scientists and Engineers.

Semester-III

Course Code	Course Name	Credits
PHY2308N	PHYSICS-III	03

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	01	02	-	01	03

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Introducing the concept of entropy and laws of thermodynamics.
2. Understand concepts of Carnot cycle and heat engines.
3. Understand basics of Probability theory and fluctuations
4. Learn different Statistical Ensembles.
5. To understand failures of Classical Mechanics.
6. Introduction to Quantum Mechanics.

Course Outcomes

1. To understand the laws of thermodynamics, concept of entropy.
2. To study heat engines, Carnot cycle and related fundamental concepts in the course.
3. To understand basic concept of probability.
4. To find connection between statistics and thermodynamics and to learn ensemble theories used to explain the behavior of the systems.
5. To study failure of classical mechanics as a emergence of quantum mechanics.
6. To understand the concepts of wave packet, its formalism and concept of wave function. To know the wave equation used in quantum mechanics and its applications to simple quantum systems.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Introduction to Thermodynamics** Introduction to thermodynamics and its variables (pressure, volume, temperature).	3	5%
2	**Laws of Thermodynamics and Heat Engine:** The laws of thermodynamics, concept of entropy, concept of absolute zero temperature. Isothermal, adiabatic, isobaric and isochoric processes, reversible and irreversible changes. Carnot cycle and its efficiency, Concept of heat engine	6	10%
3	**Basic concepts of Probability:** Random events and probability, Principle of Equal a Priori Probability, Basic Rules of Probability Theory Thermodynamic Probability, Fluctuations and their dependence on the number of particles.	4	10%
4	**Statistical Ensembles:** Types of systems and constraints on a system, Most probable state, Lifetime of a microstate and microstate. macrostate and Microstate**,** Phase space and number of accessible microstates Ω given the macrostate; Statistical definition of entropy. Introduction to Statistical Ensemble: micro-canonical, canonical and grand-canonical ensemble. Partition function.	10	25%
5	**Origin of Quantum Mechanics:** Concept of black body radiation, Stefan Boltzmann law of radiation, Rayleigh-Jeans law, Ultra-violet catastrophe, Plank's radiation law.	8	25%
6	**Introduction to Quantum Mechanics** Wave particle duality, De-Broglie matter waves, phase and group velocity. Heisenberg uncertainty principle. Wave function and its physical interpretation, Operators. Time dependent and time independent Schrödinger wave equation for free and bound states, infinite potential well.	8	25%
Total		**39**	**100%**

References:

1. *Heat Thermodynamics and Statistical Physics* by Brij Lal, N. Subramanyam, P. S. Hemne, S. Chand & Sons Pvt. Ltd.
2. *Fundamentals of Statistical and Thermal Physics* by F. Reif.
3. *Statistical Mechanics* by B. B. Lau.
4. *Statistical Mechanics, R K Pathria and P D Beale, Elsevier 2011.*
5. *Introduction to Quantum Mechanics*, 2nd edition by D.J. Griffiths, Pearson.
6. *A Textbook of Quantum Mechanics* by P. M. Mathews and K. Venkatesan, Tata Mc Graw Hill.

Semester-III

Course Code	Course Name	Credits
PHY2309N	PHYSICS-III LAB	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
-	02	-	-	01	-	01

Practical						Total
Internal Assessment				External		
Lab Journal	**Performance**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. The laboratory course is designed to get the understanding of the concepts taught in thermodynamics and wave mechanics through performing various experiments in the laboratory.
2. Analyse the relationship between various types of experiments.
3. Perform the procedure as per standard values.
4. Understand the applications of alternating magnetic field.
5. To understand the concept of magnetic susceptibility.
6. To learn theoretical concepts by performing experiments.

Course Outcomes

On completion of this course, student will be able to:

1. Perform and understand the basic concept of measurement of Coefficient of Thermal Conductivity by Searle's apparatus methods.
2. Perform and understand the basic concept of measurement of Coefficient of Thermal Conductivity by Lee's method.
3. Perform and understand the basic concept of measurement of Coefficient of Thermal Conductivity by Angstrom's Method.
4. To study magnetization behavior with alternating magnetic field.
5. Perform and understand the basic concept of some physical properties of matter such as magnetic property and corelate the results to theory taught in class.
6. Perform and understand the basic concept of Barkhausen effect on ferromagnetic material.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	To determine the Coefficient of Thermal Conductivity of Copper by Searle's apparatus.	26	100%
2	To determine the Coefficient of Thermal Conductivity of bad conductor by Lee's method.		
3	To determine the Coefficient of Thermal Conductivity of Copper by Angstrom's Method.		
4	To study magnetization behaviour with alternating magnetic field.		
5	To measure the magnetic susceptibility of the given sample.		
6	To understand the Barkhausen effect on ferromagnetic material (*in virtual mode*).		
Total		**26**	**100%**

References:

1. *A complete course in practical physics* by B. B. Swain, Kalyani Publisher.
2. *B.Sc. Practical Physics* by C. L. Arora, S. Chand publications.
3. *https://www.vlab.co.in/*
4. Guided Physics Practical Word, D. N. Publications.
5. *B.Sc. Practical Physics Main, M.N. Shrinivasan, S. Chand Publications.*
6. *B.Sc. Practical physics, Harman Singh, S. Chand Publications.*

Semester-III

Course Code	Course Name	Credits
CHY2308N	CHEMISTRY-III	03

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	01	02	-	01	03

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Introduce students to the fundamental concepts of states of matter including phase transitions, intermolecular forces, and thermodynamics.
2. To explain the behavior of real and ideal gas.
3. To differentiate between gaseous state and vapor.
4. Familiarize students with the kinetic theory of gases and its applications in explaining gas behavior, such as diffusion, effusion, and Boyle's law.
5. To explain the real velocities of gases in terms of Maxwell distribution.
6. To introduce students to various symmetry elements and operations.

Course Outcomes

1. States of matter typically revolve around understanding the fundamental properties, behaviors, and theories related to different states of matter such as solids, liquids, and gases.
2. After a successful completion of this course, students will also understand different properties along with some fundamentals of energy like average kinetic energy, law of equipartition of energy, and heat capacity.
3. Student will be able to apply gas laws in various real-life situations.
4. Student will be able to explain phase diagrams and their significance in understanding phase transitions under different temperature and pressure conditions.
5. Student will be able to determine viscosity and surface tension.
6. Student will learn fundamental aspects of symmetry.

Detailed Syllabus

Module		Contents	Hours	Marks Weightage
	Gaseous state		6	15%
1	1.1	Characteristics of gases. Kinetic molecular model of a gas, postulates, and derivation of the kinetic gas equation.		
	1.2	Deviations from ideal gas behavior, compressibility factor Z, and its variation with pressure for different gases.		
2	**Non-ideal gas behavior and Van der Waals equation**		8	20%
	2.1	Causes of deviation from ideal behaviour. Van der Waals equation of state, its derivation, and application in explaining real gas behaviour.		
	2.2	Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, the relation between critical constants and van der Waals constants, and law of corresponding states.		
3	**Solid state**		5	15%
	3.1	Characteristics of the solid state.		
	3.2	Law of constancy of interfacial angles, law of rational indices, Miller indices.		
4	**Defects in crystals**		8	20%
	4.1	Elementary ideas of symmetry, symmetry elements, symmetry operations, the qualitative idea of point and space groups, seven crystal systems, and fourteen Bravais lattices.		
	4.2	X-ray diffraction, Bragg's law. Defects in crystals. Glasses and liquid crystals.		
5	**Kinetic Theory of Gases**		6	15%
	5.1	Maxwell distribution and its use in evaluating molecular velocities (average, root mean square, and most probable).		
	5.2	Average kinetic energy, collision frequency; collision diameter; mean free path, and viscosity of gases, including their temperature and pressure dependence.		
6	**Transport phenomena in gases**		6	15%
	6.1	Relation between mean free path and coefficient of viscosity.		
	6.2	Degrees of freedom, the law of equipartition of energy.		
Total			**39**	**100%**

References:

1. K.L. Kapoor, A Textbook of Physical Chemistry 6th Edition Macmillan Publishers India Limited.
2. Puri Sharma Pathania 48th Edition Vishal Publication
3. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8th Ed., Oxford University Press (2006).
4. Ball, D. W. Physical Chemistry Thomson Press, India (2007).
5. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
6. Physical Chemistry" by R. K. Gupta, Kalyani Publishers.

Semester-III

Course Code	Course Name	Credits
CHY2309N	CHEMISTRY-III LAB	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
-	02	-	-	01	-	01

Practical						Total
Internal Assessment				External		
Lab Journal	**Performance**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. To measure surface tension and determine variation with change in concentration.
2. To learn viscosity measurement and variation with changes in concentrations and solute addition.
3. To learn pH measurements.
4. To prepare buffer solution.
5. To operate Ostwald's viscometer.
6. To learn the drop weight and drop number method for surface tension.

Course Outcomes

1. This course will train and give experience in the practical aspects of physical chemistry.
2. Student will learn to measure the viscosity surface tension.
3. Student will learn measurement of pH of solutions.
4. Students will learn to determine surface tension of given solutions.
5. Students will learn preparation of buffer solutions.
6. Students will analyse different industrial samples.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
	Surface tension (use of organic solvents excluded)	26	100%
1	Determination of the surface tension by drop number method.		
2	Determination of the surface tension by drop weight method.		
3	Study the variation of surface tension of detergent solutions with concentration		
	Viscosity		
4	Viscosity measurement using Ostwald's viscometer (use of organic solvents excluded).		
5	Study the effect of the addition of solutes such as (a) ethanol and (b) sodium chloride on the viscosity of water at room temperature.		
6	Study the effect of variation of viscosity of an aqueous solution with the concentration of solute		
	pH measurements		
7	Measurement of pH of different solutions using a pH meter.		
8	Preparation of buffer solutions using Sodium acetate-acetic acid.		
9	Preparation of buffer solutions using Ammonium chloride-ammonium hydroxide.		
10	Measurement of the pH of buffer solutions and comparison of the values.		
11	Viva, and journal writing for Exp. No. 1-3.		
12	Viva, and journal writing for Exp. No. 4-6.		
13	Viva, and journal writing for Exp. No. 7 & 10.		
Total		**26**	**100%**

References:

1. Practicals in Physical Chemistry: P S Sindhu
2. A textbook on Experiments and Calculations in Engineering Chemistry by S. S. Dara, S. Chan
3. Vogel's Textbook of Quantitative Chemical Analysis (Latest ed.), Revised by G. H. Jeffery, J. Bassett.
4. Physical Chemistry: A Laboratory Manual by S. K. Ghosh, New Central Book Agency.
5. Experimental Physical Chemistry by S. C. Kundu and S. K. Kundu, Books & Allied (P) Ltd.
6. Practical Physical Chemistry by J. B. Yadav, Krishna Prakashan Media.

Semester-III

Course Code	Course Name	Credits
STA2302N	STATISTICAL INFERENCE	03

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	01	02	-	01	03

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Gain foundational knowledge of sampling techniques and their applications.
2. Analyze hypothesis testing procedures and understand error types and critical regions.
3. Apply advanced statistical tests like MP and UMP tests based on Neyman-Pearson lemma.
4. Evaluate estimators based on criteria such as unbiasedness and sufficiency.
5. Learn practical methods for parameter estimation using MLE and method of moments.
6. Interpret results of confidence intervals and perform hypothesis tests using appropriate statistical distributions.

Course Outcomes

1. Understand key concepts like population, sample, and various sampling methods.
2. Apply hypothesis testing principles including null and alternative hypotheses, type-I and type-II errors, and critical regions.
3. Implement most powerful and uniformly most powerful tests using Neyman-Pearson lemma.
4. Develop estimators with properties like unbiasedness, consistency, sufficiency, and efficiency.
5. Master estimation methods such as method of moments, maximum likelihood estimation (MLE), and minimum chi-square.
6. Construct and interpret confidence intervals for different parameter distributions and perform significance tests using normal and t-distributions.

Detailed Syllabus

Module		Contents	Hours	Marks Weightage
1		**Module I:**	05	15%
	1.1	Population, Sample, Simple random sampling, Parameter and Statistic, Null and alternative hypothesis, Critical region, Level of Significance, Type-I and Type II Error.		
	1.2	Most Powerful (MP) and Uniformly Most Powerful (UMP) tests, Neyman-Pearson lemma, and its application in construction of MP and UMP tests.		
2		**Module II:**	07	15%
	2.1	General Statistical Inference Problem: Requirements of a good estimator: Unbiasedness, Consistency, Sufficiency, C.R. inequality and efficiency. Examples based on Normal, Binomial, Poisson, Geometric, Uniform, Exponential and Gamma distributions.		
	2.2	Sufficient, Minimal, Sufficient and Complete Statistics; Rao- Blackwell and Lehmann-Scheffe theorems, Sufficient, Minimal, Sufficient and Complete Statistics; Rao- Blackwell and Lehmann-Scheffe theorems.		
3		**Module III:**	07	20%
	3.1	Methods of Estimation: Method of Moments, Method of Maximum Likelihood (statement of properties of MLE), Method of Minimum Chi-square and interval estimation		
	3.2	Concepts of confidence interval and Confidence-coefficient, Confidence interval for the parameters of univariate normal, two independent normal and one-parameter exponential distribution.		
4		**Module IV:**	07	20%
	4.1	Test of significance based on Normal distribution (tests for single proportion, difference of two proportions, Single mean, and difference of two means).		
	4.2	Student t-distribution, Test of single mean, difference of two means, Paired t-test, F-test, ANOVA.		
5		**Module V:**	07	15%

	5.1	Order statistics and their distributions for continuous random variables.		
	5.2	Distribution functions of one and two random variables by convolution, Jacobian, distribution function and moment generating function methods.		
6		**Module VI:**	06	15%
	6.1	Bayesian and Non-Bayesian Inference: Improper, conjugate and Jeffery's prior distributions. Posterior distribution, Loss function, Risk function, Bayes estimators for parameter/parameters of exponential, Weibull, and Normal distributions		
	6.2	Sequential analysis: Introduction, Sequential Probability ratio test (SPRT), Operating characteristic (OC) function of SPRT, Average sample number (ASN) and problem related to binomial and normal distribution		
Total			**39**	**100%**

References:

1. Meyer, P.L.: Introductory Probability and Statistical Applications (Ch. 5, 6 & 11) American Publishing Co.
2. Hogg, R.V. and Craig, A.T.: Introduction to Mathematical Statistics (Ch.4) collier Macmillan International.
3. Sinha, S.K.: Reliability and Life Testing (Ch. 6) Wiley Eastern.
4. Goon, Gupta and Dasgupta: An Outline of Statistical Theory (vol. 2, Ch. 9& 13).
5. Gibbons, J. D. and Chakraborty, S. (2003): Nonparametric Statistical Inference, 4th Edition, Marcel Dekker, CRC.

Semester-III

Course Code	Course Name	Credits
STA2303N	STATISTICAL INFERENCE LAB	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
-	02	-	-	01	-	01

Practical						Total
Internal Assessment				External		
Lab Journal	**Performance**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Develop Proficiency in Sampling Techniques
2. Understand and Apply Hypothesis Testing
3. Master Test Construction and Validation
4. Explore Estimator Properties
5. Develop Competence in Maximum Likelihood Estimation
6. Analyze Data Using ANOVA and Bayesian Methods

Course Outcomes

1. Able to generate populations, draw samples, and compare sample statistics with population parameters.
2. Competent in implementing and interpreting hypothesis tests for proportions and means.
3. Skilled in constructing and validating MP and UMP tests for key distributions.
4. Proficient in evaluating estimator properties like unbiasedness and efficiency.
5. Capable of performing Maximum Likelihood Estimation and interpreting results.
6. Competent in performing ANOVA, Bayesian estimation, and SPRT using software for data analysis.

Practical exercises focused on using statistical software such as R, Python (with libraries like Pandas, NumPy, and SciPy), SPSS, or Excel for hands-on statistical analysis:

Detailed Syllabus

Module		Contents	Hours	Marks Weightage
1		**Population and Sample Identification**	02	8%
	1.1	Use statistical software to generate populations and draw random samples.		
	1.2	Compare parameters and statistics from the sample and population.		
2		**Hypothesis Testing for Proportions**	02	8%
	2.1	Implement hypothesis testing for a single proportion and difference of two proportions using software.		
	2.2	Calculate critical region, p-values, and interpret Type I and Type II errors.		
3		**Neyman-Pearson Lemma Application**	02	8%
	3.1	Construct Most Powerful (MP) and Uniformly Most Powerful (UMP) tests for Normal, Binomial, and Poisson distributions.		
	3.2	Validate the results using Neyman-Pearson lemma.		
4		**Estimator Properties**	02	8%
	4.1	Use examples from Normal, Binomial, and Poisson distributions to explore unbiasedness, consistency, and sufficiency of estimators.		
	4.2	Apply Cramér-Rao inequality and assess estimator efficiency.		
5		**Maximum Likelihood Estimation (MLE)**	02	8%
	5.1	Perform Maximum Likelihood Estimation for parameters of Normal, Binomial, and Exponential distributions.		
	5.2	Evaluate the properties of the MLE estimators using software.		
6		**Confidence Interval Estimation**	02	8%

	6.1	Calculate confidence intervals for the parameters of univariate normal and two independent normal distributions.		
	6.2	Visualize confidence intervals graphically.		
7		**Significance Tests for Means and Proportions**	02	8%
	7.1	Conduct significance tests for a single mean, difference of two means, and paired t-tests using statistical software.		
	7.2	Interpret p-values and confidence intervals for each test.		
8		**ANOVA and F-test**	02	8%
	8.1	Perform one-way ANOVA and F-tests on a dataset.		
	8.2	Use software to check assumptions of ANOVA (normality, homogeneity of variance) and interpret results.		
9		**Order Statistics**	02	8%
	9.1	Simulate order statistics for continuous random variables like Exponential or Normal distribution.		
	9.2	Analyze the distribution of order statistics using statistical software.		
10		**Distribution Function Methods**	02	8%
	10.1	Use convolution, Jacobian transformation, and moment generating function methods to derive distribution functions for two random variables.		
	10.2	Validate the results through simulation in R or Python.		
11		**Bayesian Estimation**	02	7%
	11.1	Use statistical software to implement Bayesian estimation for Normal, Exponential, and Weibull distributions.		
	11.2	Apply conjugate priors and calculate posterior distributions for various parameters.		
12		**Sequential Probability Ratio Test (SPRT)**	02	7%
	12.1	Implement SPRT for binomial and normal distributions using software.		

	12.2	Calculate operating characteristic (OC) functions and average sample number (ASN).		
13		**Loss Function and Risk Function Analysis**	02	6%
	13.1	Evaluate loss functions and risk functions for Bayes estimators using practical data examples.		
	13.2	Analyze decision-making under different loss functions using software.		
Total			**26**	**100%**

References:

1. **Mathematical Statistics with Applications**
   Dennis Wackerly, William Mendenhall, Richard L. Scheaffer, 7th Edition (2007), Cengage Learning, ISBN-13: 978-0495110811
2. **Introduction to the Theory of Statistics**
   Alexander Mood, Franklin Graybill, Duane Boes, 3rd Edition (1974), McGraw-Hill Education, ISBN-13: 978-0070854659, ISBN-10: 0070854653
3. **All of Statistics: A Concise Course in Statistical Inference**
   Larry Wasserman, 1st Edition (2004), Springer, ISBN-13: 978-1441923226
4. **The Elements of Statistical Learning: Data Mining, Inference, and Prediction**
   Trevor Hastie, Robert Tibshirani, Jerome Friedman, 2nd Edition (2009), Springer, 13: 978-0387848570
5. **Statistical Inference**
   George Casella, Roger L. Berger, 2nd Edition (2001), Cengage Learning, 13: 978-0534243128
6. **Bayesian Data Analysis**
   Andrew Gelman, John B. Carlin, Hal S. Stern, David B. Dunson, Aki Vehtari, Donald B. Rubin, 3rd Edition (2013), CRC Press, ISBN-13: 978-1439840955

Semester-III

Course Code	Course Name	Credits
FLF2311N	FRENCH-III	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	-	02	-	-	02

Theory							Total
Internal Assessment					External		
Test	**Viva**	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	20	10	05	**50**	**50**	75 mins	**100**

Course Objectives

The course is designed:

1. To engage the students to continue to refine pronunciation, focusing on more subtle aspects of accent and intonation.
2. To describe the placements of the objects etc.
3. To talk about recent experiences or of recent plans.
4. To understand biographical information.
5. To master complex grammatical structures, including the subjunctive mood, advanced tenses, and nuanced sentence structures.

Course Outcomes

After the completion of this course students will be able to:

1. Get in depth Knowledge of accents and French phonetics.
2. Write about placements of objects.
3. Talk about recent experiences or of recent plans.
4. Understand the important geographic locations and culture of France.
5. Gain mastery over complex grammatical structures, including the subjunctive mood, advanced verb tenses, and intricate sentence formations.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**Module I**		7	20%
	Leçon 1	Une journée sur Terre		
	Leçon 2	Une journée « écolo »		
	Leçon 3	Une journée avec…		
	Leçon 4	Une journée en Pologne		
2	**Module II**		6	20%
	Leçon 1	Sortir « à la française »		
	Leçon 2	Soyez les bienvenus!		
	Leçon 3	Apprendre autrement		
3	**Module III**		6	30%
	Leçon 1	Jeunes talents		
	Leçon 2	Écrivains francophones		
	Leçon 3	Un livre, un jour		
4	**Module IV**		7	30%
	Leçon 1	Il a choisi la France		
	Leçon 2	Informons-nous		
	Total		**26**	**100%**

References:

1. Berthet, Hugot et al. Alter Ego - Méthode de Français, A1: Hachette,2012.
2. Bruno Girardeau et Nelly Mous. Réussir le DELF A1. Paris : Didier, 2011.
3. Loiseau Y.,Mérieux R. Connexions 1, cahier d'exercices. Didier, Paris, 2017.
4. Loiseau Y. & Mérieux R. Connexions 1, Guide pédagogique. Didier, Paris, 2017.
5. Connexions 1, livre de l'élève – Loiseau Y. & Mérieux R., éd. Didier, Paris,2017.
6. Latitudes 1, cahier d'exercices – Loiseau Y. & Mérieux R., éd. Didier, Paris,2018.
7. Latitudes 1, Guide pédagogique – Loiseau Y. & Mérieux R., éd. Didier, Paris,2018.
8. Latitudes 1, Guide pédagogique téléchargeable – Loiseau Y. & Mérieux R., éd. Didier,2018.
9. Latitudes 1, livre d'élève + CD – Loiseau Y. & Mérieux R., éd. Didier, Paris,2018.
10. Nathalie Hirschsprung, Tony Tricot, Cosmopolite 1 Méthode de Français A1. Hachette, 2017.
11. Nathalie Hirschsprung, Tony Tricot. Cosmopolite 1 Cahier d'activités A1. Hachette, 2017.

Semester-III

Course Code	Course Name	Credits
FLG2311N	GERMAN-III	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	-	02	-	-	02

Theory							Total
Internal Assessment					External		
Test	**Viva**	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	20	10	05	**50**	**50**	75 mins	**100**

Course Objectives

The course is designed:
1. To listen and comprehend.
2. To understand and respond to audio texts, telephonic messages, and announcements.
3. To listen and speak.
4. To have proficiency in pronunciation.
5. To communicate in routine situations where exchange of basic information is required.

Course Outcomes

After the completion of this course students will be able to:
1. Listen and comprehend.
2. Understand and respond to audio texts, telephonic messages, and announcements.
3. Listen and speak.
4. Have proficiency in pronunciation.
5. Communicate in routine situations where exchange of basic information is required.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**Kapitel 7**		06	25%
	Grammatischer Aspekt	• Präpositionen mit Dativ, z.B. aus, bei • Artikelwörter: bestimmt,		

		unbestimmt, negativ im Nom., Akku., Dativ • Possessivartikel im Dativ		
2	**Kapitel 7**		07	25%
	Thematischer Aspekt	• Termine absprechen • Anleitungen verstehen und geben • Briefe verstehen und beantworten • über Sprachenlernen sprechen • Informationen in Texten finden		
3	**Kapitel 8**		06	25%
	Grammatischer Aspekt	• Adjektiv mit sein Thema:Wohnungsbeschreibung • Adjektiv sehr, zu • Wohin: in+Akku. • Wo: in+Dativ • Wechselpräpositionen z.B. über, auf, unter, vorl		
4	**Kapitel 8**		07	25%
	Thematischer Aspekt	• Wohnungsanzeigen verstehen • eine Wohnung beschreiben • die Wohnungseinrichtung planen • eine Einladung schriftlich beantworten • über eine Wohnungseinrichtung sprechen • einen Text über eine Wohnung schreiben		
	Total		**26**	**100%**

References:

1. Aufderstraße, Hartmut. *Lagune 1. Deutsch als Fremdsprache: Kursbuch und Arbeitsbuch*. Ismaning: Max Hueber Verlag 2012.
2. Braun, Anna, and Daniela Wimmer. *Schritte Plus A1/1: Arbeitsbuch*. Hueber Verlag, 2020.
3. Dengler, Stefanie. *Netzwerk A1. Teil2. Kurs- Und Arbeitsbuch: Deutsch Als Fremdsprache*. Langenscheidt, 2012.
4. Funk, Hermann, et al. *studio d A1: Deutsch als Fremdsprache*. Cornelsen Verlag, 2015.
5. Langenscheidt. *Langenscheidt Pocket Dictionary German: German-English, English-German*. Langenscheidt Publishing Group, 2022.
6. Niebisch, Daniela, et al. *Lagune A1: Kursbuch*. Hueber Verlag, 2016.

Semester-III

Course Code	Course Name	Credits
FLS2311N	SPANISH-III	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	-	02	-	-	02

Theory							Total
Internal Assessment					External		
Test	**Viva**	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	20	10	05	**50**	**50**	75 mins	**100**

Course Objectives

The course is designed:

1. To enable the students to talk and discuss about their routine and/or daily routine of others effectively and express the frequency.
2. To enable the students to understand time.
3. To enable the student to understand the geography of Spanish speaking countries along with local cuisines and food.
4. To teach the students how to write an informal E-mail.
5. To teach how to conjugate irregular verbs and incorporate them in day-to-day life.

Course Outcomes

After the completion of this course students will be able to:

1. speak and write about his/her daily routine and will be able to describe the daily routine of others and express the frequency.
2. effectively understand time, tell time and ask questions using time.
3. understand and explain the geographical structure such as area, population etc. of Spanish speaking countries along with food and local cuisines.
4. effectively write an informal E-mail.
5. conjugate irregular verbs and use them in their day-to-day life.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**¿Tus amigos son mis amigos?**		**3**	**20 %**
	1.1	La geografía de España		
	1.2	Los verbos en presente de indicativo		
2	**¿Dónde está mi reloj?**		**7**	**30 %**
	2.1	La hora en español		
	2.2	El verbo Tener en la forma TENER QUE + Infinitivo		
3	**¿Sabes estos verbos?**		**6**	**20 %**
	3.1	Los verbos irregulares		
4	**¿Día a día**		**10**	**30 %**
	4.1	Los verbos reflexivos		
	4.2	La frecuencia para la rutina diaria		
	4.3	Hablar de la rutina diaria		
	Total		**26**	**100%**

References:

1. Espinosa, Nat. *100 Reflexive Verbs In Spanish That You Need To Know*. Independently Published, 2022.
2. Floréz, Raphaela.*Verbos Irregulares (Español)*. 2023.
3. Gordon, Ronni, and David Stillman. *The Big Red Book of Spanish Verbs, Second Edition*. McGraw-Hill, 2008.
4. Palencia, Ramon, and Luis Aragones. *McGraw-Hill Education Intermediate Spanish Grammar*. McGraw-Hill Education, 2014.
5. Powell. *Autodisciplina*. Create Your Reality, 2019.
6. Reid, Stephanie. *La hora (Time) (Early Childhood Themes) (Spanish Edition)*. 2013.
7. Richmond, Dorothy. *Practice Makes Perfect: Spanish Pronouns and Prepositions, Premium Fourth Edition*. McGraw-Hill Education, 2020.
8. Saavedra, Eduardo. *La Geografía de España del Idrisi (Classic Reprint)*. Forgotten Books, 2017.
9. Tormo, Alejandro Bech, Francisco Del Moral Manzanares, et al. *El Cronómetro en clase*. 2020.
10. Tormo, Alejandro Bech. *Cronometro. Nivel B1. Con espansione online. Con CD. Per le Scuole superiori (El)*. Edinumen Editorial, 2013.

Semester-III

Course Code	Course Name	Credits
CSE2312N	READING AND COMPREHENSION	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	-	01	-	-	01

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	30	05	**50**	**50**	2 Hours	**100**

Course Objectives

The course is designed:
1. To discuss the techniques of reading and comprehension.
2. To illustrate the methods of reading technical and non-technical texts.
3. To enhance the knowledge of graphic, mind maps and pyramids.
4. To guide about ways of gathering information and processing it through effective reading strategies.
5. To teach how to do review writing after effectively applying appropriate reading methods.

Course Outcomes

After completion of this course students will be able to:
1. Attain and enhance competence in reading and comprehension skills and develop reading skills, speed and keen interest in reading different genres.
2. Read university text, manuals, technical contents and expand their vocabulary.
3. Produce best reviews after analytical and critical reading.
4. Employ various reading techniques and strategies to gain maximum output from reading.
5. Understand the nuances of reading as a skill.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**Effective Reading**		4	31%
	1.1	What is reading comprehension? Process of reading, Types of reading: (Academic reading, Professional reading, Literary reading, Technical reading & Critical reading) Strategies and Techniques of reading: (Skimming, Scanning, Intensive, Extensive, Loud & Silent reading, SQ3R etc.) Reading speed & Tips for improving reading skills		
	1.2	Strategies for Reading Comprehension		
	1.3	Note taking and Note Making,		
2	**Technical Language Development**		4	31%
	2.1	Reading Manuals: What is technical language? Characteristics of technical texts User guide – manuals: (Lab reports, Brochures, Proposals, Technical specifications & descriptions) Instructions & warnings etc.		
	2.2	Difference between Literary and Technical reading		
3	**Summarization**		3	23%
	3.1	Summarization of reading passages, reports, chapters, books & selected passages from competitive examinations.		
	3.2	Graphic organizers for summaries: Mind maps, flow charts, tree diagrams, pyramids		
4	**Activities**		2	15%
	4.1	News reading, Picture reading,		
	4.2	Review of a book/journal, Paraphrasing		
	Total		**13**	**100%**

References:

1. Fitikides, T. J. *Common Mistakes in English*. London: Orient Longman, 1984.
2. Hasson, Gill. *Brilliant Communication Skills*. Great Britain: Pearson Education, 2012.
3. Krishnaswamy N & T Sriraman. *Creative English for Communication*, Macmillan India Limited, 2000
4. Lesikar, Raymond V and Marie E. Flatley. *Basic Business Communication: Skills for Empowering the Internet Generation*: Ninth Edition. New Delhi: Tata McGraw-Hill, 2002.
5. Mascull, Bill. *Business Vocabulary in Use Advanced*, Cambridge University Press, 2004
6. Raman, Meenakshi & Singh, Prakash. *Business Communication*, Oxford University Press, 2006.
7. Neuliep, James W. *Intercultural Communication: A Contextual Approach*. Boston: Houghton Mifflin Co., 2003.
8. Rizvi, Ashraf M. *Effective Technical Communication*, McGraw Hill Education, 2017.
9. Sethi, Anjanee & Adhikari, Bhavana. *Business Communication*, Tata McGraw Hill, 2009.
10. Varinder Kumar & Bodh Raj, *Comprehension and Communication Skills in English,* Kalyani Publishers, 2022.

Semester-III

Course Code	Course Name	Credits
BEH2313N	BEHAVIOURAL SCIENCE-III	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	-	01	-	-	01

Theory				
Internal Assessment				
Activity	**Assignment**	**Viva**	**Attendance**	**Total**
20	40	35	05	**100**

Course Objectives

1. To Foster open communication and active listening among team members.
2. To Build trust and mutual respect within the group.
3. To Encourage collaboration and shared decision-making.
4. To Promote diversity and inclusion within the team.
5. To Develop clear roles and responsibilities for each member.
6. To Strengthen team cohesion through shared goals and experiences.

Course Outcomes

1. Enhanced communication and understanding among team members
2. Increased trust and respect within the team.
3. Improved collaboration and problem-solving abilities.
4. Greater appreciation for diversity and different perspectives.
5. Clearer roles, responsibilities, and accountability.
6. Stronger team unity and alignment towards common goals.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**Group formation**		4	15%
	1.1	Definition and Characteristics of group		
	1.2	Importance of groups formation		
	1.3	Classification and stages of groups formation		
	1.4	Benefits of group formation		
2	**Teams**		2	15%
	2.1	Meaning and nature of teams		
	2.2	External and internal factors effecting team.		
	2.3	Building Effective Teams		
	2.4	Consensus Building and Collaboration		
3	**Group Functions**		2	16%
	3.1	External Conditions affecting group functioning: Authority, Structure, Org. Resources, Organizational policies etc.		
	3.2	Internal conditions affecting group functioning: Roles, Norms, Conformity, Status, Cohesiveness, Size, Inter group conflict.		
	3.3	Group Cohesiveness and Group Conflict		
	3.4	Adjustment in Groups		
4	**Leadership**		2	18%
	4.1	Meaning, Nature, and Functions		
	4.2	Self-leadership		
	4.3	Leadership styles in organization		
	4.4	Leadership in Teams		
5	**Power to empower: Individual and Teams**		2	
	5.1	Meaning, Nature, and Types of Power and Empower		

	5.2	Identify the sources and uses of Power		
	5.3	Relevance in organization and Society		
	5.4	Feeling power and powerlessness		
	Total		**13**	**100%**

References:

1. Forsyth, D. R. (2018). Group Dynamics. Wadsworth, Cengage Learning.
2. Robbins, S. P., & Judge, T. A. (2019). Organizational Behavior (18th ed.). Pearson.
3. Kouzes, J. M., & Posner, B. Z. (2017). The Leadership Challenge: How to Make Extraordinary Things Happen in Organizations (6th ed.). Jossey-Bass.
4. Pfeffer, J. (2010). Power: Why Some People Have It—and Others Don't. Harper Business.
5. Lencioni, P. (2002). The Five Dysfunctions of a Team: A Leadership Fable. Jossey-Bass.
6. Hackman, J. R., & Wageman, R. (2005). A theory of team coaching. Academy of Management Review, 30(2), 269-287.

Semester-III

Course Code	Course Name	Credits
VOC2315N	INTRODUCTION TO PROGRAMMING WITH PYTHON-I	03

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	01	-	02	01	-	03

Theory					Total
Internal Assessment			External		
Continuous Evaluation / Coding Report	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
45	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. To learn how to design and Python Programs.
2. To explore the innards and understand the components of Python Programming.
3. To learn to write loops and decision statements in Python.
4. To learn about the built input/output operations and compound data types in Python.

Course Outcomes

On completion of this course, student will be able to:

1. explain and use the basic concepts of Python Programming,
2. demonstrate proficiency in the handling of conditional statements and loops,
3. use inbuilt functions as well as create new functions while writing Python codes,
4. identify the methods to create and manipulate lists, tuples and dictionaries,
5. discover the commonly used operations involving file handling, and
6. write and execute Python codes for various mathematical problems.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Introduction to Python**: History & Versions, Features, Installing Python, Execution of a Python program, Debugging: (1) Syntax, Runtime & Semantic Errors and (2) Experimental Debugging, Formal and Natural Languages, The Difference Between Brackets, Braces, and Parentheses. **Variables and Expressions**: Values and Types, Variables, Variable Names and Keywords, Type conversion, Operators and Operands, Expressions, Interactive Mode and Script Mode, Order of Operations, Modulus operator, String Operator.	06	13%
2	**Conditional Statements**: If, if-else, nested if-else. **Looping**: For, while, nested loops. Control statements: Terminating loops, skipping specific conditions.	05	12%
2	**Functions**: Function Calls, Built-in functions, Type conversion functions, Math functions, Composition, Adding New Functions, Definitions and Uses, Flow of Execution, Parameters and Arguments, Variables and Parameters Are Local, Stack Diagrams, Fruitful Functions and Void Functions, Why Functions? Importing with from, Return Values, Incremental Development, Composition, Boolean Functions, More Recursion, Leap of Faith, Checking Types.	06	13%
3	**Strings**: A String Is a Sequence, Traversal with a Loop, String Slices, Strings Are Immutable, Searching, Looping and Counting, String Methods, The *in* Operator, String Comparison, String Operations.	05	12%
4	**Lists**: Values and Accessing Elements, Lists are mutable, traversing a List, Deleting elements from List, Built-in List Operators, Concatenation, Repetition, In Operator, Built-in List functions and methods. **Tuples and Dictionaries**: Tuples, Accessing values in Tuples, Tuple Assignment, Tuples as return values, Variable-length argument tuples, Basic tuples operations, Concatenation, Repetition, in Operator, Iteration, Built-in Tuple Functions Creating a Dictionary, Accessing Values in a dictionary, Updating Dictionary, Deleting Elements from Dictionary, Properties of Dictionary keys,	06	13%

	Operations in Dictionary, Built-In Dictionary Functions, Built-in Dictionary Methods.		
5	**Files**: Opening files, Text Files and lines, Reading files, Searching through a file, Using *try*, *except* and *open*, Writing files, The File Object Attributes, Directories. Exceptions: Built-in Exceptions, Handling Exceptions, Exception with Arguments, User-defined Exceptions.	05	12%
6	**Hands-on Practice with Python Programming**: To be performed in parallel with above modules and maintain the record for internal assessment. 7. Write a Python Program to implement various control statement using suitable examples. 8. Write a Python Program to define and call functions for suitable problem. 9. Write Python program to demonstrate different types of function arguments. 10. Write a Python program to demonstrate the precedence and associativity of operators. 11. Write a Python Program to check if a number belongs to the Fibonacci Sequence. 12. Write a Python program to implement and use lambda function. 13. Write a Python Program to create and manipulate arrays. Also demonstrate use of slicing and indexing for accessing elements from the array. 14. Write a Python Program to implement list for suitable problem. Demonstrate various operations on it. 15. Write a Python Program to implement tuple for suitable problem. Demonstrate various operations on it. 16. Write a Python Program to implement dictionary for suitable problem. Demonstrate various operations on it. 17. Write a Python Program to read an entire text file, to append text to the file and display the text. 18. Write aPython Program to write a list to a file.	06	25%
Total		**39**	**100%**

References:

1. *Python for Everybody: Exploring Data Using Python 3* by Dr Charles R. Severance, ISBN: 1530051126, 9781530051120 (2016).
2. *Master Python Using Version 3.11: Learn Python Like Never Before* by Abhishek Singh, ISBN: 979-8385523276 (First edition, March 2023).
3. *Python from the Very Beginning* by John Whitington, ISBN: 979-8852254672 (July 2023).
4. *Python Data Science Handbook: Essesntial tools for working with Data* by Jake VanderPlas, ISBN: 9781491912058 (2016).
5. *Data Analysis with Python* by Bernd Klein.

Semester-III

Course Code	Course Name	Credits
DSC2317N	DATA SCIENCE AND COMPUTATION: STATISTICAL INFERENCE	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	-	02	-	-	02

Theory						Total
Internal Assessment				External		
Assignment	**Coding Report**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
20	25	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. Gain a comprehensive understanding of correlation, regression, curve fitting, and hypothesis testing, with a focus on practical implementation using Python.

Course Outcomes

1. Proficiency in analyzing correlations and performing regression analysis.
2. Competence in hypothesis testing and interpretation of statistical results.
3. Mastery of Python coding for statistical analysis and visualization.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Correlation** Bivariate distribution Correlation, Types of Correlation, Simple Correlation Coefficient for ungrouped data, Properties and Interpretation of Correlation Coefficient, Coefficient of determination, Scatter diagram, Standard, Error, Probable error of Correlation Coefficient. Rank correlation, Some examples. (Coding of above concepts using Python).	7	25%

2	**Regression and curve fitting** Linear regression, method of least squares. (Coding of above concepts using Python).	6	25%
3	**Testing of Hypothesis (Small and large sample test)** Formulation of Hypothesis (One-tailed & Two-tailed), Type I and Type II errors, power of a test, Significance of a test, P-value testing, Hypothesis testing (student's t-test, Z-test) (Coding of above concepts using Python).	7	25%
4	**Testing of Hypothesis (F-test, Chi square test, ANOVA)** (F-test, Chi-square test). Analysis of variance (ANOVA). (Coding of above concepts using Python).	6	25%
Total		**26**	**100%**

References:

1. **Fundamentals of Mathematical Statistics**
   S.C. Gupta, V.K. Kapoor, 12th Revised Edition (2020), S. Chand & Co., ISBN-13: 978-9351611738
2. **Introductory Statistics**
   Neil A. Weiss, 10th Edition (2017), Pearson, ISBN-13: 9780321989178
3. **Statistical Analysis for Decision Making**
   T.L. Kaushal, 8th Edition (2018), Kalyani Publishers, ISBN-13: 9789327290691
4. **Statistical Analysis**
   T.L. Kaushal, Kalyani Publishers, ISBN-13: 9789327234190
5. **Mathematical Statistics**
   H.C. Saxena, V.K. Kapoor, Edition and ISBN details currently unavailable
6. **Think Stats: Exploratory Data Analysis in Python**
   Allen B. Downey, 2nd Edition (2014), O'Reilly Media, ISBN-13: 978-1491907337
7. **Statistics for Data Science with Python**
   Peter Bruce, Andrew Bruce, 1st Edition (2017), O'Reilly Media, ISBN-13: 978-1491952962
8. **Python for Data Analysis**
   Wes McKinney, 2nd Edition (2017), O'Reilly Media, ISBN-13: 978-14919576604
9. **Hands-On Data Science with Anaconda: Utilize the right mix of tools to create high-performance data science applications**
   Dr. Yuxing Yan, 1st Edition (2018), Packt Publishing, ISBN-13: 978-1788831192

Semester-III

Course Code	Course Name	Credits
ANM2317N	ANIMATION-II	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	02	-	01	01	-	02

Theory						Total
Internal Assessment				External		
Test	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
35	10	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. Enhanced Animation Skills: Develop advanced skills in character animation, including character posing, movement, and expression, applying the 12 principles of animation effectively.
2. Technical Proficiency: Gain proficiency in advanced rigging techniques, character setup for complex movements, and the use of advanced features in animation software.
3. Creative Storytelling: Understand narrative structure in animation, create storyboards and animatics, and apply visual language and symbolism to enhance storytelling in animations.
4. Professional Portfolio Development: Create a professional animation portfolio that showcases advanced skills, creativity, and understanding of industry practices, preparing for careers in animation.

Course Outcomes

1. Advanced Animation Skills: Students will develop advanced skills in character animation, including character posing, movement, and expression, applying the 12 principles of animation effectively.
2. Technical Proficiency: Students will gain proficiency in advanced rigging techniques, character setup for complex movements, and the use of advanced features in animation software.
3. Visual Storytelling: Students will understand narrative structure in animation, create storyboards and animatics, and apply visual language and symbolism to enhance storytelling in their animations.
4. Application of Innovative Methods: Students will apply cutting-edge animation techniques to create professional-quality projects.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Foundations of Animation**	6	20%
	Principles of Animation: Explore and apply the 12 principles of animation to create believable and dynamic motion.		
	Storyboarding Techniques: Learn to develop and present visual stories through storyboards, focusing on composition and narrative flow.		
	Character Design Basics: Understand the fundamentals of character design, including silhouette, shape language, and visual appeal.		
	Introduction to 3D Animation: Gain a basic understanding of 3D animation software and its interface, focusing on keyframe animation.		
2	**Intermediate Animation Techniques**	6	20%
	Character Rigging and Weighting: Learn advanced rigging techniques to create flexible and realistic character movements.		
	Advanced Keyframe Animation: Refine keyframe animation skills, focusing on timing, spacing, and character performance.		
	Lip Sync and Facial Animation: Explore techniques for syncing character dialogue with lip movements and expressive facial animations.		
	Camera and Cinematography: Understand the principles of camera movement and shot composition to enhance storytelling and visual interest.		
3	**Specialized Animation Skills**	6	30%
	Creature Animation: Study the principles of creature animation, focusing on animalistic movement and behaviour.		
	Physics-based Animation: Learn to create realistic animations using physics simulations for objects like cloth, hair, and fluid.		
	Character Animation for Games: Explore the unique challenges and techniques involved in creating animations for interactive game environments.		

	Advanced Techniques and Styles: Exploration of niche animation styles and techniques, such as motion capture, effects animation, or advanced 3D modeling.		
4	**Advanced Character Animation and Dynamics**	8	30%
	Complex Character Rigging: Advanced rigging techniques for creating detailed and flexible character rigs. Setup of facial rigs and body deformations for realistic movement.		
	Dynamic Motion and Simulation: Implementation of physics-based simulations for natural movement, including cloth and hair simulations. Techniques for simulating natural forces and interactions.		
	Dynamic Motion: Physics-based simulations for natural movement.		
	Complex Rigging: Advanced character rigging and facial deformation		
Total		**26**	**100%**

References:

1. Williams, R. (2012). The animator's survival kit. Faber & Faber.
2. Hooks, E. (2017). Acting for animators: 4th edition. Routledge.
3. Vaughan, W. (2012). Digital modeling. New Riders.
4. Kerlow, I. V. (2017). The art of 3D computer animation and effects (4th ed.). Wiley.
5. Goldberg, E. (2008). Character animation crash course! Silman-James Press.
6. Osipa, J. (2013). Stop staring: Facial modeling and animation done right (3rd ed.). Wiley.

Semester-III

Course Code	Course Name	Credits
PHT2317N	PHOTOGRAPHY-II	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	02	-	01	01	-	02

Theory						Total
Internal Assessment				External		
Test	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
35	10	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. Students will gain a basic knowledge of camera parts.
2. Gain knowledge about controlling light to get desired Results.
3. Technicalities to take photographs during nighttime & Day Time
4. The aim of the course is to train the mind in how to see the world through a camera.

Course Outcomes

1. Students will know Camera modes
2. Student will know about lenses
3. Students will know about different cameras & lenses
4. Field visit Studios or art gallery, Outdoor Photography Practice.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Camera and its Parts**	6	20%
	Introduction to Camera parts & Different Modes of Camera Dial		
	Shutter speed		
	Aperture, ISO		

	Exposure		
2	**Different types of cameras**	6	20%
	Pinhole camera		
	Compact camera		
	Mirrorless		
	SLR & DSLR		
3	**Different types of Lenses**	6	30%
	Wide Angle		
	Tele-photo lens		
	Macro Lens		
	Prime Lens		
4	**Assignment: Use of Mirror Less cameras & Large Format Cameras, Sensor Size**	8	30%
	Mirror less cameras		
	DSLR Crop Sensor		
	Full Frame Sensor		
	Large Format Cameras		
Total		**26**	**100%**

References:

1. Mastering Shutter Speed By AI Judge
2. The Photography Journal
3. Horenstein, H. (2012). Digital Photography: A Basic Manual. Little, Brown and Company.
4. Shore, S. (2007). The nature of photographs. Aperture.
5. Birnbaum, B. (2010). The art of photography: A personal approach to artistic expression. Rocky Nook.

Semester-III

Course Code	Course Name	Credits
POL2317N	POLITICAL SCIENCE-II	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	01	01	-	01	02

Theory						Total
Internal Assessment				External		
Mid Sem	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	30	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. To comprehend the historical evolution and underlying principles of India's foreign policy.
2. To analyze contemporary challenges and opportunities in India's foreign relations.
3. To evaluate the effectiveness and impact of India's diplomatic strategies.

Course Outcomes

1. Recall the historical events and milestones that have shaped India's foreign policy.
2. Explain the underlying principles and ideologies guiding India's foreign policy decisions.
3. Apply theoretical frameworks to analyse contemporary challenges and opportunities in India's foreign relations.
4. Compare and contrast India's foreign policy approaches with those of other major powers, such as China and the United States.
5. Critically assess the successes and failures of India's foreign policy initiatives in promoting national interests and global stability.
6. Develop policy recommendations to enhance India's role in regional and global governance structures.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Determinants of India's Foreign Policy**	5	20%
	Domestic sources of India's Foreign Policy		
	International sources of India's Foreign Policy		
2	**Objectives and Principles of India's Foreign Policy**	6	20%
	Objectives of India's Foreign Policy		
	Principles of India's Foreign Policy		
3	**Non-Alignment in Indian Foreign Policy**	7	30%
	Conceptual Framework & Principles of Non-Alignment Policy		
	Relevance of Non-Alignment Policy		
4	**India & the World**	8	30%
	India and the major powers- US, Russia, China		
	India and Global Institutions		
Total		**26**	**100%**

References:

1. Bandhopadhyaya, The Making of India's Foreign Policy, Allied Publishers, New Delhi (1970).
2. R. Basu, The United Nations: Structure and Functions of an International Organisation, Revised and Enlarged ed., Sterling, New Delhi (2004).
3. A. Mattoo & H. Jacob (eds.), India and the Contemporary International System, Manohar Publications in collaboration with RCSS Colombo, New Delhi (2014).
4. S. Cohen, India: Emerging Power, Brookings Institution Press (2002).

Semester-III

Course Code	Course Name	Credits
TSM2317N	TOURISM MANAGEMENT-II	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	01	01	-	01	02

Theory						Total
Internal Assessment				External		
Mid Sem	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	30	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. To gain knowledge about the characteristics of tourist attractions in India.
2. To study the Cultural aspects, Fair & festivals of India.
3. To gain destination knowledge of India through different tangible and non-tangible aspects

Course Outcomes

1. Students will be able to remember and identify the basic concepts and types of tourism products, including heritage, wildlife, religious, and cultural tourism.
2. Students will be able to describe the different types of heritage tourism, the role of heritage management organizations, and identify major wildlife sanctuaries, national parks, and biological reserves in India.
3. Students will apply their understanding of religious and cultural tourism concepts to identify key centers for various religions, as well as important cultural sites and events, such as classical and folk dances, handicrafts, and tourism fairs and festivals.
4. Students will critically evaluate the impact of different tourism products on the promotion and preservation of heritage, wildlife, religious, and cultural tourism in India.
5. Students will evaluate the contributions of organizations like UNESCO, ASI, and INTACH in preserving and promoting heritage sites and will assess the importance of these sites in the context of tourism.
6. Students will synthesize their learning by creating a comprehensive presentation or case study on a chosen tourism product, analysing its significance, impact, and potential for tourism development.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Tourism Products**	5	15%
	Tourism Products: Definition, Concept and classification		
2	**Heritage & Wildlife-based Tourism Products**	7	30%
	Heritage – Meaning, Types of Heritage Tourism, Heritage Management Organizations- UNESCO, ASI, INTACH		
	Major places for heritage tourism, important monuments, circuits etc		
	Major wildlife sanctuaries, national parks and biological reserves		
3	**Religious and Cultural Tourism Products**	7	25%
	Religious Tourism- concept and definition, two major centers of religious tourism of each religion.		
	Cultural Tourism – Concept		
	Classical and Folk dances of India, Handicrafts and textiles: important handicraft objects and centers, Tourism Fairs and festivals.		
4	**Case Study**	7	30%
	Prepare a presentation on any one of the above themes and explain in detail the tourism products		
Total		**26**	**100%**

References:

1. Cultural Tourism in India: A Case Study of Kerala by N. Jayaram and A. P. Krishna (2017)
2. Heritage Tourism: Theories and Practices by Dallen J. Timothy (2018)
3. Wildlife Tourism: Theory and Practice by David Newsome and Susan A. Moore (2017)
4. Religious Tourism in Asia: Tradition and Change through Case Studies and Narratives edited by Courtney Bruntz and Brooke Schedneck (2020)
5. Indian Classical Dance and Cultural Tourism: The Global Approach by Priyanka Verma (2019)

Semester-III

Course Code	Course Name	Credits
SCW2317N	SOCAL WORK-II	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	01	-	01	01	-	02

Theory						Total
Internal Assessment				External		
Mid Sem	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	30	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. The knowledge of this subject is essential to understand the concepts of rural, urban and tribal communities.
2. It will be helpful to understand the issues of rural, urban and tribal communities.
3. It will be helpful to gain a fundamental knowledge on policies and programmes of Urban and Rural Development and Panchayati Raj Institutions.
4. The insights from this subject will help the students to understand how to practice social work in different social work fields.

Course Outcomes

1. To understand the concepts of rural, urban and tribal communities.
2. To understand the issues of rural, urban and tribal communities.
3. To understand policies and programmes of Urban and Rural Development and aspects of Panchayati Raj Institutions.
4. To understand how to practice social work in different social work fields.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Introduction to Rural Society**	13	50%

	Introduction to Rural Society. Characteristics of Rural society.		
	Problems – Issues faced by the rural poor such as indebtedness, Bonded labour, Low wages, Unemployment.		
	Introduction to Rural Society. Characteristics of Rural society.		
2	**Introduction to urban community**	13	50%
	Characteristics of urban community. for urban development.		
	Problems- issues faced by urban community.		
	Government programmes for urban development.		
Total		**26**	**100%**

References:

1. Alexander, K.C., Prasad R.R., Jahagirdar M.P. (1991) Tribals - Rehabilitation and Development, Jaipur: Rawat Publications
2. Ashok Narang (2006) Indian Rural Problems, New Delhi : Murari Lal & Sons
3. Baluchamy, S. (2004) Panchayat Raj Institutions, New Delhi : Mittal Publication
4. C.G.Pickvance, (Ed.) (1976) Urban Sociology: Critical Essays, UK : Methuen
5. Chahar, S.S. (Ed.) (2005) Governance of Grassroots Level in India, New Delhi : Kanishka

Semester-III

Course Code	Course Name	Credits
CES2319N	COMMUNITY OUTREACH	03

Duration	Credits Assigned
Minimum 2 weeks (Total 60 Hrs.)	03

Contiuous Evalution (50)			Report (50)				Total
Choice of the problem	Mode and quality of engagement	Performance indicator	Content	Data Collection & Analysis	Presentation	Outreach Impact	
10	20	20	10	20	10	10	**100**

Course Objectives

1. To expose students to the socio-economic issues in the society

Guidelines

Students will be involved in the community outreach activities to create and/or spread awareness on issues related to:

1. Science and technology
2. Science education and research
3. Environmental issues at local, regional and global levels and allied problems

through awareness programs / workshops / seminars / expert talks / field activity / extension activities / digital media campaign / street play / questionaire.

Semester - IV						
	Course Code	**Course Title**	**Lecture Credits**	**Tutorial Credits**	**Practical Credits**	**Total Credits**
Discipline-I (Core)						**8**
Discipline-I	MTH2401N	Functions of Several Variables	3	1	-	4
	MTH2402N	Linear Algebra	3	1	-	4
Discipline-II (any one from the basket)						**4**
Discipline-II	PHY2408N PHY2409N	Physics-IV Physics-IV Lab	2 -	1 -	- 1	3 1
	CHY2408N CHY2409N	Chemistry-IV Chemistry-IV Lab	2 -	1 -	- 1	3 1
	STA2403N	Operations Research	3	1	-	4
Total (Discipline-I + II)						**12**
Foreign Language (any one from the basket)						**2**
Foreign Language	FLF2411N	French-IV	2	-	-	2
	FLG2411N	German-IV				
	FLS2411N	Spanish-IV				
Communication Skills	CSE2412N	Effective Writing Skills	1	-	-	1
Sub Total						**3**
Behavioural Science	BEH2413N	Behavioural Science-IV	1	-	-	1
Vocational Courses/ Entrepreneurship*/ Industry Led Courses	VOC2415N	Introduction to Programming with Python-II	2	-	1	3
Sub Total						**4**
VAC-II (any one from the basket)						**2**
VAC-II	DSC2417N	Data Science & Computation: Basics of Machine Learning	2	-	-	2
	ANM2417N	Animation-III				
	PHT2417N	Photography-III				
	POL2417N	Political Science-III				
	TSM2417N	Tourism Management-III				

	SCW2417N	Social Work-III				
					Sub Total	**2**
VAC-III	PHE2318N	Physical Education & Sports**	-	-	-	0
					Total	**9**
					Grand Total	**21**

Semester-IV

Course Code	Course Name	Credits
MTH2401N	FUNCTIONS OF SEVERAL VARIABLES	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. To learn how to sketch the graph of a simple function of two variables and draw a contour diagram of a simple function of two variables.
2. To describe important properties of a function of two variables using a surface graph, a contour diagram, and a table of data.
3. To understand the concepts of limits, continuity, and partial derivatives of functions of several variables.
4. To explore the use of curvilinear coordinates and their geometric applications in solving problems in engineering and science.
5. To analyze vector fields, compute gradients, divergences, and curls, and apply these concepts to solve real-life physical problems.
6. To learn and apply various integral theorems such as Green's theorem, Stokes' theorem, and the divergence theorem in different contexts.

Course Outcomes

1. Sketch graphs and draw contour diagrams of simple functions of two variables.
2. Describe the properties of functions of two variables using surface graphs, contour diagrams, and data tables.
3. Apply the concepts of limits, continuity, and partial derivatives to functions of several variables.
4. Use curvilinear coordinates and understand their geometric applications in various fields.
5. Calculate gradients, divergences, and curls of vector fields and apply these operations in solving physical problems.
6. Evaluate line integrals and surface integrals and apply integral theorems like Green's theorem, Stokes' theorem, and the divergence theorem**.**

Detailed Syllabus

Module		Content	Hours	Marks Weightage
1	**Module I**		11	20%
	1.1	Functions of several variables. Domains and Range. Functional notation, Level curves and level surfaces. Limits and continuity. Partial derivatives.		
	1.2	Total differential. Fundamental lemmas. Differential functions of n variables and of vector functions.		
	1.3	The Jacobian matrix. Derivatives and differentials of composite functions, the general chain rule.		
2	**Module II**		09	20%
	2.1	Implicit functions. Inverse functions. Curvilinear co-ordinates. Geometrical Applications. The directional derivatives. Partial derivatives of higher order		
	2.2	Higher derivatives of composite functions. The Laplacian in polar, cylindrical, and spherical co-ordinates		
	2.3	Higher derivatives of implicit functions. Maxima and minima of functions of several variables.		
3	**Module III**		09	20%
	3.1	Introduction. Vector fields and scalar fields. The gradient field. The divergence of vector fields. The curl of a vector field. Combined operations		
	3.2	Irrotational fields and Solenoidal fields. Double integrals, triple integrals, and multiple integrals in general		
	3.3	Change of variables in integrals. Arc length and surface area.		
4	**Module IV**		09	15%
	4.1	Line integrals in the plane. Integrals with respect to arc length, Basic properties of line integrals. Line integrals as integrals of vectors. Green's Theorem.		
	4.2	Independence of path simply connected domains, Extension of results to multiply connected domains. Line Integrals in space		
	4.3	Surfaces in space, orientability. Surface integrals. The divergence theorem. Stokes's theorem. Integrals independent of path.		
5	**Module V**		08	15%
	5.1	Curves in space, parametric representation. Arc length and natural parameter. Contact of curves. Tangent to a curve. Osculating plane. Principal normal		
	5.2	Binomial. Expression for t, n and b in generalized parameter. Curvature and torsion. Serret-Frenet Formulae. Helices.		

	5.3	Fundamental theorem for space curves.		
6	**Module VI**		06	10%
	6.1	De Moivre‟s theorem and its applications, Expansion of sin x_, cos x_ and tan x		
	6.2	Separation into real and imaginary parts. Summation of series based on C+iS method.		
Total			**52**	**100%**

References:

1. H. Behnke and P. Thullen, Theorie der Funktionen mehrerer komplexer Veränderlichen (1934)
2. Salomon Bochner and W. T. Martin Several Complex Variables (1948)
3. Lars Hörmander, An Introduction to Complex Analysis in Several Variables (1966) and later editions
4. Henrici P., Applied and Computational Complex Analysis (Wiley). [Three volumes: 1974, 1977, 1986.]
5. Kreyszig, E., Advanced Engineering Mathematics, 9 ed., Ch.13-18 (Wiley, 2006).
6. A.I.Markushevich.,*Theory of Functions of a Complex Variable* (Prentice-Hall, 1965). [Three volumes.]
7. Scheidemann, V., *Introduction to complex analysis in several variables* (Birkhauser, 2005
8. Abramowitz, Milton and Irene A. Stegun, *Handbook of Mathematical Functions with Formulas, Graphs, and Mathematical Tables*, *Dover,* New York. (1964). ISBN 0-486-61272-4.
9. Lars Ahlfors, *Complex Analysis: an introduction to the theory of analytic functions of one complex variable*, second edition, McGraw-Hill Book Company, New York, 1966.
10. Boyer, Carl B., *A History of Mathematics*, John Wiley & Sons, Inc., 2nd edition(1991). ISBN 0-471-54397-7.
11. Gal, Shmuel and Bachelis, Boris. An accurate elementary mathematical library for the IEEE floating point standard, ACM Transaction on Mathematical Software (1991).
12. Joseph, George G., *The Crest of the Peacock: Non-European Roots of Mathematics*, 2nd ed. Penguin Books, London. (2000). ISBN 0-691-00659-8.

Semester-IV

Course Code	Course Name	Credits
MTH2402N	LINEAR ALGEBRA	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. To construct mathematical expressions that involve vectors, matrices, and linear systems of linear equations.
2. To evaluate mathematical expressions to compute quantities that deal with linear systems and eigenvalue problems.
3. To apply linear algebra concepts to model, solve, and analyze real-world situations.
4. To understand and use equivalent statements regarding invertible matrices, pivot positions, and solutions of homogeneous systems.
5. To explore the axioms for abstract vector spaces and discuss examples and non-examples of these spaces.
6. To interpret properties of linear systems and recognize their applications in various fields.

Course Outcomes

1. Formulate, solve, and interpret properties of linear systems using matrix representation and Gaussian elimination.
2. Recognize and use equivalent statements regarding invertible matrices, pivot positions, and solutions of homogeneous systems.
3. Apply concepts of vector spaces, including subspaces, linear independence, basis, and dimension, to various problems.
4. Analyze linear transformations, compute their rank and kernel, and understand matrix representation and change of basis.
5. Understand and apply orthogonality in vector spaces, including the Gram-Schmidt process and properties of unitary matrices.
6. Compute eigenvalues and eigenvectors, and apply concepts of diagonalization and canonical forms to solve problems involving linear transformations.

Detailed Syllabus

Module		Content	Hours	Marks Weightage
1	**Module I Linear Systems and Gaussian Elimination**		**08**	20%
	1.1	Linear systems. Matrix representation of linear systems. Gaussian-Jordan elimination. Homogeneous linear systems.		
	1.2	Row echelon form and the General solution. Row rank of a matrix		
	1.3	solution sets of homogeneous linear systems and general linear systems. Elementary matrices.		
2	**Module II Vector Spaces**		**06**	20%
	2.1	Definition, examples, and basic properties. Subspaces. Linear independence		
	2.2	Linear combinations and span. Basis and dimension		
	2.3	Sum and intersection of subspaces. Direct sum of subspaces		
3	**Module III Linear Transformations**		**07**	20%
	3.1	Definition and examples. Properties of linear transformations. Rank and kernel		
	3.2	The rank and nullity of a matrix. The matrix represents a linear transformation		
	3.3	Change of basis. Isomorphism.		
4	**Module IV Orthogonality in Vector Spaces**		**07**	15%
	4.1	Scalar products in R^n and C^n. Complex matrices and orthogonality in C^n. Inner product spaces. Orthogonality in inner product spaces.		
	4.2	Normed linear spaces. Inner product on complex vector spaces. Orthogonal complements.		
	4.3	Orthogonal sets and the Gram-Schmidt process. Unitary matrices.		
	Module V Eigenvalues and Eigenvectors		06	15%

5	5.1	Eigenvalues and eigenvectors. Characteristic equation and polynomial. Eigenvectors and eigenvalues of linear transformations.		
	5.2	Similar matrices and diagonalization. Triangolizable matrices.		
	5.3	Eigenvalues and eigenvectors of symmetric and Hermition matrices.		
6	**Module VI Canonical Forms**		05	10%
	6.1	Quadratic forms and conic sections. Quadrices. Bilinear forms.		
	6.2	Minimal polynomials. The Caley-Hamilton theorem.		
Total			**52**	**100%**

References:

1. V. Krishnamurthy, V. P. Mainra, J. L. Arora -An Introduction to Linear Algebra
2. D. T. Finkbeiner -Introduction to Matrices and Linear Transformation
3. S. Kumaresan - Linear Algebra; A Geometric Approach Prentice Hall of India, 2000
4. S. H. Friedberg, A. J. Insel, L. E. Spence, Linear Algebra(4th Edition), Prentice Hall Publishing House, 2002.
5. Titu Andreescu and Dorin Andrica, Complex Numbers from A to …. Z, Birkhauser, 2006.
6. E.J. Barbeau, Polynomials, Springer Verlag, 2003.
7. Joseph A. Gallian, Contemporary Abstract Algebra (4th Edition), Narosa Publishing House, New Delhi, 1999.
8. Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory (2nd Edition), Pearson Education (Singapore) Pvt. Ltd., Indian Reprint, 2003.
9. David C. Lay, Linear Algebra and its Applications (3rd Edition), Pearson Education Asia, Indian Reprint, 2007.

Semester-IV

Course Code	Course Name	Credits
PHY2408N	PHYSICS-IV	03

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	01	02	-	01	03

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

This course aims at exposing the student's to

1. learn semiconductors and their applications.
2. learn the interference of light.
3. apply knowledge of diffraction of light.
4. learn polarization of light.
5. learn the basics of laser.
6. learn applications of laser.

Course Outcomes

On completion of this course, student will be able to:

1. apply the concept of semiconductor for electronic device applications,
2. apply the concept of interference to study thin films,
3. apply the concept of diffraction of light to study grating,
4. apply the concept of polarization of light to study polarimeter,
5. apply the concept of absorption, emission and amplification to study Laser, and
6. apply concept of laser for its various applications.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Semiconductor** Intrinsic and Extrinsic Semiconductors. Carrier concentration. Fermi level, fermi level in intrinsic and Extrinsic Semiconductors, variation of Fermi level with temperature. Hall Effect & its applications. P-N junction diode, forward biased and reversed biased diode, LED, Photodiode.	14	30%
2	**Interference of Light** Interference: Coherent Sources, Conditions of interference, Interference due to division of wavefront and division of amplitude, Interference due to thin films and wedge shaped film, Newton's rings.	04	10%
3	**Diffraction of Light** Diffraction: Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit, double slit, N Slits, Transmission grating.	05	15%
4	**Polarization of Light** Polarization: Plane polarize light, production of plane polarized light, circularly and elliptically polarized light, Optical rotation, Polarimeter.	05	15%
5	**Lasers** Einstein coefficients, conditions for light amplification, Population inversion, optical pumping. Three level and four level lasers.	06	15%
6	**Applications of Laser** He-Ne, Semiconductor laser, Nd:YAG laser, Properties and applications of lasers	05	15%
Total		**39**	**100%**

References:

1. *Textbook of Optics by N Subramanyam* by Brij Lal, M. N. Avdhanulu, S. Chand Publications.
2. *A textbook of Engineering Physics* by Dr. M. N. Avadhanulu & Dr. P. G. Khsirsagar, S. Chand Publications.
3. *Engineering Physics* by M. Singh, D. Tripathi, H. Kumar, by Vayu Education India publisher.
4. *Lasers- Fundamentals and Applications* by Ajoy Ghatak and K.Thyagarajan by Springer.
5. *Lasers and Non-Linear Optic*s by B. B. Laud, by New Age International Publisher.

Semester-IV

Course Code	Course Name	Credits
PHY2409N	PHYSICS-IV LAB	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
-	02	-	-	01	-	01

Practical						Total
Internal Assessment				External		
Lab Journal	**Performance**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

The laboratory course is designed to:

1. get the understanding of the concepts different phenomenon of light.
2. expose the students to the concept of interference of light.
3. expose the students to the concept of diffraction of light.
4. get the understanding the concept of polarization of light.
5. expose the students to the concept refractive index.
6. get the understanding the concept of polarization of light to study the polarization of light.

Course Outcomes

On completion of this course, student will be able to:

1. perform and understand the basic concept of interference of light by Newton's ring method experiments.
2. perform and understand the basic concept diffraction of light through single and double slit experiments.
3. perform and understand the basic concept diffraction of light through double slit experiments.
4. perform and understand the basic concept refractive index.
5. perform and understand the basic concept of polarization and refraction of light by using instruments such as polarimeter.
6. perform and understand the basic concept of polarization and refraction of light by using instruments such as spectrometer.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	To determine the wavelength of a monochromatic light by Newton's ring method.	26	100%
2	To measure the slit width of a single slit by observing the diffraction fringes.		
3	To measure the slit width and the separation between the slits of a double slit by observing the diffraction and interference fringes.		
4	To determine the refractive index of material of Prism using Spectrometer.		
5	To calibrate a polarimeter and hence to determine the concentration of sugar solution.		
6	To determine the refractive index of material of Prism using Spectrometer.		
Total		**26**	**100%**

References:

1. *A complete course in practical physics* by B. B. Swain, Kalyani Publisher.
2. *B.Sc. Practical Physics* by C. L. Arora, S. Chand publications.
3. *https://www.vlab.co.in/*
4. *B.Sc. Practical Physics* Main, M.N. Shrinivasan, S. Chand Publications.
5. *B.Sc. Practical physics,* Harman Singh, S. Chand Publications.
6. *Guided Physics Practical* Word, D. N. Publications.

Semester-IV

Course Code	Course Name	Credits
CHY2408N	CHEMISTRY-IV	03

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	01	02	-	01	03

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Understanding bonding principles and the concepts of electrostatic attraction, sharing of electrons, and the role of valence electrons.
2. In-depth understanding of bonding models and theories.
3. Understanding properties of metallic compounds.
4. Involvement of weak forces in molecular structures.
5. Identify conductors, semiconductors, and insulators.
6. Understanding defects.

Course Outcomes

1. After learning the course students will comprehend the fundamental principles underlying ionic, covalent, and metallic bonding.
2. To learn comparative analysis between ionic and covalent bonds regarding their strengths, weaknesses, and suitability for different types of compounds and materials.
3. Students will develop problem-solving skills related to predicting bond types.
4. Understanding bond energies, and interpreting chemical behaviors based on the type of bonding present.
5. Students will be able to identify structures of inorganic compounds by applying VSEPR theory.
6. Students will be able to apply MOT.

Detailed Syllabus

Module	Course Module / Contents		Hours	Marks Weightage
	Module I: Ionic bond		8	20%
1	1.1	General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals.		
	1.2	Born-Lande equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle and its application:		
2	**Module II: Covalent bond**		8	20%
	2.1	Solvation energy, Lewis structure, Covalent character in ionic compounds, polarizing power, and polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds		
	2.2	Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference.		
3	**Module III: Bond theory**		6	15%
	3.1	Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach), and bond lengths.		
	3.2	Valence Bond theory (Heitler-London approach) & its limitations, Energetics of hybridization, equivalent and non-equivalent hybrid orbitals.		
4	**Module IV: Molecular orbital theory**		6	15%
	4.1	Molecular orbital theory. Molecular orbital diagrams of diatomic molecules N_2, O_2, C_2, B_2, F_2, CO, NO and their ions; HCl.		
	4.2	Molecular orbital diagrams of simple polyatomic molecules BeF_2, CO_2, (idea of s-p mixing and orbital interaction to be given).		
5	**Module V: Metallic Bond:**		5	15%
	5.1	Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids.		
6	**Module VI: Weak Chemical forces:**			

	6.1	Van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, and Instantaneous dipole-induced dipole interactions. Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment).	6	15%
Total			**39**	**100%**

References:

1. Lee, J.D. Concise Inorganic Chemistry, ELBS, 1991.
2. Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry, Oxford, 1970.
3. Atkins, P.W. & Paula, J. Physical Chemistry, Oxford Press, 2006.
4. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications 196.
5. Inorganic Chemistry by O. P. Agarwal, Krishna Prakashan Media.
6. Inorganic Chemistry: Principles of Structure and Reactivity by James E. Huheey, Ellen A. Keiter, and Richard L. Keiter, Pearson Publication.

Semester-IV

Course Code	Course Name	Credits
CHY2409N	CHEMISTRY-IV LAB	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
-	02	-	-	01	-	01

Practical						Total
Internal Assessment				External		
Lab Journal	**Performance**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. To learn basic chemistry lab skills like prepare a solution of a fixed concentration, analysis of strength of a given solution
2. To learn various analytical techniques like iodometric titration for estimation of some ions like Cu, Mn, Al ions etc.
3. To learn various inorganic salts and complexes preparation.
4. To learn how a chemical reaction proceeds and what are titrants and titrate.
5. To gain knowledge of water of crystallization and oxidation states of complexes.
6. To learn basic lab safety protocols and various behavioral aspects like precautions taken during lab.

Course Outcomes

Student will be able to
1. gain knowledge of basic techniques used in chemistry laboratory such as solution preparation.
2. Understand different titration methods of chemical analysis such as iodometric, precipitation etc.
3. gain knowledge of various inorganic complexes and salts preparation.
4. gain knowledge of basic chemistry like water of crystallization
5. function as a member of a team, communicate effectively and engage in further learning. Also, learn safety rules in the practice of laboratory investigations
6. analyze the need, design and perform a set of experiments.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	Iodo/Iodimetric titrations (i) Estimation of Cu (II) and $K2C_{r2}$ O_7 Using sodium thiosulphate solution (Iodimetrically).	26	100%
2	(ii) Estimation of available chlorine in bleaching powder iodometrically.		
3	Inorganic preparations (i) Cuprous Chloride, Cu2Cl2		
4	(ii) Preparation of Manganese (III) phosphate, MnPO4.H2O		
5	(iii) Preparation of Aluminum Potassium sulphate KAl(SO4)2.12H2O (Potash alum) or Chrome alum.		
6	Practice lab		
7	Practice lab		
8	Practice lab		
Total		**26**	**100%**

References:

1. Practical Chemistry: For B.Sc. I-, II- And III-Year Students by Dr. O.P. Pandey, Dr. D. N. Bajpai and Dr. S. Giri. S Chand Publication
2. Vogel, A. I., Mendham, J., Denney, R. C., Barnes, J. D., & Thomas, M. J. K. (2000). Vogel's Textbook of Quantitative Chemical Analysis (6th ed.). Pearson Education. ISBN: 9780582226289.
3. Woollins, J. D., & Glen, D. R. (1994). Inorganic Experiments (1st ed.). VCH Publishers. ISBN: 9780471939030.
4. Ghosh, S. K. (2013). Experimental Inorganic Chemistry: A Laboratory Manual (2nd ed.). New Central Book Agency. ISBN: 9788173810761.
5. Jaiswal, R. K., & Gupta, R. P. (2007). Practical Chemistry: For B.Sc. Students (2nd ed.). S. Chand & Company Pvt. Ltd. ISBN: 9788121907902.
6. Sundaram, K. S., Ganapragasam, R., & Sasi Kumar, R. (2017). Practical Chemistry for B.Sc. I, II & III Year (3rd ed.). S. Chand & Company Pvt. Ltd. ISBN: 9789352532454.

Semester-IV

Course Code	Course Name	Credits
STA2403N	OPERATIONS RESEARCH	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Understand Operations Research (OR) fundamentals and their practical applications.
2. Differentiate between PERT and CPM for effective project scheduling and critical path analysis.
3. Master Linear Programming techniques for optimization problems.
4. Solve transportation and assignment problems using appropriate methods.
5. Learn data analysis techniques like curve fitting and statistical modeling.
6. Apply theoretical knowledge to real-world scenarios through case studies.

Course Outcomes

1. Gain a solid understanding of OR principles and their applications.
2. Analyze project schedules using PERT/CPM to manage resources efficiently.
3. Use Linear Programming to solve optimization problems effectively.
4. Solve transportation and assignment problems to optimize logistics.
5. Interpret data trends and make forecasts using statistical methods.
6. Develop practical skills through case studies for real-world decision-making.

Detailed Syllabus

Module	Contents	Hours	Marks Weightage
1	Introduction Basic Definition, Nature and Significance of OR feature of OR Approach Application and Scope of OR	07	15%
	Basic Idea of PERT & CRM, Difference between PERT & CPM, PERT/CPM Network Components and Precedence Relationship Critical Path Analysis		
	Project Scheduling, Project Time-Cost, Trade-Off, Resource Allocation		
2	Linear Programming General Structure of Linear Programming, Advantages and Limitations of Linear Programming,	04	10%
	Application Areas of Linear Programming. Type of Linear Programming Solutions Multiple Solution, Unbounded Solutions, Infeasible Solution		
3	Simplex Method Maximization and Minimization Problem, two Phase Method, Big M Method. Duality in LPP,	14	20%
4	Dual Linear Programming Problem, Rules for Constructing the Dual from Primal, Feature of Duality, Sensitivity Analysis	07	10%
5	Transportation Problem, Mathematical Model of Transportation Problem, Transportation Method, North-West Corner Method, Linear Cost Method, Vogel's Approximation Method, Unbalanced Supply and Demand.	13	25%
6	Degeneracy Problem, Alternative Optional Solution, Maximization Transportation Problem, Trans-Shipment Problem Assignment Problems.	07	20%
	Frequency chart, Curve fitting by method of least squares, fitting of straight lines, polynomials, exponential curves etc., Data fitting with Cubic splines		
Total		**52**	**100%**

References:

1. Operations Research, J K Sharma, Macmillan Publication:
2. Operations Research, H. A. Taha
3. Operations Research, Kanti Swaroop, Macmillan Publication

Semester-IV

Course Code	Course Name	Credits
FLF2411N	FRENCH-IV	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	-	02	-	-	02

Theory							Total
Internal Assessment					External		
Test	**Viva**	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	20	10	05	**50**	**50**	75 mins	**100**

Course Objectives

The course is designed:

1. To strengthen the language of the students in both oral and written
2. To revise the grammar in application and the communication tasks related to topics covered already
3. To get acquainted with the current social communication skills, oral (dialogue, telephone conversations, etc.) and written and perform simple communication tasks
4. To engage the students to speak with near-native pronunciation and intonation, effectively conveying meaning and emotion.
5. To differentiate positively or negatively.

Course Outcomes

After the completion of this course students will be able to:

1. Enhance students' language skills in both spoken and written forms.
2. Apply and the communicate tasks related to topics covered already
3. Acquire the current social communication skills, oral (dialogue, telephone conversations, etc.) and written and perform simple communication tasks.
4. To speak with near-native pronunciation and intonation, effectively conveying meaning and emotion.
5. To differentiate positively or negatively.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**DOSSIER 6 – Nous rêvons d'aller dans un pays francophone**		13	50%
	Leçon 1	100% photo		
	Leçon 2	Voyager autrement		
	Leçon 3	Tour de France		
	Leçon 4	Séjour au Maroc		
	Leçon 5	Quand partir ?		
	Leçon 6	Carnets de voyages		
2	**DOSSIER 7 – Nous allons vivre « à la française »**		13	50%
	Leçon 1	Manger français à Bogota		
	Leçon 2	La France à Budapest		
	Leçon 3	Les français et les livres		
	Leçon 4	Retour aux sources		
	Leçon 5	S'habiller « à la française »		
	Leçon 6	Petits coins de France		
	Total		**26**	**100%**

References:

1. Berthet, Hugot et al. Alter Ego - Méthode de Français, A1: Hachette,2012.
2. Bruno Girardeau et Nelly Mous. Réussir le DELF A1. Paris : Didier, 2011.
3. Loiseau Y.,Mérieux R. Connexions 1, cahier d'exercices. Didier, Paris, 2017.
4. Loiseau Y. & Mérieux R. Connexions 1, Guide pédagogique. Didier, Paris, 2017.
5. Connexions 1, livre de l'élève – Loiseau Y. & Mérieux R., éd. Didier, Paris,2017.
6. Latitudes 1, cahier d'exercices – Loiseau Y. & Mérieux R., éd. Didier, Paris,2018.
7. Latitudes 1, Guide pédagogique – Loiseau Y. & Mérieux R., éd. Didier, Paris,2018.
8. Latitudes 1, Guide pédagogique téléchargeable – Loiseau Y. & Mérieux R., éd. Didier,2018.
9. Latitudes 1, livre d'élève + CD – Loiseau Y. & Mérieux R., éd. Didier, Paris,2018.
10. Nathalie Hirschsprung, Tony Tricot, Cosmopolite 1 Méthode de Français A1. Hachette, 2017.
11. Nathalie Hirschsprung, Tony Tricot. Cosmopolite 1 Cahier d'activités A1. Hachette, 2017.

Semester-IV

Course Code	Course Name	Credits
FLG2411N	GERMAN-IV	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	-	02	-	-	02

Theory							Total
Internal Assessment					External		
Test	**Viva**	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	20	10	05	**50**	**50**	75 mins	**100**

Course Objectives

The course is designed:
1. To communicate in every-day situations in writing.
2. To talk about their daily routine.
3. To communicate verbally with a dialogue-partner with respect to basic topics, provided the partner speaks slowly, clearly and is willing to help.
4. To frame and understand simple sentences in past tense.
5. To have a basic conversation using the vocabulary related to clothes and apparels.

Course Outcomes

After the completion of this course students will be able to:
1. Communicate in every-day situations in writing.
2. Talk about their daily routine.
3. Communicate verbally with a dialogue-partner with respect to basic topics, provided the partner speaks slowly, clearly and is willing to help.
4. Frame and understand simple sentences in past tense.
5. Have a basic conversation using the vocabulary related to clothes and apparels.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**Kapitel 9**		06	25%
	Grammatischer Aspekt	• Perfekt		

		• Partizip II • Konnektoren und Konjunktionen (und,oder, aber)		
2	**Kapitel 9**		07	25%
	Thematischer Aspekt	• einen Tagesablauf beschreiben • über Vergangenes sprechen • Stellenanzeigen verstehen • Meinung über Jobs äußern, Blogs über Jobs verstehen • ein Telefongespräch vorbereiten, telefonieren und nachfragen • über Jobs sprechen		
3	**Kapitel 10**		06	25%
	Grammatischer Aspekt	• Interrogativartikel: welch im Nom. U. Akku. • Demonstrativartikel: dies im Nom. U. Akku. • Partizip II: Trennbare u. nicht trennbare Verben • Personalpronomen im Dativ • Verben im Dativ		
4	**Kapitel 10**		07	25%
	Thematischer Aspekt	• über Kleidung sprechen • Farben • Chat über einen Einkauf verstehen • über Vergangenes berichten • Gespräche beim Kleiderkauf führen • sich im Kaufhaus orientieren • Informationen über Berlin verstehen und recherchieren		
	Total		**26**	**100%**

References:

1. Aufderstraße, Hartmut. *Lagune 1. Deutsch als Fremdsprache: Kursbuch und Arbeitsbuch*. Ismaning: Max Hueber Verlag 2012.
2. Braun, Anna, and Daniela Wimmer. *Schritte Plus A1/1: Arbeitsbuch*. Hueber Verlag, 2020.
3. Dengler, Stefanie. *Netzwerk A1. Teil2. Kurs- Und Arbeitsbuch: Deutsch Als Fremdsprache*. Langenscheidt, 2012.
4. Funk, Hermann, et al. *studio d A1: Deutsch als Fremdsprache*. Cornelsen Verlag, 2015.
5. Langenscheidt. *Langenscheidt Pocket Dictionary German: German-English, English-German*. Langenscheidt Publishing Group, 2022.
6. Niebisch, Daniela, et al. *Lagune A1: Kursbuch*. Hueber Verlag, 2016.

Semester-IV

Course Code	Course Name	Credits
FLS2411N	SPANISH-IV	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	-	02	-	-	02

Theory							Total
Internal Assessment					External		
Test	**Viva**	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	20	10	05	**50**	**50**	75 mins	**100**

Course Objectives

The course is designed:

1. To strengthen the language of the students in both oral and written form.
2. To enable the students to use interrogatives in Spanish.
3. To enable the students to use simple future tense to frame and speak sentences about future.
4. To enable students to write and speak about past tense.
5. To teach how to write a formal E-mail.

Course Outcomes

After the completion of this course students will be able to:

1. Write and speak about geography, food, culture and themselves effectively.
2. Demonstrate effective use of interrogatives in Spanish and use them appropriately to form questions and answer them.
3. Get a deep knowledge about the future tense, and they will be able to frame sentences using simple future.
4. Use past perfect tense to talk about activities and events that happened in the past.
5. Understand how to write a formal or business E-mail.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**María tiene suerte**		**8**	**31 %**
	1.1	El verbo TENER		
	1.2	Las expresiones con el verbo TENER		
	1.3	Acuerdo y desacuerdo		
2	**¿Sabes conducir?**		**7**	**27 %**
	2.1	El verbo Saber y Conocer		
	2.2	Las diferencias entre Saber y Conocer		
	2.3	El futuro simple en español		
	2.4	Un ensayo basado en el futuro simple		
3	**¿Quién quiere aprender español?**		**5**	**19 %**
	3.1	Los interrogativos y las preguntas usando el interrogativo		
	3.2	La cultura de España		
4	**¿Dónde has estado?**		**6**	**23 %**
	4.1	El pretérito perfecto en español		
	4.2	Escribir correo electrónico usando el pretérito perfecto.		
	Total		**26**	**100%**

References:

1. Balea, Amalia, and Pilar Ramos Vicent. *Cultura en España, B1-B2*. 2015.
2. Cantarino, Vicente. *Civilización y cultura de España*. Prentice Hall, 2006.
3. Gambluch, Carina. *Diverso 1*. 2015.
4. Melero, Pilar, and Enrique Sacristán. *Protagonistas B1. Libro del alumno + CD [Internacional]*. 2010.
5. Ortega, María Luisa Hortelano, et al. *Colega*. 2009.
6. Pereira-Muro, Carmen. *Culturas de Espana*. Cengage Learning, 2014.
7. Prisma, Equipo Nuevo, and Evelyn Aixalà I. Pozas. *Nuevo prisma A2*. 2014.
8. Prisma, Equipo Nuevo. *Nuevo prisma*. 2015.
9. Richmond, Dorothy. *Practice Makes Perfect: Spanish Verb Tenses, Premium Fifth Edition*. McGraw-Hill Companies, 2023.
10. Skelton, Adam, and Laura Garrido. *Essential Spanish Phrasebook. Over 1500 Most Useful Spanish Words and Phrases for Everyday Use*. 2012.

Semester-IV

Course Code	Course Name	Credits
CSE2412N	EFFECTIVE WRITING SKILLS	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	-	01	-	-	01

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	30	05	**50**	**50**	2 Hours	**100**

Course Objectives

The course is designed:
1. To demonstrate understanding of effective writing fundamentals.
2. To master various forms of writing.
3. To develop proficiency in official correspondence.
4. To acquire report writing skills.
5. To explore the professional aspects of writing.

Course Outcomes

After completion of this course students will be able to:
1. Articulate and apply guidelines for effective writing, avoiding common errors in various contexts.
2. Demonstrate proficiency in crafting well-structured paragraphs, assignments, and letters, adhering to prescribed formats and guidelines.
3. Compose official documents, including memos, notices, circulars, agendas, and minutes, following established formats and guidelines.
4. Understand the principles of report writing, distinguish between types of reports, and effectively create project reports.
5. Recognize the advantages and opportunities of social networking for professional growth, and they will be able to make meaningful contacts.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**Introduction to Writing Skills**		3	23%
	1.1	Guidelines to Effective Writing Skills, Avoiding Common Errors		
	1.2	Paragraph Writing Assignment Writing		
	1.3	Plagiarism		
2	**Letter Writing**		3	23%
	2.1	Types of letters		
	2.2	Formats & Guidelines		
3	**Official Correspondence**		4	31%
	3.1	Memo & Notice		
	3.2	Circulars, Agenda and Minutes		
4	**Report Writing**		3	23%
	4.1	Principles of Report Writing,		
	4.2	Types of Report Writing		
	4.3	Project Report Writing		
	4.4	Social Networking: Advantages, Opportunities, Making Contacts		
	Total		**13**	**100%**

References:

1. Adair, John. *Effective Communication: The most important management skill of all*. Rev. ed. Pan Macmillan, 2011.
2. Crystal, D. *The Cambridge Encyclopaedia of the English Language*. Cambridge: Cambridge University Press.1997
3. Jones, Leo. *Working in English*, Cambridge University Press, 2001
4. Krishnaswamy N & T Sriraman. *Creative English for Communication*, Macmillan India Limited, 2000.
5. Lesikar, Raymond V., & John D. Pettit, Jr. *Report Writing for Business*: Tenth Edition. Delhi: McGraw-Hill, 1998.
6. Mascull, Bill. *Business Vocabulary in Use Advanced*, Cambridge University Press, 2004.
7. Prasad, H. M. *How to Prepare for Group Discussion and Interview*. New Delhi: Tata McGraw-Hill Publishing Company Limited, 2001.
8. Raman, Meenakshi & Singh, Prakash. *Business Communication*, Oxford University Press, 2006.

9. Seely, John. *Writing Reports*. New York: Oxford University Press, 2002.
10. Sharma, R. C. & Krishna Mohan. *Business Correspondence and Report Writing*: Third Edition. New Delhi: Tata McGraw-Hill Publishing company Limited, 2007.
11. Smoke, Trudy. *A Writer's Workbook: A Writing Text with Readings*, Cambridge University Press, 2005

Semester-IV

Course Code	Course Name	Credits
BEH2413N	BEHAVIOURAL SCIENCE-IV	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	-	01	-	-	01

Theory				
Internal Assessment				
Activity	**Assignment**	**Viva**	**Attendance**	**Total**
20	40	35	05	**100**

Course Objectives

1. To introduce the student about stress and coping mechanisms.
2. To take students, step by step, through an interactive understanding of each of the basic related to stress and coping mechanisms.
3. To give the student a basic understanding of stress and coping mechanisms so that they can have a better understanding of how to cope with stressors.
4. To give the student a basic understanding which will act as a foundation for dealing with general life stress.
5. To develop an understanding of stress and coping mechanisms
6. To understand ability to recognize and manage stress triggers.

Course Outcomes

1. The knowledge of this subject is essential to understand about Stress and Coping Strategies as a human is very important concept to understand Stress as stress.
2. To help students become aware of the signs and symptoms of stress early, to prevent chronic stress.
3. To help students identify potential sources of stress and to develop an awareness that they can cope with the stress in their lives.
4. To Enhanced emotional resilience and stability.
5. Better work-life balance and reduced burnout.
6. Strengthened support networks and relationships.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**Introduction of Stress**		4	15%
	1.1	Nature, Meaning & characteristics of Stress.		
	1.2	Psychological meaning of Stress		
	1.3	Primary appraisal, secondary appraisal, and past experiences		
	1.4	Sign and Symptoms of Stress		
2	**Types & Sources of stress**		2	15%
	2.1	Stages of stress, The physiology of stress		
	2.2	Stimulus-oriented approach.		
	2.3	The transactional and interactional model.		
	2.4	Pressure – environment fit model of stress.		
3	**Causes and symptoms of stress**		2	16%
	3.1	Personal, Organizational and Environmental		
	3.2	Cognitive & Behavioral symptoms		
	3.3	Stress and Immune system		
	3.4	GAD and symptoms in general life		
4	**Consequences of stress**		2	18%
	4.1	Effect on behavior and personality		
	4.2	Effect of stress on performance		
	4.3	Individual and Organizational consequences with special focus on health		
	4.4	Effect of stress on physical health		
5	**Strategies for stress management**		2	
	5.1	Coping with Stress: Stress management techniques, Meditation procedure		

	5.2	Meditation procedure and Biofeedback		
	5.3	Positive health, happiness, and wellbeing		
	5.4	Relaxation Techniques		
	Total		**13**	**100%**

References:

1. McEwen, B. S. (2002). The End of Stress as We Know It. Dana Press
2. Sapolsky, R. M. (2004). Why Zebras Don't Get Ulcers (3rd ed.). Holt Paperbacks.
3. Marmot, M. G., & Wilkinson, R. G. (2006). Social Determinants of Health (2nd ed.). Oxford University Press.
4. Cohen, S., Janicki-Deverts, D., & Miller, G. E. (2007). Psychological stress and disease. JAMA, 298(14), 1685-1687.
5. Seligman, M. E. P. (2011). Flourish: A Visionary New Understanding of Happiness and Well-being. Atria Books.
6. Ganster, D. C., & Rosen, C. C. (2013). Work stress and employee health: A multidisciplinary review. Journal of Management, 39(5), 1085-1122.

Semester-IV

Course Code	Course Name	Credits
VOC2415N	INTRODUCTION TO PROGRAMMING WITH PYTHON-II	03

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	01	-	02	01	-	03

Theory					TermWork/Practical/Oral			
Internal Assessment			End Sem Exam	Duration of End Sem Exam	Term Work	Pract.	Oral	Total
Continuous Evaluation / Coding Report	Attendance	Total						
45	05	**30**	**70**	2 Hours	-	-	-	**100**

Course Objectives

1. To learn about NumPy, Pandas and Matplotlib libraries.
2. To analyse data using NumPy, Pandas and Matplotlib libraries.

Course Outcomes

On completion of this course, student will be able to:

1. understand basic concepts in the NumPy, Pandas, Matplotlib and Seaborn libraries,
2. sort data using NumPy, Pandas, Matplotlib and Seaborn libraries,
3. perform data analysis using NumPy, Pandas, Matplotlib and Seaborn libraries,
4. use Matplotlib and Seaborn libraries for plotting graphs and data visualization,
5. write Python codes using NumPy, Pandas, Matplotlib and Seaborn libraries, and
6. use Python for general data analysis and visualization studies.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
Introduction to NumPy			
1	Understanding data types in Python, Basics of NumPy Arrays, Computations on NumPy Arrays,	06	17%
2	Aggregations, Comparisons, Masks and Boolean Logic Examples, Fancy Indexing, Sorting Arrays, Structured Data.	07	18%
Data Manipulation with Pandas			
3	Installing and using Pandas, Introducing Pandas Objects, Data Indexing and Selection, Operating on Data in Pandas,	07	15%
4	Combining Datasets, Aggregations and Grouping, Pivot Tavles, Data Analysis	06	15%
Visualization with Matplotlib & Seaborn			
5	Introduction to Matplotlib, Simple line plots, Simple Scatter plots, Visualizing Errors, Density and Contour Plots, Histograms,	07	17%
6	Binnings and Density, Customizing Plot Legends, Customizing Colorbars, Multiple subplots, Customizing ticks, Visualization with Seaborn.	06	18%
7	**Project**: To be performed Program-wise in parallel with above modules.		
Total		**39**	**100%**

References:

1. *Python for Everybody: Exploring Data Using Python 3* by Dr Charles R. Severance, ISBN: 1530051126, 9781530051120 (2016).
2. *Master Python Using Version 3.11: Learn Python Like Never Before* by Abhishek Singh, ISBN: 979-8385523276 (First edition, March 2023).
3. *Python from the Very Beginning* by John Whitington, ISBN: 979-8852254672 (July 2023).
4. *Python Data Science Handbook: Essesntial tools for working with Data* by Jake VanderPlas, ISBN: 9781491912058 (2016).
5. *Data Analysis with Python* by Bernd Klein.

Semester-IV

Course Code	Course Name	Credits
DSC2417N	DATA SCIENCE AND COMPUTATION: BASICS OF MACHINE LEARNING	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	-	02	-	-	02

Theory						Total
Internal Assessment				External		
Assignment	**Coding Report**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
20	25	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. Introduce students to the fundamental concepts of machine learning, including its definition, applications, and types, with a focus on supervised and unsupervised learning algorithms, implemented using Python.

Course Outcomes

1. Proficiency in supervised learning algorithms for prediction tasks.
2. Competence in unsupervised learning techniques for data grouping.
3. Successful completion of a practical project showcasing machine learning skills.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Introduction of Machine Learning** Bivariate distribution Correlation, Types of Correlation, Simple Correlation Coefficient for ungrouped data, Properties and Interpretation of Correlation Coefficient, Coefficient of determination, Scatter diagram, Standard, Error, Probable error of Correlation Coefficient. Rank correlation, Some examples, Linear regression, method of least squares. (Coding of above concepts using Python).	8	30%

2	**K-means clustering of Big Data Set** Formulation of Hypothesis (One-tailed & Two-tailed), Type I and Type II errors, power of a test, Significance of a test, P-value testing, Hypothesis testing (student's T-test, F-test, Chi-square test). Analysis of variance (ANOVA). (Coding of above concepts using Python).	9	35%
3	**Markov Clustering of Big Data Set** Explanations of Markov clustering, to find out network analysis of small ligand migrations in Macromolecules.	9	35%
4	**Project**: To be performed Program-wise in parallel with above modules.		
Total		**26**	**100%**

References:

1. **Introduction to Machine Learning with Python: A Guide for Data Scientists**
   Andreas C. Müller, Sarah Guido, 1st Edition (2016), O'Reilly Media, ISBN-13: 978-1449369415
2. **Machine Learning: A Probabilistic Perspective**
   Kevin P. Murphy, 1st Edition (2012), MIT Press, ISBN-13: 978-0262018029
3. **Pattern Recognition and Machine Learning**
   Christopher M. Bishop, 1st Edition (2006), Springer, ISBN-13: 978-0387310732
4. **Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow**
   Aurélien Géron, 2nd Edition (2019), O'Reilly Media, ISBN-13: 978-1492032649
5. **Python Machine Learning**
   Sebastian Raschka, Vahid Mirjalili, 3rd Edition (2023), Packt Publishing, ISBN-13: 978-1800567700
6. **Python Machine Learning for Beginners**
   Arman Zahedi, 1st Edition (2018), Independently Published, ISBN-13: 978-1983355757
7. **Machine Learning for Beginners: A Comprehensive Introduction to Neural Networks and Machine Learning Algorithms**
   Kamal Ved, 1st Edition (2019), Independently Published, ISBN-13: 978-1795926762
8. **Machine Learning in Python: Hands-On for Beginners**
   Johnson R. Mark, 1st Edition (2018), Independently Published, ISBN-13: 978-1979486060
9. **Introduction to Machine Learning with Python: A Step-by-Step Guide to Learn and Master Python Machine Learning**
   Hrishikesh Aradhye, 1st Edition (2017), Independently Published, ISBN-13: 978-1986281558
10. **Machine Learning for Absolute Beginners: A Plain English Introduction**
    Oliver Theobaldo, 1st Edition (2018), Independently Published, ISBN-13: 978-1979524397

Semester-IV

Course Code	Course Name	Credits
ANM2417N	ANIMATION-III	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	02	-	01	01	-	02

Theory						Total
Internal Assessment				External		
Test	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
35	10	05	**50**	**50**	2 Hours	**100**

Course Objectives

5. To enhance students' proficiency in advanced animation software and techniques.
6. To develop a deep understanding of character animation, storytelling, and visual communication.
7. To cultivate critical thinking and problem-solving skills in animation production.
8. To prepare students for careers in animation through the creation of a professional animation portfolio.

Course Outcomes

1. Advanced Animation Skills: Students will demonstrate proficiency in advanced animation techniques, including character animation, rigging, and effects.
2. Creative Storytelling: Students will develop the ability to create compelling narratives and visual stories through animation.
3. Technical Proficiency: Students will gain advanced technical skills in animation software and tools.
4. Professional Portfolio: Students will create a professional animation portfolio showcasing their skills and creativity.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Advanced Character Animation**	6	20%
	Character Acting and Emotion: Explore advanced techniques for character acting, conveying emotions, and creating believable performances.		
	Advanced Rigging and Controls: Learn advanced rigging techniques to create flexible and expressive character rigs.		
	Lip Sync and Facial Animation: Master the art of lip syncing and facial animation to bring characters to life.		
	Advanced Animation Exercises: Practice advanced animation exercises to refine animation skills and techniques.		
2	**Visual Storytelling and Cinematography**	6	20%
	Storyboarding for Animation: Develop storyboarding skills for animation, focusing on shot composition, pacing, and visual storytelling.		
	Cinematic Techniques in Animation: Explore advanced cinematic techniques, such as camera angles, lighting, and mood, to enhance storytelling.		
	Editing and Timing: Animating to Audio: Sync animation with audio tracks, including dialogue, music, and sound effects, to create cohesive storytelling.		
	Animating to Audio: Sync animation with audio tracks, including dialogue, music, and sound effects, to create cohesive storytelling.		
3	**Advanced Animation Production**	6	30%
	Short Film Production: Collaborate with peers to produce a short, animated film, applying advanced animation techniques and principles.		
	Visual Effects and Dynamics: Learn to create visual effects and dynamics, such as particle systems, cloth simulations, and fluid dynamics, in animation.		

	Motion Capture and Performance Capture: Explore the use of motion capture and performance capture technologies in animation production.		
	Interactive Animation: Learn about interactive animation techniques for games and other interactive media.		
4	**Advanced Rigging Techniques:**	8	30%
	Character and Object Rigging: Development of complex rigs for characters and objects with advanced controls and deformations.		
	Sophisticated Animation Methods: Character Animation: Techniques for animating detailed character interactions and nuanced movements.		
	Motion Capture Integration: Data Utilization: Importing and refining motion capture data for enhanced realism in character animations.		
	Advanced Visual Effects: Effects Creation: Techniques for creating and integrating complex visual effects, including particle systems and fluid dynamics.		
Total		**26**	**100%**

References:

1. Williams, R. (2012). The animator's survival kit. Faber & Faber.
2. Hooks, E. (2017). Acting for animators: 4th edition. Routledge.
3. Vaughan, W. (2012). Digital modeling. New Riders.
4. Kerlow, I. V. (2017). The art of 3D computer animation and effects (4th ed.). Wiley.
5. Goldberg, E. (2008). Character animation crash course! Silman-James Press.
6. Osipa, J. (2013). Stop staring: Facial modeling and animation done right (3rd ed.). Wiley.

Semester-IV

Course Code	Course Name	Credits
PHT2417N	PHOTOGRAPHY-III	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	02	-	01	01	-	02

Theory						Total
Internal Assessment				External		
Test	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
35	10	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. Students will get an overview on different genres of photography
2. Analyzing the difference of the photography culture
3. Analyzing the difference of the photography, composition and technical aspects used in shooting related subjects.
4. The aim of the course is to train the mind in how to see the world through a camera.

Course Outcomes

1. Students will know about Product Photography
2. Student will learn about Glamour Studio Photography
3. How to control exposure during event photography
4. How to use camera in wildlife photography

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Photojournalism**	6	20%
	What is Photojournalism		
	How to deal with people		

	How to get information		
	How to find perfect frame		
2	**Table-top Photography**	6	20%
	Product Selection		
	Props Selection		
	Gear-Camera selection		
	How to use light		
3	**Glamour Photography**	6	30%
	How to use Artificial light		
	One point – Two point – Three Point lighting		
	Makeup		
	Retouching		
4	**Assignment: Assignment: Shooting Travel Photography, Portrait Photography**	8	30%
	Framing		
	Composition		
	Color Palette		
	Techniques		
Total		**26**	**100%**

References:

1. World of DSLR
2. The British Journal of Photography
3. Ang, T., & Studd, R. (2013). Digital Photography Step by Step.
4. Frost, L. (2019). Creative Photography Ideas Using Adobe Photoshop: 75 Workshops to Enhance Your Photographs. Ilex Press.
5. Hirsch, R. (2014). Seizing the light: A history of photography. McGraw-Hill Education.
6. Sontag, S. (1977). On photography. Farrar, Straus, and Giroux.

Semester-IV

Course Code	Course Name	Credits
POL2417N	POLITICAL SCIENCE-III	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	01	01	-	01	02

Theory						Total
Internal Assessment				External		
Mid Sem	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	30	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. To understand the structure and functioning of the Indian political system: This objective aims to provide students with a comprehensive understanding of the institutions, processes, and principles that govern the Indian political system.
2. To analyze the dynamics of Indian democracy and governance: This objective focuses on examining the various dimensions of Indian democracy, including electoral politics, political parties, federalism, and governance challenges.
3. To evaluate the impact of socio-economic and cultural factors on Indian politics: This objective aims to explore the interplay between socio-economic, cultural, and political factors in shaping the Indian polity.

Course Outcomes

1. Memorize the structure and functions of different branches of the Indian government, including the legislature, executive, and judiciary.
2. Explain the principles of Indian democracy and the features of its political system, including federalism, secularism, and parliamentary democracy.
3. Apply theoretical concepts and frameworks to analyse current political issues and trends in Indian society.
4. Compare and contrast different political ideologies and movements influencing Indian politics, such as socialism, liberalism, and nationalism.
5. Critically assess the strengths and weaknesses of India's democratic institutions and governance structures.
6. Develop strategies for enhancing political participation, accountability, and representation in the Indian political system.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Introduction to Indian Political System**	5	20%
	Introduction to key concepts: democracy, federalism, secularism		
	Historical background of Indian political system		
2	**Institutions of Indian Democracy**	6	20%
	Parliament and Legislative Process		
	Executive Branch		
	Judiciary and Legal System		
3	**Political Dynamics in India**	7	30%
	Evolution of party system in India		
	Electoral process, party competition, and electoral reforms		
4	**Contemporary Issues and Challenges**	8	30%
	Regionalism in Indian Politics		
	New Social Movements since the 1970s, Environmental Movements, Women's Movements, Human Rights Movements		
Total		**26**	**100%**

References:

1. B. Chandra, Essays on Colonialism, Orient Longman, Delhi, (1999).
2. S. Sarkar, Modern India, Macmillan, Delhi (1983).
3. B. Chandra et. al. (eds.), India's Struggle for Independence, Penguin UK, 2016.
4. P. Brass, The Politics of India since Independence, Cambridge University Press, Cambridge (1994).
5. B.Chakrabarty & R.K.Pandey, Indian government and Politics. SAGE Publications India, New Delhi (2008).
6. Hoveyda, Indian Government and Politics, Pearson Education India, New Delhi (2010).

Semester-IV

Course Code	Course Name	Credits
TSM2417N	TOURISM MANAGEMENT-III	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	01	01	-	01	02

Theory						Total
Internal Assessment				External		
Mid Sem	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	30	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. To obtain knowledge on new emerging trends of Tourism in India.
2. To study the effect of the emerging trends on Indian Economy.

Course Outcomes

1. Students will be able to remember and identify significant patterns and factors that have influenced the growth and development of tourism in India.
2. Students will be able to interpret and describe the factors contributing to the growth of Indian tourism and explain the patterns in foreign tourist arrivals.
3. Students will be able to map and analyze tourism trends in states like Tamil Nadu, Uttar Pradesh, Karnataka, Madhya Pradesh, Delhi, and Maharashtra, and understand the impact of these trends on state tourism organizations.
4. Students will critically evaluate and analyze emerging tourism trends, products, and technologies that are shaping the future of the industry.
5. Students will evaluate the implications of the latest trends and emerging tourism products, considering their potential impact on the industry
6. Students will create comprehensive presentations or case studies on the latest tourism trends, synthesizing information from various sources to provide detailed explanations and insights.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Mapping Trends in Tourism**	7	25%
	Domestic and International Trends and Patterns in Indian Tourism Travel.		
	Factors responsible for growth and development of Indian tourism		
	Foreign Tourist Arrivals accounting.		
2	**Current Tourism Scenario in India**	7	30%
	State Tourism Organizations: - Changing pattern observed on the arrival of tourists.		
	Mapping and analyzing of tourism trends of the following states: - Tamil Nadu, Uttar Pradesh, Karnataka, Madhya Pradesh, Delhi, Maharashtra.		
3	**Emerging Tourism Trends**	7	30%
	Emerging trends within tourists and travelers		
	Emerging tourism products of India		
	Emerging technologies, change in scope of tourism		
4	**Case Study**	5	15%
	Presentation on any latest/emerging tourism trend in the country and explain in detail.		
Total		**26**	**100%**

References:

1. Tourism: Principles and Practice by John Fletcher, Alan Fyall, David Gilbert, and Stephen Wanhill (2017)
2. Emerging Trends in Tourism and Hospitality by B. I. Mahajan and S. R. Vyas (2018)
3. Indian Tourism: Past, Present, and Future by Patrick M. Casabona (2020)
4. Tourism in India: New Trends and Opportunities by Ratandeep Singh (2016)
5. Sustainable Tourism Practices in the Tourism Industry by James E. S. Higham and Michael Lück (2016)

Semester-IV

Course Code	Course Name	Credits
SCW2417N	SOCAL WORK-III	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	01	-	01	01	-	02

Theory						Total
Internal Assessment				External		
Mid Sem	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	30	05	**50**	**50**	2 Hours	**100**

Course Objectives

1. To study the basic concepts of social problem and social work approaches.
2. To understand various social problems and its management and legislative measures.
3. To understand role of social work and social worker in management of social problems.
4. To study social development and social change process to deal with social problems.

Course Outcomes

1. Students will understand conceptual and theoretical aspects of social problems in India.
2. Student will be aware about the problems and crimes of society.
3. Students will be able to understand the problems and effects individual, family & society.
4. Students should be able to handle social problems and treatment. In future, they would contribute to social policy making as a social work professional.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Social Problems**	7	25%
	Social problems: Meaning, Concept and Definitions,		
	Classification of social problems.		
2	Causes and consequences of social problems.	7	30%

	Social work approach in the prevention, control, and management of social problems.		
	Various Social Problems in India		
3	Extent, causes, management and legislative measures	7	30%
	Youth Unrest, Human Trafficking, Substance Abuse, Beggary, Commercial Sex Work, Corruption, Terrorism, Child labour, Role of social worker in identifying social problems and developing strategies for help		
4	Case-studies	5	15%
Total		**26**	**100%**

References:

1. Ahuja, Ram (1992), Social Problems in India, Rawat Publications, Jaipur.
2. Keneth, Henry (1978), Social Problems: Institutional and Interpersonal Perspectives, Scott, Foresman and Company, Illinois, London.
3. Merton, Robert K, and Robert Nisbet (1971), Contemporary Social Problems, Fourth Edition, Harcourt Brace and Co., New York.

Semester - V						
	Course Code	**Course Title**	**Lecture Credits**	**Tutorial Credits**	**Practical Credits**	**Total Credits**
Discipline-I (Core)						**12**
Discipline-I	MTH2501N	Matric Spaces	3	1	-	4
	MTH2502N	Complex Analysis	3	1	-	4
	MTH2503N	Numerical Analysis	2	1	-	3
	MTH2504N	Numerical Analysis Lab	-	-	1	1
Discipline-II (any one from the basket)						**4**
Discipline-II	PHY2508N PHY2509N	Physics-V Physics-V Lab	2 -	1 -	- 1	3 1
	CHY2508N CHY2509N	Chemistry-V Chemistry-V Lab	2 -	1 -	- 1	3 1
	STA2504N	Advanced Operations Research	3	1	-	4
Total (Discipline-I + II)						**16**
Foreign Language (any one from the basket)						**2**
Foreign Language	FLF2511N	French-V	2	-	-	2
	FLG2511N	German-V				
	FLS2511N	Spanish-V				
Communication Skills	CSE2512N	Employability Skill	1	-	-	1
Sub Total						**3**
Behavioural Science	BEH2513N	Behavioural Science-V	1	-	-	1
Sub Total						**1**
VAC-III	PHE2318N	Physical Education & Sports**	-	-	-	0
Total						**4**
SIP/Internship/ Project/Dissertation/ Field Visit	MTH2521N	Summer Internship	-	-	-	5
Total						**5**
Grand Total						**25**

Semester-V

Course Code	Course Name	Credits
MTH2501N	METRIC SPACES	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. To understand the fundamental concepts of metric spaces and their properties.
2. To learn about the different types of metrics and examples of standard metric spaces.
3. To explore the concepts of continuity, connectedness, and compactness in metric spaces.
4. To study the relationship between various properties of metric spaces such as separability, second countability, and denseness.
5. To investigate the structure of open sets and the implications of connectedness and continuity in real and complex analysis.
6. To comprehend the concept of completeness and its significance in the context of metric spaces.

Course Outcomes

1. Students will be able to define and provide examples of various metric spaces, including Euclidean and discrete metrics.
2. Students will understand and apply the concepts of open sets, closed sets, limit points, and metric topology.
3. Students will be able to analyze and interpret the properties of continuous functions within metric spaces.
4. Students will gain insight into the concepts of connectedness and compactness, and their applications in real and complex analysis.
5. Students will learn to construct and utilize sequences, subsequences, and Cauchy sequences in the study of metric spaces.
6. Students will be able to prove and apply the Heine-Borel theorem and understand the implications of uniform continuity and compactness in metric spaces.

Detailed Syllabus

Module		Content	Hours	Marks Weightage
1	**Module I: Metric Spaces**		5	10%
	1.1	Metric, examples of standard metric spaces including Euclidean and Discrete metrics.		
	1.2	Open ball, closed ball, open sets; metric topology; closed sets		
	1.3	Limit points and their fundamental properties;		
2	**Module II: Topological Spaces**		5	10%
	2.1	Interior, closure and boundary of subsets and their interrelation		
	2.2	Denseness		
	2.3	Separable and second countable metric spaces and their relationship		
3	**Module III: Continuity and Real-Valued Functions**		5	10%
	3.1	Definition of continuous functions, algebra of real/complex-valued continuous functions.		
	3.2	Distance between a point and a subset, distance between two subsets.		
4	**Module IV: Connectedness and Continuity**		10	15%
	4.1	Connectedness, connected subset of the real line R		
	4.2	Open connected subset in R^2 components; components of open sets in R and R^2		
	4.3	Structure of open set in R, continuity and connectedness; intermediate value theorem.		
5	**Module V: Sequences and Completeness**		12	25%
	5.1	Sequence, subsequence, and their convergence.		
	5.2	Cauchy sequence and completeness, completeness of R^n ; Cantor's theorem concerning completeness		
	5.3	Definition of completion of a metric space, construction of the reals as the completion of the incomplete metric space of the rationals with usual distance (without proof). Continuity preserves convergence.		

6	**Module VI: Compactness**		15	30%
	6.1	Definitions (by means of open covering), Compact metric spaces and finite intersection property (FIP) of closed sets.		
	6.2	Compact subsets, continuity, and compactness; sequential compactness,		
	6.3	Equivalence between compactness and sequential compactness, relation between compactness, completeness and total boundedness		
	6.4	Heine-Borel theorem concerning characterization of compact subsets of R^n. Uniform continuity and continuity on compact sets; distance between two non-empty disjoint closed sets, one of which is compact, is a positive real.		
Total			**52**	**100%**

References:

1. R. G. Bartle and D. R. Sherbert, **Introduction to Real Analysis**, Fourth Edition, Wiley, 2011, ISBN 978-0470647691.
2. S. R. Ghorpade and B. V. Limaye, **A Course in Calculus and Real Analysis**, First Edition, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2006, ISBN 978-0387687692.
3. K. A. Ross, **Elementary Analysis: The Theory of Calculus**, Second Edition, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2013, ISBN 978-1461462712.
4. W. Rudin, **Principles of Mathematical Analysis**, Third Edition, McGraw-Hill, 1976, ISBN 978-0070542358.
5. B. S. Thomson and J. B. Bruckner**, Elementary Real Analysis**, Second Edition, Springer, 2008, ISBN 978-0971576684.
6. S. Narayan and M. D. Raisinghania, **Elements of Real Analysis**, Fourteenth Edition, S. Chand Limited, 2022, ISBN 978-8121903066.
7. R. D. Sarma, A. Gupta, and R. Singh, **Concepts of Real Analysis**, First Edition, Sultan Chand & Sons, 2022, ISBN 978-9391820275.

Semester-V

Course Code	Course Name	Credits
MTH2502N	COMPLEX ANALYSIS	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. To study the development and applications of functions of one complex variable.
2. To learn techniques of complex variables and functions, including their derivatives and contour integration.
3. To explore transformations in the complex plane.
4. To understand complex power series and the classification of singularities.
5. To study the calculus of residues and its applications in the evaluation of integrals.
6. To gain proficiency in using complex analysis concepts and properties in various problems.

Course Outcomes

1. Identify curves and regions in the complex plane defined by simple expressions.
2. Describe basic properties of complex integration and compute such integrals.
3. Determine when and where a given function is analytic.
4. Find series developments of analytic functions.
5. Apply concepts of complex power series and singularities.
6. Utilize the calculus of residues in evaluating integrals and other applications.

Detailed Syllabus

Module		Content	Hours	Marks Weightage
1	**Module I: Complex Numbers**		08	15%
	1.1	Complex Numbers: De-Moivre's Theorem and its Applications		
	1.2	Exponential, Sine, Cosine, and Logarithm of a complex number. Definition of $a^z (a \neq 0)$.		
	1.3	Inverse circular and Hyperbolic functions.		
2	**Module II: Fundamental Concepts in Complex Analysis**		08	15%
	2.1	Review of complex plane, sequences and series		
	2.2	Stereographic projection		
	2.3	Connected sets and polygonally connected sets in the complex plane		
3	**Module III: Analyticity**		08	15%
	3.1	Analytic polynomials, analytic functions		
	3.2	Power series,		
	3.3	Cauchy-Riemann equations, functions ez, sin z, and cos z.		
4	**Module IV: Complex Integration and Theorems**		10	20%
	4.1	Line integrals and their properties, closed curve theorem for entire functions, Cauchy integral formula, and Taylor expansions for entire functions		
	4.2	Liouville's theorem and the fundamental theorem of algebra.		
5	**Module V: Analytic Functions and Mapping**		10	20%
	5.1	Power series representation for functions analytic in a disc, analyticity in an arbitrary open set, uniqueness theorem		
	5.2	definitions and examples of conformal mappings, bilinear transformations		
	Module VI: Fourier Series		08	15%

6	6.1	Fourier series, Piecewise continuous functions, Fourier cosine and sine series		
	6.2	property of Fourier coefficients, Fourier theorem, discussion of the theorem, and its corollary.		
Total			**52**	**100%**

References:

1. Stein, E. M. and Shakarchi, R., **Complex Analysis**, second edition, Princeton Lectures in Analysis, Princeton University Press, 2010, ISBN 978-0691169181.
2. Bak, J. and Newman, D. J., **Complex Analysis**, second edition, Undergraduate Texts in Mathematics, Springer, 1997, ISBN 978-3031058973.
3. J. P. D'Angelo, **An Introduction to Complex Analysis and Geometry**, second edition, Cambridge University Press, 2018, ISBN 978-1009411457.
4. Fourier Series, **Lecture Notes** Published by the Institute of Lifelong Learning, University of Delhi, Delhi, 2011.
5. S. Narayan, **Theory of Functions of a Complex Variable**, second edition, S. Chand & Company, 2020, ISBN 978-8121919791.
6. R. Kumar, **Complex Analysis**, Tata McGraw-Hill Education, 2007, ISBN 978-0070705793.

Semester-V

Course Code	Course Name	Credits
MTH2503N	NUMERICAL ANALYSIS	03

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	01	02	-	01	03

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. To understand and apply various methods for solving algebraic and transcendental equations.
2. To learn interpolation techniques and their applications for estimating values within a range of data points.
3. To explore numerical differentiation and integration methods and their practical uses.
4. To apply numerical methods for solving ordinary differential equations.
5. To perform statistical computations and data fitting using various techniques.
6. To develop problem-solving skills and computational techniques for scientific and engineering applications.

Course Outcomes

1. Apply methods like Bisection, Iteration, and Newton-Raphson for solving algebraic and transcendental equations.
2. Utilize finite differences and interpolation techniques for estimating and predicting data points.
3. Implement numerical differentiation and integration using rules like Trapezoidal and Simpson’s.
4. Solve ordinary differential equations using methods such as Euler’s and Runge-Kutta.
5. Perform statistical computations, including curve fitting and data fitting with cubic splines.
6. Analyze and interpret the results of numerical and statistical methods in various applications.

Detailed Syllabus

Module		Content	Hours	Marks Weightage
1	**Module I: Solution of Algebraic and Transcendental Equation**		04	10%
	1.1	Error in a series approximation Bisection Method, Iteration method, Method of false position		
	1.2	Newton-Raphson method		
2	**Module II: Solution of Simultaneous Equations**		05	10%
	2.1	Gauss Elimination Method		
	2.2	Jacobi Iteration Method		
	2.3	Gauss-Seidel Method		
3	**Module III: Interpolation**		10	25%
	3.1	Finite Differences, Difference tables, Polynomial Interpolation: Newton's forward and backward formula		
	3.2	Central Difference Formulae: Gauss forward and backward formula. Interpolation with unequal intervals		
	3.3	Lagrange's Interpolation, Newton's Divided difference formula		
4	**Module IV: Numerical Integration and Differentiation**		08	20%
	4.1	Introduction, Numerical differentiation, Numerical Integration		
	4.2	Trapezoidal rule, Simpson's 1/3 and 3/8 rules.		
5	**Module V Solution of Differential Equations**		07	20%
	5.1	Euler's Method		
	5.2	Runge-Kutta Method		
6	**Module VI: Statistical Computation**		05	15%
	6.1	Frequency chart, Curve fitting by method of least squares, Fitting of straight lines		
	6.2	Polynomials, exponential curves, etc., Data fitting with Cubic splines.		

Total	**39**	**100%**

References:

1. V. Rajaraman, **Computer Oriented Numerical Methods**, third edition, PHI Learning Pvt. Ltd., 2018, ISBN 978-8120316108.
2. C.F. Gerald and P.O. Wheatley, **Applied Numerical Analysis**, seventh edition, Pearson/Addison-Wesley, 2004, ISBN 978-0321133045.
3. A. W. Jain, S.R.K. Iyengar, and R.K. Jain, **Numerical Methods for Scientific and Engineering Computations**, sixth edition, New Age International, 2012, ISBN 978-8122438754.
4. B. S. Grewal, **Numerical methods in Engineering and Science**, ninth edition, Khanna Publishers, 2017, ISBN 978-8174093225.
5. T. Veerarajan and T. Ramachandran, **Theory and Problems in Numerical Methods**, first edition, Tata McGraw-Hill Publishing Company Limited, 2008, ISBN 978-0070634593.
6. P. Niyogi, **Numerical Analysis and Algorithms**, first edition, Tata McGraw-Hill, 2003, ISBN 978-0070494930.
7. F. Scheid, **Numerical Analysis**, second edition, McGraw-Hill, 1988, ISBN 978-0070552210.
8. S. S. Sastry, **Introductory Methods of Numerical Analysis**, fifth edition, PHI Learning Pvt. Ltd., 2012, ISBN 978-8120345924.
9. C.B. Gupta, **Introduction to Statistical Methods**, fourth edition, Vikas Publishing House, 1995, ISBN 978-0706996226.

Semester-V

Course Code	Course Name	Credits
MTH2504N	NUMERICAL ANALYSIS LAB	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
-	02	-	-	01	-	01

Practical						Total
Internal Assessment				External		
Lab Journal	**Performance**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Understand Key Numerical Methods
2. Apply Numerical Methods to Real-World Problems
3. Gain Proficiency in Scientific Software
4. Explore Statistical Computation Techniques
5. Evaluate Accuracy and Efficiency of Methods
6. Bridge Theory and Practical Application.

Course Outcomes

1. Implement and analyze root-finding methods like bisection and Newton-Raphson using software
2. Apply and assess methods such as Gauss elimination and Jacobi iteration for solving linear equations
3. Implement and utilize polynomial interpolation methods like Newton's and Lagrange's formulas
4. Apply numerical integration and differentiation techniques to approximate functions
5. Solve differential equations using Euler's and Runge-Kutta methods
6. Implement least squares and cubic spline techniques for curve fitting and data analysis

Practical exercises focused on using software such as R, Python (with libraries like Pandas, NumPy, and SciPy), Excel, MATLAB or GNU Octave for hands-on numerical analysis.

Detailed Syllabus

Module		Content	Hours	Marks Weightage
1	**Series Approximation**		02	5%
	1.1	Implement series approximations (e.g., Taylor series) and calculate truncation errors. Compare the approximated results with exact values.		
2	**Root-Finding Methods**		02	10%
	2.1	Write a script to apply the bisection method for finding roots of nonlinear equations. Analyze the convergence and accuracy of the results.		
	2.2	Implement fixed-point iteration for solving nonlinear equations and visualize the iteration process and convergence.		
	2.3	Develop a script to use the Regula Falsi method for root-finding. Compare results with other root-finding methods in terms of accuracy and convergence.		
	2.4	Code the Newton-Raphson method for solving nonlinear equations and visualize the results. Compare the performance with bisection and false position methods.		
3	**Gauss Elimination Method for Solving Simultaneous Equations**		02	8%
	3.1	Implement Gauss Elimination to solve systems of linear equations. Apply it to different matrix sizes and analyze the computational efficiency.		
4	**Simultaneous Equations**		02	8%
	4.1	Write a script to solve linear equations using the Jacobi Iteration method. Compare the results with the Gauss-Seidel method.		
	4.2	Implement the Gauss-Seidel method for solving linear equations and measure its convergence rate compared to the Jacobi method.		
5	**Interpolation**		02	8%
	5.1	Apply Newton's forward and backward interpolation formulas to estimate unknown values from given data. Compare accuracy with other interpolation methods.		

	5.2	Implement Lagrange's interpolation for a set of data points and plot the interpolation polynomial. Compare results with Newton's method.		
6	**Newton Divided Difference Interpolation**		02	8%
	6.1	Use Newton's divided difference formula for interpolation with data points that have unequal intervals. Compare with other interpolation methods.		
7	**Numerical Differentiation and Integration**		02	8%
	7.1	Implement numerical differentiation and the trapezoidal rule to compute derivatives and integrals of functions. Visualize and compare the results.		
8	**Trapezoidal Rule for Numerical Integration**		02	8%
	8.1	Apply trapezoidal rules to approximate definite integrals		
9	**Simpson's 1/3 and 3/8 Rules for Numerical Integration**		02	8%
	9.1	Apply Simpson's 1/3 and 3/8 rules to approximate definite integrals and compare accuracy with the trapezoidal rule.		
10	**Euler's Method for Solving Differential Equations**		02	8%
	10.1	Implement Euler's method to solve ordinary differential equations and plot the numerical solution against the exact solution.		
11	**Runge-Kutta Methods for Solving Differential Equations**		02	7%
	11.1	Code the 4th-order Runge-Kutta method to solve differential equations and compare the accuracy with Euler's method.		
12	**Curve Fitting Using the Least Squares Method**		02	7%
	12.1	Use least squares fitting to model data with straight lines, polynomials, and exponential functions. Evaluate the fit quality and visualize the results.		
13	**Data Fitting Using Cubic Splines**		02	7%
	13.1	Apply cubic spline fitting to data using built-in functions and compare the smoothness and accuracy with polynomial fitting methods.		
Total			**26**	**100%**

References:

1. **Numerical Methods in Engineering with Python**
   Jaan Kiusalaas, 3rd Edition (2013), Cambridge University Press, ISBN-13: 978-1107033856
2. **Numerical Methods for Engineers and Scientists: An Introduction with Applications Using MATLAB**
   Amos Gilat and Vish Subramaniam, 3rd Edition (2013), Wiley, ISBN-13: 978-1118554937
3. **Applied Numerical Methods with MATLAB for Engineers and Scientists**
   Steven C. Chapra, 4th Edition (2017), McGraw-Hill Education, ISBN-13: 978-0073397962
4. **Python Programming and Numerical Methods: A Guide for Engineers and Scientists**
   Qingkai Kong, Timmy Siauw, and Alexandre Bayen, 1st Edition (2020), Academic Press, ISBN-13: 978-0128195499
5. **GNU Octave by Example: Fast, Simple and Effective**
   Dr. James B. Allen, 1st Edition (2021), Apress, ISBN-13: 978-1484260315
6. **MATLAB: A Practical Introduction to Programming and Problem Solving**
   Stormy Attaway, 5th Edition (2018), Butterworth-Heinemann, ISBN-13: 978-0128154793

Semester-V

Course Code	Course Name	Credits
PHY2508N	PHYSICS-V	03

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	01	02	-	01	03

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Understanding quantum numbers and their relation with vector atom model.
2. Study of the atomic spectra.
3. Understanding the vibrational behavior of diatomic molecules
4. Understanding the rotational behavior of diatomic molecules
5. Understanding the nuclear properties.
6. Understanding nuclear decay

Course Outcomes

1. To study quantum numbers and their relation with vector atom model.
2. To investigate the atomic spectra.
3. To study vibrational behavior of diatomic molecules and corresponding energy levels
4. To study rotational behavior of diatomic molecules and corresponding energy levels
5. To study the properties of nucleus.
6. To investigate the nuclear decay.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	Quantum number; Orbital quantum number, Magnetic quantum number and space quantization; Total angular momentum, electronic configuration	8	18%

	Vector atom model, LS coupling, jj- coupling, Hunds rule		
2	Spectral lines, Fine & Hyperfine structure splitting (qualitative), Zeeman effect (qualitative)	6	16%
3	Vibrational spectra in diatomic molecule – Harmonic & Anharmonic oscillator	6	16%
4	Rotational Spectra in diatomic molecules - Rigid & Non rigid rotator. Raman Spectroscopy (qualitative)	6	16%
5	Constituents of nucleus, Charge, size, density of nucleus, Nuclear magnetic moment, quadrupole moment, Parity, mass defect and binding energy,	6	16%
6	Modes of decay of radioactive nuclides and decay Laws, half-life, mean life; Alpha, beta & gamma decay (qualitative)	7	18%
Total		**39**	**100%**

References:

1. Concepts of modern physics by Arthur Beiser, 1995, McGraw-Hill edition, in English - 5th edition.
2. Atomic and Nuclear Physics. Authors, Shatendra K. Sharma, Sharma. Publisher, Pearson Education India, 2008. ISBN, 8131719243, 9788131719244.
3. Introduction to atomic spectra; H. E White, 1934; Publisher: McGraw-Hill.
4. Nuclear Physics: An Introduction, Dr. S B Patel , Publisher-New Age International (P) Ltd., Publishers , Edition-2, ISBN-9788122430455.
5. Fundamentals of molecular spectroscopy/ by Colin N. Banwell and Elaine M. McCash ; Publication details: New Delhi: Tata McGraw Hill, 2006 ; Edition: 4th edition.
6. Introduction to Molecular Spectrosocpy, G. M. Barrow, 1962, Publisher: McGraw-Hill.

Semester-V

Course Code	Course Name	Credits
PHY2509N	PHYSICS-V LAB	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
-	02	-	-	01	-	01

Practical						Total
Internal Assessment				External		
Lab Journal	**Performance**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Understand interference of light using Newton's ring method.
2. Understand diffraction of light using single and double slit diffraction methods.
3. Understand the basic concept of spectrometer
4. Understand refractive index of a material.
5. Understand polarization of light.
6. Understand divergence in lasers.

Course Outcomes

1. Perform and understand experiments on interference light using Newton's ring method.
2. Perform and understand experiments on diffraction of light using single and double slit diffraction methods.
3. Perform and understand the basic concept of spectrometer
4. Perform and understand experiments on refractive index of a material.
5. Perform and understand the basic concept of polarization of light by a polarimeter
6. Perform and understand the basic concept of divergence of laser beam.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	To measure the slit width of a single slit by observing the diffraction fringes.	26	100%
2	To measure the slit width and the separation between the slits of a double slit by observing the diffraction and interference fringes.		
3	To determine the wavelength of spectral lines of Mercury lamp using diffraction grating.		
4	To measure dispersive power and angle of minimum deviation using prism.		
5	To determine the refractive index of material of Prism using Spectrometer.		
6	To determine the wavelength of a monochromatic light by Newton's ring method.		
Total		**26**	**100%**

References:

1. A complete course in practical physics by B. B. Swain, Kalyani Publisher, 2003.
2. B.Sc. Practical Physics by C. L. Arora, S. Chand publications, 1957.
3. https://www.vlab.co.in/
4. Guided Physics Practical Word, D. N. Publications, 2021.
5. B.Sc. Practical Physics Main, M.N. Shrinivasan, S. Chand Publications, 2013.
6. B.Sc. Practical physics, Harman Singh, S. Chand Publications, 2022.

Semester-V

Course Code	Course Name	Credits
CHY2508N	CHEMISTRY-V	03

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	01	02	-	01	03

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. To lteach students the concept of aromaticity.
2. To learn various reactions of aromatic as well as non-aromatic compounds.
3. This course also teaches the physical and chemical properties of various alkyl and aryl halides.
4. To learn peculiar reaction patterns of organometallic compounds.
5. To learn the reaction and synthesis of alcohol functional group including phenols.
6. To learn how ether and epoxides show reactivity and their synthesis.

Course Outcomes

1. Students will be introduced to the concept of aromaticity and its significance.
2. Students will have knowledge of chemical reactions of benzene and its derivatives.
3. Students will have knowledge of properties and reactions of halogenated compounds.
4. Students will have understanding of reactivity organometallic compounds and their importance.
5. Students will have understanding of various reactions of alcohols functional group also in phenols.
6. Students will have knowledge of chemical and physical properties of ethers and epoxide

Detailed Syllabus

Module	Course Module / Contents		Hours	Marks Weightage
	Module I: Aromaticity		7	15%
1	1.1	Nomenclature of benzene derivatives. The aryl group, Aromatic nucleus, side chain, Structure of benzene molecular formula, Kekule structure, Stability and carbon-carbon bond lengths of benzene, resonance structure.		
	1.2	MO picture. Aromaticity: the Huckel rule, aromatic ions. Aromatic electrophilic substitution general pattern of the mechanism, orientation, and ortho/para ratio.		
2	**Module II: Reactions of Arenes**		6	15%
	2.1	Side chain reactions of benzene derivatives. Birch reduction. Methods of formation and chemical reactions of alkylbenzenes, alkynylbenzenes, and biphenyls.		
3	**Module III: Chemistry of Halogenated hydrocarbons:**		7	20%
	3.1	Alkyl halides: Methods of preparation, nucleophilic substitution reactions – SN1, SN2 and SNi mechanisms with stereochemical aspects and effect of solvent etc. Nucleophilic substitution vs elimination.		
	3.2	Aryl halides: Preparation, including preparation from diazonium salts. nucleophilic aromatic substitution; SNAr, Benzyne mechanism. Relative reactivity of Alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.		
4	**Module IV: Organometallic Chemistry:**		6	15%
	4.1	Organometallic compounds of Mg and Li – Use in synthesis of organic compounds.		
5	**Module V: Alcohols, Phenols:**		7	20%
	5.1	Alcohols: preparation, properties and relative reactivity of 1^0 2^0, 3^0 alcohols, Bouvaelt-Blanc Reduction; Preparation and properties of glycols: Oxidation by periodic acid and lead tetraacetate, PinacolPinacolone rearrangement.		
	5.2	Phenols: Preparation and properties; Acidity and factors effecting it, Ring substitution reactions, Reimer – Tiemann and Kolbe's – Schmidt Reactions, Fries and Claisen rearrangements with Mechanism.		

6	**Module VI: Ethers and Epoxide:**		6	15%
	6.1	Ethers and Epoxides: Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia derivatives and LiAlH4		
Total			**39**	**100%**

References:

1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education.
3. Introduction to Organic Chemistry" by William H. Brown and Thomas Poon
4. Organic Chemistry by O.P. Agarwal, Himalaya Publishing House.
5. Organic Chemistry by Jagdamba Singh and S.P. Singh, Pearson Education India.
6. Advanced Organic Chemistry by J. Clayden, N. Greeves, S. Warren, and P. Wothers, Oxford University Press.

Semester-V

Course Code	Course Name	Credits
CHY2509N	CHEMISTRY-V LAB	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
-	02	-	-	01	-	01

Practical						Total
Internal Assessment				External		
Lab Journal	**Performance**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. To provide practical experience in qualitative analysis of unknown organic compounds.
2. To learn to identify extra elements present in a given unknown organic compound.
3. To learn to detect unsaturation in a given compound.
4. To identify whether the given compound is aromatic or nonaromatic.
5. To determine various functional groups present in a given unknown compound.
6. To learn general lab practice, like to perform heating, mixing, solution preparation etc.

Course Outcomes

1. Students will have understanding of how a given unknown organic compound could be analyzed step by step.
2. Students will have learn systematic analysis of extra elements in the given unknown compounds.
3. Students will have knowledge to determine unsaturation in given compounds.
4. Students will have knowledge to know whether a given organic compound is aromatic or nonaromatic.
5. Students will have a deeper understanding of the key analysis steps of various functional groups present in unknown molecules.
6. Overall, students will have a sound knowledge of working in a chemistry lab with collaboration and precautions.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	Systematic analysis of extra elements in the given unknown compounds	26	100%
2	Tests for following functional groups and unsaturation.		
3	Qualitative analysis of the following types of unknown organic compounds • Carboxylic acids • Phenols • Alcohols • Aldehydes • Ketones • Esters • Carbohydrates • Primary, secondary and tertiary amines • Nitro compounds • Amides • Aryl halides • Hydrocarbons		
Total		**26**	**100%**

References:

1. Vogel, A. I., Furniss, B. S., Hannaford, A. J., Smith, P. W. G., & Tatchell, A. R. (1989). Vogel's Textbook of Practical Organic Chemistry (5th ed.). Longman Scientific & Technical. ISBN: 9780582462366.
2. Pavia, D. L., Lampman, G. M., Kriz, G. S., & Engel, R. G. (2014). Introduction to Organic Laboratory Techniques: A Small-Scale Approach (4th ed.). Cengage Learning. ISBN: 9781305253926.
3. Practical Chemistry: For B.Sc. I-, II-, And III-Year Students by Dr. O.P. Pandey, Dr. D. N. Bajpai, and Dr. S. Giri. S Chand Publication
4. Ahluwalia, V. K., & Aggarwal, R. (2001). Comprehensive Practical Organic Chemistry: Qualitative Analysis (1st ed.). Universities Press. ISBN: 9788173712928.
5. Furniss, B. S., Hannaford, A. J., Smith, P. W. G., & Tatchell, A. R. (1989). Vogel's Textbook of Practical Organic Chemistry (5th ed.). Longman Scientific & Technical. ISBN: 9780582462366.
6. Carey, F. A., & Giuliano, R. M. (2016). Organic Chemistry (10th ed.). McGraw-Hill Education. ISBN: 9780073511214.

Semester-V

Course Code	Course Name	Credits
STA2504N	ADVANCED OPERATIONS RESEARCH	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Understand decision-making under risk and certainty using tools like pay-off and regret tables.
2. Analyze game theory concepts including two-person zero-sum games and mixed strategies.
3. Explore queuing theory principles and apply models like M/M/1 and M/M/K.
4. Master classical and numerical optimization techniques for unconstrained and constrained problems.
5. Utilize dynamic programming for solving optimization challenges.
6. Apply mathematical tools to model and solve decision-making, game theory, queuing, and optimization problems.

Course Outcomes

1. Apply decision analysis tools effectively in real-world scenarios.
2. Analyze and strategize using game theory principles.
3. Optimize queuing systems to improve efficiency.
4. Solve complex optimization problems using advanced techniques.
5. Develop mathematical modelling skills for practical applications.
6. Evaluate and propose enhancements for real-world systems using theoretical frameworks.

Detailed Syllabus

Module	Contents	Hours	Marks Weightage
1	**Game Theory** Game theory-Introduction, Pay-off table, regret table, decision under risk, expected value of profit or loss, decision under certainty- Minimax, Maximax, Hurwicz criterion, decision tree & its Uses	09	20%
2	**Game Theory Principle** Introduction, Payoff, two-person zero sum games, saddle point, Max-Min and Min-max principle, Games without saddle point – Mixed strategies, Graphic solution of 2Xn and mX2 games, Dominance property.	09	16%
3	**Queuing Theory** Introduction, Operating Characteristics of a Queuing System, Constituents of a Queuing System, Service Facility	08	16%
4	**Queue Discipline** Queue Discipline, Single Channel with Finite & Infinite Population, Multiple Channel with finite & infinite population, OC of Queuing system, M/M/1,M/M/K application	08	16%
5	**Unconstrained optimization of functions of several variables** Basic theory, Classical techniques and numerical methods for unconstrained optimization (Gradient methods, Newton's method, Conjugate Direction methods, and Quasi-Newton methods).	09	16%
6	**Constrained Non- Linear Optimization** Constrained Non- Linear Optimization Constrained nonlinear optimization of functions of several variables: Method of Lagrange multipliers, Kuhn-Tucker theory, Convex optimization, Quadratic optimization, Numerical methods for constrained optimization, Dynamic programming	09	16%
Total		**52**	**100%**

References:

1. Engineering Optimization: Theory and Practice By Singiresu S. Rao , John Wiley Publication
2. Optimization Concepts and Applications in Engineering by Ashok D. Belegundu, Tirupathi R. Chandrupatla, Cambridge University Press, 2011
3. Theory and Techniques of Optimization for Practicing Engineers by Raymond L. Zahradnik , Barnes & Noble, 1971
4. Operations Research: Applications and Algorithms (2004), by W. L. Winston
5. Hamdy A. Taha (2022): Operations Research
6. A.K. Bhunia, L. Sahoo (1 January 2011): Advanced Operations Research

Semester-V

Course Code	Course Name	Credits
FLF2511N	FRENCH-V	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	-	02	-	-	02

Theory							Total
Internal Assessment					External		
Test	**Viva**	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	20	10	05	**50**	**50**	75 mins	**100**

Course Objectives

The course is designed:

1. To strengthen the language of the students in both oral and written.
2. To get the students acquainted with the current social communication skills, oral (dialogue, telephone conversations, etc.) and written and perform simple communication tasks.
3. To talk about a film or a show.
4. To describe a person using good vocabularies and different adjectives
5. To use the different tenses, different moods in French.

Course Outcomes

After the completion of this course students will be able to:

1. Enhance proficiency in both spoken and written language.
2. Develop familiarity with modern social communication skills, both oral (such as dialogues and telephone conversations) and written, and to perform basic communication tasks effectively.
3. Write a review of a movie or a show.
4. Describe a person using good vocabulary and different adjectives.
5. Apply various tenses and moods in French using subjunctive tense.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**Module I**		6	50%
	Leçon 1	Histoires d'étudiants		
	Leçon 2	Un dîner en ville		
2	**Module II**		6	30%
	Leçon 1	Soirée déguisée Un dîner en ville		
	Leçon 2	Chez l'habitant		
3	**Module III**		6	10%
	Leçon 1	Un peu de culture ?		
4	**Module IV**		6	10%
	Leçon 1	Une soirée originale		
	Total		**26**	**100%**

References:

1. Berthet, Hugot et al. Alter Ego - Méthode de Français, A1: Hachette,2012.
2. Bruno Girardeau et Nelly Mous. Réussir le DELF A1. Paris : Didier, 2011.
3. Loiseau Y.,Mérieux R. Connexions 1, cahier d'exercices. Didier, Paris, 2017.
4. Loiseau Y. & Mérieux R. Connexions 1, Guide pédagogique. Didier, Paris, 2017.
5. Connexions 1, livre de l'élève – Loiseau Y. & Mérieux R., éd. Didier, Paris,2017.
6. Latitudes 1, cahier d'exercices – Loiseau Y. & Mérieux R., éd. Didier, Paris,2018.
7. Latitudes 1, Guide pédagogique – Loiseau Y. & Mérieux R., éd. Didier, Paris,2018.
8. Latitudes 1, Guide pédagogique téléchargeable – Loiseau Y. & Mérieux R., éd. Didier,2018.
9. Latitudes 1, livre d'élève + CD – Loiseau Y. & Mérieux R., éd. Didier, Paris,2018.
10. Nathalie Hirschsprung, Tony Tricot, Cosmopolite 1 Méthode de Français A1. Hachette, 2017.
11. Nathalie Hirschsprung, Tony Tricot. Cosmopolite 1 Cahier d'activités A1. Hachette, 2017.

Semester-V

Course Code	Course Name	Credits
FLG2511N	GERMAN-V	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	-	02	-	-	02

Theory							Total
Internal Assessment					External		
Test	**Viva**	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	20	10	05	**50**	**50**	75 mins	**100**

Course Objectives

The course is designed:

1. To handle situations which one normally encounters while travelling.
2. To take part in conversations and discussions pertaining to familiar topics such as family, hobbies, travel etc. without prior preparation.
3. To develop the listening comprehension skills.
4. To understand programs on television or radio and informing oneself about current events or areas of interest/ provided the speaker speaks clearly.
5. To have a basic conversation using the vocabulary related to body parts and basic diseases.

Course Outcomes

After the completion of this course students will be able to:

1. Handle situations which one normally encounters while travelling.
2. Take part in conversations and discussions pertaining to familiar topics such as family, hobbies, travel etc. without prior preparation.
3. Develop the listening comprehension skills
4. Understand programs on television or radio and informing oneself about current events or areas of interest/ provided the speaker speaks clearly.
5. Have a basic conversation using the vocabulary related to body parts and basic diseases.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**Kapitel 11**		06	25%
	Grammatischer Aspekt	• Imperativ: du, ihr, Sie • Modalverben: dürfen, sollen		
2	**Kapitel 11**		07	25%
	Thematischer Aspekt	• persönliche Angaben machen • Körperteile nennen • eine Sportübung verstehen und erklären • Aufforderungen wiedergeben • Gespräche beim Arzt führen • Anweisungen verstehen und geben • Gesundheitstipps verstehen und geben Wörter erschließen		
3	**Kapitel 12**		06	25%
	Grammatischer Aspekt	• Pronomen: man • Fragewörter: wer, wen, wem, was(Nom. u. Akk.) Ort: wo, wohin, woher, wann & wie • Zeitadverbien: zuerst, dann, später, zum Schluss		
4	**Kapitel 12**		07	25%
	Thematischer Aspekt	• Vorschläge für eine Stadttour verstehen • einen Weg beschreiben • eine Postkarte schreiben • die Jahreszeiten kennen lernen • das Wetter beschreiben • Reiseberichte verstehen • Probleme im Hotel beschreiben • sich im Hotel beschweren • über Reiseziele sprechen		
	Total		**26**	**100%**

References:

1. Aufderstraße, Hartmut. *Lagune 1. Deutsch als Fremdsprache: Kursbuch und Arbeitsbuch*. Ismaning: Max Hueber Verlag 2012.
2. Braun, Anna, and Daniela Wimmer. *Schritte Plus A1/1: Arbeitsbuch*. Hueber Verlag, 2020.
3. Dengler, Stefanie. *Netzwerk A1. Teil2. Kurs- Und Arbeitsbuch: Deutsch Als Fremdsprache*. Langenscheidt, 2012.
4. Funk, Hermann, et al. *studio d A1: Deutsch als Fremdsprache*. Cornelsen Verlag, 2015.
5. Langenscheidt. *Langenscheidt Pocket Dictionary German: German-English, English-German*. Langenscheidt Publishing Group, 2022.
6. Niebisch, Daniela, et al. *Lagune A1: Kursbuch*. Hueber Verlag, 2016.

Semester-V

Course Code	Course Name	Credits
FLS2511N	SPANISH-V	02

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	-	02	-	-	02

Theory							Total
Internal Assessment					External		
Test	**Viva**	**Continuous Evaluation**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	20	10	05	**50**	**50**	75 mins	**100**

Course Objectives

The course is designed:

1. To enable the students to comprehend and make use of verbs with vocal changes.
2. To revise the grammar in application and the communication tasks related to topics covered already.
3. To enable the students to use preterit tense to describe events that happened in the past.
4. To enhance the vocabulary of the students based on shops, restaurants and airport.
5. Simulate and participate in mock Vivas and conversations.

Course Outcomes

After the completion of this course students will be able to:

1. Understand how to conjugate verbs with vocal changes and use them effectively in sentences.
2. Revise all the grammar topics which were taught in the previous semesters.
3. Describe events, activities and incidents that occurred in the past using preterit tense effectively and efficiently.
4. Understand and apply vocabulary based on shops, restaurants and airports and will be able to communicate at the given places.
5. Actively engage in mock viva sessions, applying the skills learned throughout the course. This practical experience will enhance their ability to handle real-life conversations with native speakers.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**El español y tú**		**5**	**20 %**
	1.1	Las preposiciones del lugar		
	1.2	Expresiones cotidianas		
2	**¿Sabes verbos con cambios vocales?**		**5**	**20 %**
	2.1	Los verbos regulares en español		
	2.2	Los verbos con cambios vocales. (AR, ER, IR)		
3	**¿Qué comiste ayer?**		**8**	**30 %**
	3.1	Introducción del pretérito indefinido en español.		
	3.2	Los verbos regulares en el pretérito indefinido		
4	**¿Dónde estuviste ayer, Juan?**		**8**	**30 %**
	4.1	Los verbos irregulares en el pretérito indefinido		
	4.2	Un ensayo usando el pretérito indefinido.		
	Total		**26**	**100%**

References:

1. Ballesteros, Margarita Porroche. *Ser, estar y verbos de cambio*. Arco Libros, 1988.
2. Bregstein, Barbara. *Advanced Spanish Step-by-Step*. McGraw Hill Professional, 2011.
3. Butt, John, et al. *A New Reference Grammar of Modern Spanish*. Routledge, 2019.
4. Castromil, Javier Díaz, and Laura Gil-Merino. *Objetivo DELE A2 – B1*. 2016.
5. Hollis, Maria Rosario. *Essential Spanish Verbs*. Teach Yourself, 2010.
6. Holodyk, Daniel. *Ultimate Spanish*. 2003.
7. Howkins, Angela, et al. *Practising Spanish Grammar*. 2019.
8. Kattán-Ibarra, Juan, and Angela Howkins. *Spanish Grammar in Context*. Languages in Context, 2014.
9. Loaeza, Pablo Garcia. *Easy Spanish Phrase Book NEW EDITION*. Courier Corporation, 2013.
10. Mahler, Michael. *Dictionary of Spanish Slang and Colloquial Expressions*. Barron's Educational Series, Incorporated, 2008.

Semester-V

Course Code	Course Name	Credits
CSE2512N	EMPLOYABILITY SKILLS	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	-	01	-	-	01

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	30	05	**50**	**50**	2 Hours	**100**

Course Objectives

The course is designed:
1. To understand and apply interview techniques.
2. To develop effective interview skills.
3. To conduct self-discovery through swot analysis.
4. To master Professional Etiquette.
5. To simulate and participate in mock interview sessions.

Course Outcomes

After completion of this course students will be able to:
1. Categorize different types of interviews, recognize various interview styles, and demonstrate fundamental skills required when facing interviews.
2. Create professional resumes, covering letters, and follow-up letters, showcasing their ability to articulate their qualifications and experiences during job applications and interviews.
3. Perform a SWOT analysis, identifying their strengths, weaknesses, opportunities, and threats, fostering self-awareness, and aiding in strategic career planning.
4. Understand and apply social etiquette, including the proper way to shake hands and exchange business cards. They will also demonstrate knowledge of dining etiquette and appropriate behavior in a professional setting such as the cubicle.
5. Enact in mock interview sessions, applying the skills learned throughout the course. This practical experience will enhance their ability to handle real-life interview scenarios.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**Interviews**		5	38%
	1.1	Types of Interviews and Styles of Interview		
	1.2	Facing Interviews-Fundamentals		
	1.3	Practice Session Conducting Interviews		
	1.4	Fundamentals and Practice Session, Mock Interview Sessions		
2	**Interview Skills**		5	38%
	2.1	Resume Writing,		
	2.2	Covering Letters		
	2.3	Interview Follow Up Letters		
3	**Self- Discovery**		1	8%
	3.1	SWOT [Strengths, Weakness, Opportunities, and Threats] Analysis		
4	**Employability Skills**		2	16%
	4.1	Conflict Management		
	4.2	Work Ethics		
	Total		**13**	**100%**

References:

1. Amos, Julie-Ann. Handling Tough Job Interviews. Mumbai: Jaico Publishing, 2004.
2. Anjanee Sethi & Bhavana Adhikari, Business Communication, Tata McGraw Hill.2009.
3. Brown, Michele & Gyles Brandreth. How to Interview and be Interviewed. London: Sheldon Press, 1994.
4. https://resumewriterusa.com
5. https://youtu.be/45uNWLmAZR8
6. Jermy Comfort, Speaking Effectively, et.al, Cambridge University Press.1994
7. Krishnaswamy, N, Creative English for Communication, Macmillan.2022
8. Patcher, Barbara. The Essentials of Business Etiquette: How to Greet, Eat, and Tweet Your Way to Success.Paperback.2013
9. Raman Prakash, Business Communication, Oxford.2012
10. Rizvi, M. Ashraf. Effective Technical Communication. Tata McGraw Hill.2017
11. Taylor, Grant. Conversation in Practice. McGraw-Hill Education.2001.
12. Thorpe, Edgar & Showick Thorpe. Winning at Interviews. 2nd Edition. Delhi: Dorling Kindersley, 2006.

Semester-V

Course Code	Course Name	Credits
BEH2513N	BEHAVIOURAL SCIENCE-V	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
01	-	-	01	-	-	01

Theory				
Internal Assessment				
Activity	**Assignment**	**Viva**	**Attendance**	**Total**
20	40	35	05	**100**

Course Objectives

1. To Understand the importance of individual differences
2. Better understanding of self in relation to society and nation
3. Facilitation for a meaningful existence and adjustment in society
4. Inculcating patriotism and national pride
5. To develop an understanding of importance of human values.
6. To Understand the Value of individual

Course Outcomes

1. A strong personality fosters resilience and adaptability in diverse life situations.
2. Nationalism fosters a sense of belonging and unity among citizens.
3. Human values form the foundation of ethical behavior and moral integrity.
4. Personality development enhances effective communication and interpersonal relationships.
5. It strengthens cultural identity and promotes the preservation of traditions and heritage.
6. They promote empathy, compassion, and respect for others, fostering harmonious societies.

Detailed Syllabus

Module	Contents		Hours	Marks Weightage
1	**Individual differences& Personality**		4	15%
	1.1	Personality: Definition& Relevance		
	1.2	Importance of nature & nurture in Personality Development		
	1.3	Importance and Recognition of Individual differences in Personality		
	1.4	Accepting and Managing Individual differences (adjustment mechanisms) Intuition, Jugement, Perception & Sensation (MBTI), BIG5 Factors		
2	**Managing Diversity**		2	15%
	2.1	Defining Diversity		
	2.2	Affirmation Action and Managing Diversity		
	2.3	Increasing Diversity in Work Force		
	2.4	Barriers and Challenges in Managing Diversity		
3	**Socialization**		2	16%
	3.1	Nature of Socialization		
	3.2	Social Interaction		
	3.3	Interaction of Socialization Process		
	3.4	Contributions to Society and Nation		
4	**Patriotism and National Pride**		2	18%
	4.1	Sense of pride and patriotism		
	4.2	Importance of discipline and hard work		
	4.3	National Integrity, Integrity, accountability, and national pride.		
	4.4	National pride and prejudice.		
5	**Human Rights, Values and Ethics**		2	
	5.1	Meaning and Importance of human rights		

	5.2	Human rights awareness		
	5.3	Obligation to respect, character-based system of human rights.		
	5.4	Values and Ethics- Learning based on project work on Scriptures like- Ramayana, Mahabharata, Gita etc.		
	Total		**13**	**100%**

References:

1. Pervin, L. A., & John, O. P. (2001). Personality: Theory and Research (8th ed.). Wiley.
2. Jayne, M. E. A., & Dipboye, R. L. (2004). Workforce diversity: A key to improve productivity. Journal of Human Resource Management, 43(4), 409-424.
3. Nettle, D. (2007). The Nature of Personality: Genes, Culture, and National Character. MIT Press.
4. Kirton, G., & Greene, A. M. (2015). The Dynamics of Managing Diversity: A Critical Approach (4th ed.). Routledge.
5. Funder, D. C. (2019). The Personality Puzzle (8th ed.). W. W. Norton & Company.
6. Barak, M. E. M. (2021). Managing Diversity: Toward a Globally Inclusive Workplace (5th ed.). SAGE Publications.

Semester-V

Course Code	Course Name	Credits
MTH2521N	SUMMER INTERNSHIP	05

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
-	-	-	-	-	-	05

Internship/Project		Total
Report	**Presentation and Viva-Voce**	
50	50	**100**

Course Objective

The internship aims to equip students with the intellectual, practical, and personal skills necessary to succeed in their chosen field.

Course Outcomes

On completion of summer project, the student will be able to

1. apply knowledge and skills in real world problems through project,
2. function in a team and use experience related to professional and ethical issues in the work environment.

Duration

Summer break of Sem-IV and Sem-V.

Project Theme

Summer Internship is to be tailored as per specific interests and skills. Reach out to Professors, Research Groups, or Companies in area of interest to explore potential opportunities.

Guidelines

1	**Step-I**
	Selection of the topic for the project by taking following points into consideration: 1. Suitability of the topic. 2. Relevance of the topic. 3. Time available at the disposal. 4. Feasibility of data collection within the given time limit. 5. Challenges involved in the data collection (time & cost involved in the data collection, possibility of getting responses, etc.)
2	**Step-II**
	Finalization of the Topic and preparation of Project Proposal in consultation with the Supervisor.
3	**Step-III**
	Collection of information and data relating to the topic and analysis of the same.
4	**Step-IV**
	Writing the report dividing it into suitable chapters, viz., Chapter 1:Introduction (5 marks), Chapter 2: Conceptual Framework / National & International Scenario (15 marks), Chapter 3: Presentation, Analysis & Findings (15 marks), Chapter 4: Conclusion and Recommendations (10 marks), Chapter-5: Bibliography (05 marks)
5	**Step-V**
	The following documents are to be attached with the Final Project Report. 1) Approval letter from the supervisor (Annexure - IA) 2) Student's declaration (Annexure - IB) 3) Certificate from the Competent Authority of the Organisation / Institution, if the student undertakes the Project Work in any Organisation / Institution.

Components of Report	
1	**Cover Page**
	This should contain the title of the project proposal, to whom it is submitted, for which degree, the name of the author, name of the supervisor, year of submission of the project work, name of the University.

2	**Acknowledgement**
	Various organizations and individuals who might have provided assistance /co-operation during the process of carrying out the study.
3	**Table of Content**
	Page-wise listing of the main contents in the report, i.e., different Chapters and its main Sections along with their page numbers.
4	**Body of the Report**
	The body of the report should have these four logical divisions
	a) ***Introduction:*** This will cover the background, rationale/ need / justification, brief review of literature, objectives, methodology (the area of the study, sample, type of study, tools for data collection, and method of analysis), Limitations of the Study, and Chapter Planning.
	b) ***Conceptual Framework / National and International Scenario*****:** (relating to the topic of the Project).
	c***) Presentation of Data, Analysis and Findings*****:** (using the tools and techniques mentioned in the methodology).
	d) ***Conclusion and Recommendations:*** In this section, the concluding observations based on the main findings and suggestions are to be provided.
5	**Bibliography or References**
	This section will include the list of books and articles which have been used in the project work, and in writing a project report.
6	**Annexures**
	Questionnaires (if any), relevant reports, etc. (The main text of the Project should normally be in the range of 5000 words. However, there may be annexure in addition to the main text)

Evaluation / Assessment
1. Each of the students has to undertake a Project individually under the supervision of a teacher and to submit the same following the guidelines stated below. 2. Language of Project Report and Viva-Voce Examination may be English. The Project Report must be typed and hard bound. 3. Failure to submit the Project Report or failure to appear at the Viva-Voce Examination will be treated as "Absent" in the Examination. He /she has to submit the Project Report and appear at the Viva-Voce Examination in the subsequent years (within the time period as per University Rules). No marks will be allotted on the Project Report unless a candidate appears at the Viva-Voce Examination. Similarly, no marks will be allotted on Viva-Voce Examination unless a candidate submits his/her Project Report. 4. Evaluation of the Project Work to be done jointly by one internal expert and one external expert with equal weightage, i.e., average marks of the internal and external experts will be allotted to the candidate.

Semester - VI						
	Course Code	**Course Title**	**Lecture Credits**	**Tutorial Credits**	**Practical Credits**	**Total Credits**
Discipline-I (Core)						**16**
Discipline-I	MTH2601N	Discrete Mathematics	3	1	-	4
	MTH2602N	Number Theory	3	1	-	4
	MTH2603N	Topology	3	1	-	4
	MTH2604N	Transform Techniques and 2D 3D Geometry	3	1	-	4
Discipline-II (any one from the basket)						**4**
Discipline-II	PHY2608N PHY2609N	Physics-VI Physics-VI Lab	2 -	1 -	- 1	3 1
	CHY2609N CHY2610N	Chemistry-VI Chemistry-VI Lab	2 -	1 -	- 1	3 1
	STA2605N STA2606N	Data Analysis & Decision Making Data Analysis & Decision Making Lab	2 -	1 -	- 1	3 1
Total (Discipline-I + II)						**20**
VAC-III	PHE2318N	Physical Education & Sports**	-	-	-	0
Grand Total						**20**

Semester-VI

Course Code	Course Name	Credits
MTH2601N	DISCRETE MATHEMATICS	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Develop a solid understanding of foundational concepts in set theory, including relations, functions, and induction principles.
2. Introduce students to the principles of propositional calculus and logical operations, enabling them to analyze and construct logical arguments.
3. Explore fundamental graph theory concepts such as connectivity, paths, cycles, and algorithms for optimization and problem-solving.
4. Provide a comprehensive introduction to lattices and Boolean algebra, emphasizing their applications in computer science and mathematics.
5. Cultivate problem-solving skills through the application of mathematical techniques to real-world scenarios.
6. Foster critical thinking and reasoning abilities necessary for advanced studies in mathematics and related disciplines.

Course Outcomes

1. Ability to analyze and solve problems using set theory, including applications in number theory and discrete mathematics.
2. Proficiency in constructing and evaluating logical statements and arguments, essential for programming, algorithm design, and formal reasoning.
3. Competence in applying graph theory algorithms to solve practical problems such as route optimization and network analysis.
4. Understanding of the structural properties of lattices and Boolean algebra, with the capability to apply these concepts to digital circuit design and software engineering.
5. Improved mathematical reasoning skills, demonstrated through rigorous proofs and logical deductions.

6. Preparation for advanced coursework in mathematics, computer science, and related fields by building a strong foundational knowledge base.

Detailed Syllabus

Module		Content	Hours	Marks Weightage
1	**Module I:**		6	10%
	1.1	Sets, binary relations, equivalence relations, congruence relations between integers, finite product of sets, functions		
	1.2	Composition of functions, bijective functions, invertible functions, the introduction of finite and infinite sets through correspondence		
2	**Module II: Fundamental Concepts in Mathematics**		7	15%
	2.1	Binary operations, principle of mathematical induction, well-ordering property of positive integers		
	2.2	Division algorithm, statement of the fundamental theorem of arithmetic.		
3	**Module III: Mathematical Logic**		13	25%
	3.1	Proposition, Propositional Calculus- Propositional Variables and Compound Propositions, Basic Logical Operations: Conjunction, Disjunction, Negation		
	3.2	Conditional, Biconditional. Compound Statements, Equivalence, Duality		
	3.3	Algebra of Statements, Valid and Invalid, Arguments		
	3.4	Tautologies, Contradiction, Contingency.		
4	**Module IV: Introduction to Graph Theory**		6	10%
	4.1	Graph, Finite graph, Infinite graph, connected graph, Disconnected graph, Null graph.		
	4.2	Subgraph, Incidence, Adjacency, Degree, Directed Graph, Walk, Path, Circuit, Wheel		
	4.3	Eulerian graph, Hamiltonian graph, Planar graph. pseudographs, complete graphs, bipartite graphs		
5	**Module V: Advanced Graph Theory**		7	15%
	5.1	Isomorphism of graphs, paths and circuits, Eulerian circuits, Hamiltonian cycles.		

	5.2	The adjacency matrix, weighted graph, traveling salesman's problem, shortest path.		
	5.3	Dijkstra's algorithm, and Floyd-Warshall algorithm.		
6	**Module IV Lattices and Boolean Algebra**		13	25%
	6.1	Lattices: definition, sub lattices, direct product, homomorphism Boolean algebra: definition, properties, isomorphic structures (in particulars, structures with binary operations)		
	6.2	sub algebra, direct product and homomorphism, Boolean function, Boolean expression, representation & minimization of Boolean function.		
Total			**52**	**100%**

References:

1. C.L. Liu, **Elements of Discrete Mathematics**, third edition, McGraw-Hill, 2008, ISBN 978-0070669137.
2. R.J. Wilson, **Graph Theory**, fifth edition, Pearson, 2010, ISBN 978-0273728897.
3. N. Deo, **Graph Theory with Applications to Engineering and Computer Science**, first edition, Prentice Hall India Pvt. Limited, 2004, ISBN 978-8120301459.
4. B A. Davey and H. A. Priestley, **Introduction to Lattices and Order**, second edition, Cambridge University Press, 2002, ISBN 978-0521784510.
5. E. G. Goodaire and M. M. Parmenter, **Discrete Mathematics with Graph Theory**, third edition, Pearson Prentice Hall, 2006, ISBN 978-0131679955.
6. R. Lidl and G. Pilz, **Applied Abstract Algebra**, Springer Science & Business Media, 1998, ISBN 978-0387982908.
7. H. Kishan and S. Pundir, **Discrete Mathematics**, first edition, Pragati Prakashan, 2009.

Semester-VI

Course Code	Course Name	Credits
MTH2602N	NUMBER THEORY	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Develop proficiency in solving linear Diophantine equations and applying number theoretic functions.
2. Explore advanced concepts such as congruences, Euler's theorem, and quadratic reciprocity.
3. Investigate the properties of prime numbers, including the prime number theorem and Goldbach conjecture.
4. Understand the significance of residue classes, least residues, and the Chinese remainder theorem in number theory.
5. Apply theoretical knowledge to solve problems related to primitive roots, Legendre symbols, and Fermat's Last Theorem.
6. Enhance problem-solving skills through applications of modular arithmetic and algorithms like Euclid’s algorithm.

Course Outcomes

1. Ability to apply Euclid’s algorithm and related techniques to find quotients, remainders, and solutions to linear Diophantine equations.
2. Proficiency in identifying and utilizing residue classes and least residues in solving problems involving modular arithmetic.
3. Competence in evaluating number theoretic functions such as Euler’s phi-function, Möbius function, and Dirichlet product.
4. Understanding of advanced topics including quadratic reciprocity, Euler’s criterion, and the properties of primitive roots.
5. Capability to analyze and solve problems related to congruences and quadratic congruences with composite moduli.
6. Preparation for further study in advanced number theory and related mathematical disciplines.

Detailed Syllabus

Module		Content	Hours	Marks Weightage
1	**Module I: Fundamental Concepts in Number Theory**		8	15%
	1.1	Linear Diophantine equation, prime counting function, statement of prime number theorem		
	1.2	Goldbach conjecture, linear congruences, complete set of residues, Chinese remainder theorem		
	1.3	Fermat's little theorem, Wilson's theorem		
2	**Module II: Basic Number Theoretic Functions**		8	15%
	2.1	Number theoretic functions, sum and number of divisors,		
	2.2	Totally multiplicative functions, definitions and properties of the Dirichlet product		
	2.3	The Möbius inversion formula, the greatest integer function,		
3	**Module III: Advanced Number Theoretic Functions**		10	15%
	3.1	Euler phi function, Euler's theorem		
	3.2	Reduced set of residues		
	3.3	Some properties of Euler's phi-function		
4	**Module IV: Order and Primitive Roots**		8	20%
	4.1	Order of an integer modulo n, primitive roots for primes, Euler's criterion		
	4.2	Composite numbers having primitive roots		
	4.3	The Legendre symbol and its properties		
5	**Module V: Quadratic Reciprocity and Congruences**		8	20%
	5.1	Quadratic reciprocity		
	5.2	Quadratic congruences with composite moduli		
	Module VI: Special Equations and Theorems		10	15%

6	6.1	solution of the equation $x^2 + y^2 = z^2$		
	6.2	Fermat's Last Theorem.		
Total			**52**	**100%**

References:

1. D. M. Burton, **Elementary Number Theory**, seventh edition, Tata McGraw-Hill Publishing Company Limited, 2010, ISBN 978-0073383149.
2. K. H. Rosen, **Discrete Mathematics and Its Applications**, sixth edition, McGraw-Hill, 2006, ISBN 978-0072880083.
3. K. H. Rosen, **Elementary Number Theory and Its Applications**, sixth edition, Pearson, 2010, ISBN 978-0321500311.
4. I. Niven and N. S. Zuckerman – **An Introduction to Theory of Numbers**, fifth edition, Wiley, 1991, ISBN 978-0471625469.
5. T. M. Apostol, **Introduction to Analytic Number Theory,** first edition, Springer New York, 1976, ISBN 978-0387901633.
6. G. H. Hardy and E. M. Wright, **An Introduction to the Theory of Numbers**, sixth edition, Oxford University Press, 2008, ISBN 978-0199219865.

Semester-VI

Course Code	Course Name	Credits
MTH2603N	TOPOLOGY	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Develop proficiency in solving linear Diophantine equations and applying number theoretic functions.
2. Explore advanced concepts such as congruences, Euler's theorem, and quadratic reciprocity.
3. Investigate the properties of prime numbers, including the prime number theorem and Goldbach conjecture.
4. Understand the significance of residue classes, least residues, and the Chinese remainder theorem in number theory.
5. Apply theoretical knowledge to solve problems related to primitive roots, Legendre symbols, and Fermat's Last Theorem.
6. Enhance problem-solving skills through applications of modular arithmetic and algorithms like Euclid’s algorithm.

Course Outcomes

1. Ability to apply Euclid’s algorithm and related techniques to find quotients, remainders, and solutions to linear Diophantine equations.
2. Proficiency in identifying and utilizing residue classes and least residues in solving problems involving modular arithmetic.
3. Competence in evaluating number theoretic functions such as Euler’s phi-function, Möbius function, and Dirichlet product.
4. Understanding of advanced topics including quadratic reciprocity, Euler’s criterion, and the properties of primitive roots.
5. Capability to analyze and solve problems related to congruences and quadratic congruences with composite moduli.
6. Preparation for further study in advanced number theory and related mathematical disciplines.

Detailed Syllabus

Module		Content	Hours	Marks Weightage
1	**Module I: Set Theory**		9	15%
	1.1	Cartesian Products, Finite Sets, Countable and Uncountable Sets		
	1.2	Infinite Sets and Axiom of Choice		
	1.3	Well Ordered Sets		
2	**Module II: Topological spaces**		9	15%
	2.1	Topology, Basis for a topology, Order topology, Subspace Topology		
	2.2	Product topology, closed sets and limit points,		
	2.3	Continuous functions, Metric Topology		
3	**Module III: Connected Spaces**		9	20%
	3.1	Connected spaces, Connected Subspaces of Real Line		
	3.2	Components and Local Connectedness		
4	**Module IV: Compact Spaces**		10	20%
	4.1	Compact spaces, Compact Subspaces of the Real Line		
	4.2	Limit point compactness		
	4.3	Local Compactness		
5	**Module V: Countablity and Separation Axioms**		8	15%
	5.1	Countability Axioms, Separation axioms, Normal Spaces		
	5.2	Urysohn's Lemma (without proof)		
6	**Module VI: Product Spaces**		7	15%
	6.1	Titetz Extension Theorem (Without Proof), Metrization Theorem (without proof)		

	6.2	Tychono's Theorem		
Total			**52**	**100%**

References:

1. J. R. Munkres, **Topology: A First Course**, first edition, Prentice Hall, 1974, ISBN 978-0139254956.
2. W. J. Pervin, **Foundations of General Topology**, first edition, Elsevier Science, 1964, ISBN 978-1483225159.
3. S. A. Morris, **Topology Without Tears,** University of New England 1989.
4. J. Dugundji,, **Topology**, first edition, Allyn and Bacon, 1966, ISBN 978-0201002881.
5. S. Willard, **General Topology**, first edition, Addison-Wesley, 1970, ISBN 978-0201087062.
6. G. F. Simmons, **Introduction to Topology and Modern Analysis**, first edition, McGraw-Hill, 1963, ISBN 978-0070572279.
7. J. L. Kelley, **General Topology**, first edition, Springer, 1955, ISBN 978-0387901251.

Semester-VI

Course Code	Course Name	Credits
MTH2604N	TRANSFORM TECHNIQUES AND 2D 3D GEOMETRY	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Develop logical arguments and apply theorems to two and three-dimensional figures.
2. Solve multi-dimensional figure problems using geometric tools, proofs, and formulas.
3. Justify geometric procedures and verify results algebraically when possible.
4. Understand the equations and properties of conic sections, including parabolas, ellipses, and hyperbolas.
5. Master the equations and properties of three-dimensional figures, such as planes, lines, and spheres.
6. Analyse the intersections and relationships between different geometric shapes in three-dimensional space.

Course Outcomes

1. Transform coordinate systems using rotation of axes and reduce second-degree equations to their simplest forms.
2. Classify conics using the discriminant.
3. Understand and apply geometric terminology to planes, straight lines, spheres, cylindrical surfaces, and conicoids.
4. Analyze plane sections of conicoids and understand their tangent and normal properties.
5. Solve geometric problems involving three-dimensional figures using algebraic and geometric tools.
6. Apply concepts of planes, lines, and spheres to real-world scenarios and complex geometric problems.

Detailed Syllabus

Module		Content	Hours	Marks Weightage
1	**Module I**		05	10%
	1.1	Conic sections, General equation of second degree		
	1.2	Pair of lines, Lines joining the origin to the points Of intersection of a curve and a line.		
2	**Module II**		13	20%
	2.1	Equation of parabola in standard and parametric form: Equations of Tangent and Normal, equation of chord of contact, pole and polar of a points and their properties.		
	2.2	Equations of ellipse in standard and parametric form: Equations of Tangent and Normal, condition for tangency Pole and polar and their elementary properties. Conjugate diameters.		
	2.3	Equations of hyperbola in standard and parametric form: Conjugate hyperbola and rectangular hyperbola, conjugate diameters, Asymptotes		
3	**Module III: Polar forms of conic sections**		05	10%
	3.1	Polar Equation of a conic (parabola, ellipse and hyperbola)		
	3.2	Polar equation of tangent, Normal, and Asymptotes		
4	**Module IV: Planes in Space**		13	25%
	4.1	General equation of plane, equation of plane in intercept form and in normal form. Pair of planes, and angle between two planes		
	4.2	distance of a point from a plane, plane bisecting the angle between two planes, equation of plane through the line of intersection of two planes.		
	4.3	Equations of a line, Shortest distance between plane and line.		
	Module V: Spheres and Their Properties		09	20%

5	5.1	General equation of sphere, plane sections of a sphere, sphere through a given circle, Tangent plane, plane of contact and polar plane		
	5.2	Intersection of a sphere and a straight line, Intersection of two spheres and its angle, Radical plane		
	5.3	Coaxial system of spheres. Conjugate systems.		
6	**Module VI: Cones and Cylinders**		07	15%
	6.1	The cone and cylinder: Equation of cone Intersection of a cone with a plane, Enveloping cone, Right circular cone,		
	6.2	Tangent lines and Tangent plane of a cone. Equation of a cylinder, equation of a cylinder through given conic		
	6.3	Enveloping cylinder, Right circular cylinders.		
Total			**52**	**100%**

References:

1. P.K. Jain and K. Ahmad, **Analytical Geometry of two Dimensions**, first edition, New Age International (P) Ltd., New Delhi, 1994, ISBN 978-0852264133.
2. P.K. Jain, **A Textbook of Analytical Geometry of Three Dimensions**, second edition, New Age International (P) Ltd., New Delhi, 2005, ISBN 978-8122403008.
3. R.J.T. Bell, **Elementary Treatise on Co-ordinate Geometry of Three Dimensions**, reprint edition, Macmillan India Ltd., 1911, ISBN 978-1406734467.
4. Shanti Narayan, **Analytical Solid Geometry**, first edition, S. Chand & Company Ltd., New Delhi, 2004, ISBN 978-8121926165.
5. S. L. Loney, **The Elements of Coordinate Geometry**, revised edition, Cambridge University Press, 1905, ISBN 978-0521066515.
6. R. Ballabh, **A Textbook of Co-ordinate Geometry: Analytical Geometry of Two Dimensions. Transformation of Rectangular Axes**, first edition, Pothishala Pvt. Ltd., 1960.

Semester-VI

Course Code	Course Name	Credits
PHY2608N	PHYSICS-VI	03

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	01	02	-	01	03

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. This course is designed to provide fundamental and conceptual knowledge of electricity, magnetism.
2. The course is designed to understand the correlation of electricity and magnetism using laws and principles. This course aims to make the students aware of electrical and electronic circuits.
3. The course is design to provide the basics of electromagnetism.
4. The course is design to make students aware of laws and principles of electrodynamics.
5. The course is designed to provide the basics of electronics.
6. The course aims to make students aware of applications of current electricity.

Course Outcomes

On completion of this course, student will be able to:

1. understand the basic concepts of electricity and magnetism by learning laws and principles and their mathematical foundation.
2. understand the correlation between electrostatics and magnetostatics, Maxwells equations and their important application in material science.
3. understand the basic ideas in electronics and basic circuits.
4. develop thinking skills.
5. understand current electricity and its applications.
6. develop the ability to apply knowledge in daily life.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	**Electrostatics and magnetostatics** Concepts of electric charge, Coulomb Force, Field, Potential, Electric flux, capacitance. Gauss' theorem and its applications. Lorentz Force, Motion of charged particle in magnetic field, Biot-Savart law, Ampere's circuital law.	6	15%
2	**Fields** Electric and Magnetic fields (E and B) in matter, concepts of permittivity, permeability, susceptibility, Para, Dia and Ferromagnetism	6	15%
3	**Electrodynamics** Concepts of curl, divergence of E and B, gradient of scalar quantity. Applications.	6	15%
4	**Maxwells Equations** Maxwells equations in vacuum and inside the matter. Electro-magnetic (EM) wave in vacuum. Electromagnetic (EM) wave as light, interaction of EM wave with matter.	6	15%
5	**Electronics** Concepts of dc and ac circuits, resistance and impedance, CR , LR and LCR circuits. Light Emitting diode (LED), Light dependent resistor (LDR), Transistors and transistorized circuits, Active and passive filters, low pass and high pass filters.	10	30%
6	**Logic Gates** Logic gates- AND, OR, NOT, NAND, NOR gates, seven segment display	5	10%
Total		**39**	**100%**

References:

1. *Classical Electromagnetism* by H C Verma, Bharti Bhavan, ISBN:9789388704823 (2022)
2. *Advanced Engineering Electromagnetism* by Balanis CA 3rd edition, Wiley, ISBN:978139418001 (2024)
3. *Engineering Electromagnetisn* by Ida N., Springer, ISBN:9783030155599, (2021)
4. *Introduction to Electrodynamics* by David Griffiths, Pearson (2019).
5. *Electricity and magnetism* by Murugeshan, S Chand, ISBN:9789352837342 (2019)
6. *Electronics* by Chattopadhay and Rakshit, New-age International Publishers, ISBN:9789387788633 (2020)

Semester-VI

Course Code	Course Name	Credits
PHY2609N	PHYSICS-VI LAB	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
-	02	-	-	01	-	01

Practical						Total
Internal Assessment				External		
Lab Journal	**Performance**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. The laboratory course is designed to provide skills to use various types of instruments and electrical devices.
2. The course is designed to provide the techniques to measure electronic parameters and understanding of different concepts of electronics.
3. The course is designed to provide basic and advanced understanding of current electricity.
4. The course is designed to develop thinking skills.
5. The course is designed to correlate theoretical and practical concepts.
6. The course is designed to make the students aware of electrical and electronic circuits.

Course Outcomes

On completion of this course, student will be able to:

1. Construct and use of different types of logic circuits.
2. Design and study the working of rectifier circuits.
3. Learn and perform the operation of half adders and full adders in logic circuits.
4. Perform and understand the basic concept of PN junction diode circuits.
5. Understand and learn an op-amp as an Integrator.
6. Understand and learn an op-amp as a Differentiator.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	To verify the basic logic gates using logic gate trainer kit	26	100%
2	To study (a) Half-wave rectifier, and (b) Full-wave bridge rectifier.		
3	To execute half adders and full adders with basic gates and hence to verify addition of binary numbers.		
4	To study the characteristics curves of a PN Junction diode in forward and reversed bias.		
5	To investigate the use of an op-amp as an Integrator.		
6	To investigate the use of an op-amp as a Differentiator.		
Total		**26**	**100%**

References:

1. *B.Sc. Practical Physics* by C. L. Arora, S. Chand publications, ISBN:978-81-219-0909-9 (2020)
2. *B.Sc. Practical physics* by Harnam Singh and P. S. Hemne, S. Chand Publications, ISBN : 9789355010940 (2022).
3. *Experimental Physics: Principles and Practical for Laboratory* by Walter F. Smith, CRC Publications. ISBN: 1498778801 (2020)
4. *B.Sc. Practical physics* by Harnam Singh and P. S. Hemne, S. Chand Publications, ISBN : 9789355010940 (2022).
5. *Electronics: fundamentals and applications* by D. Chattopadhay and P.C. Rakshit, ISBN:9387788636 (2020)

Semester-VI

Course Code	Course Name	Credits
CHY2609N	CHEMISTRY-VI	03

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	01	02	-	01	03

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. To learn to determine the pH of acidic basic and buffer solutions.
2. To learn to determine solubility products of solute in solution.
3. To learn about chemical equilibria and the factors affecting them.
4. To Le Chatelier principle and its application.
5. To impart basic knowledge of various colligative properties and their variations.
6. To learn calculation of the molar mass of solute in solution state.

Course Outcomes

1. Students will have understanding of the types of electrolytes and salts and their dissociation in solution.
2. Students will have knowledge of the solubility of salts and the extent of their dissociation.
3. Students will have understanding of development of concepts of chemical equilibrium.
4. Students will have understanding of Free energy change in a chemical reaction.
5. Students will have knowledge of colligative properties and its application
6. Students will have understanding of changes in molar mass solute in solution.

Detailed Syllabus

Module	Course Module / Contents		Hours	Marks Weightage
	Module I: Ionic equilibria:		**7**	20%
1	1.1	Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant of weak acids and bases and ionic product of water. pH scale, common ion effect; Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts.		
	1.2	Buffer solutions; derivation of Henderson equation and its applications; buffer capacity, buffer range, buffer action and applications of buffers in analytical chemistry and biochemical processes in the human body.		
2	**Module II: Solubility and solubility product:**		**6**	15%
	2.1	Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. Qualitative treatment of acid-base titration curves (calculation of pH at various stages). Theory of acid-base indicators; selection of indicators and their limitations.		
3	**Module III: Chemical equilibrium:**		**7**	20%
	3.1	Criteria of thermodynamic equilibrium, Law of Mass Action, The equilibrium constant and their quantitative dependence on temperature, pressure and concentration,		
	3.2	thermodynamic derivation of relations between the various equilibrium constants Kp, Kc and Kx. Experimental determination of equilibrium constant		
4	**Module IV: Fugacity**		**6**	15%
	4.1	concept of fugacity. Free energy and chemical equilibrium, Le Chatelier principle and its application.		
5	**Module V: Solutions and Colligative Properties:**		**7**	15%
	5.1	Dilute solutions; lowering of vapor pressure, Raoult's and Henry's Laws and their applications		
	5.2	Thermodynamic derivation using chemical potential to derive relations between the four colligative properties (i) Relative lowering of vapour pressure, (ii) Elevation of boiling point,		

		(iii) Depression of freezing point, (iv) Osmotic pressure and amount of solute		
6	**Module VI: Molar Mass Calculations:**		**6**	15%
	6.1	Calculation of molar masses of normal, dissociated and associated solutes in solution.		
Total			**39**	**100%**

References:

1. Atkins, P. W., & de Paula, J. (2018). Atkins' Physical Chemistry (11th ed.). Oxford University Press. ISBN: 9780198769866.
2. Levine, I. N. (2008). Physical Chemistry (6th ed.). McGraw-Hill Education. ISBN: 9780072538625.
3. Silbey, R. J., Alberty, R. A., & Bawendi, M. G. (2004). Physical Chemistry (4th ed.). Wiley. ISBN: 9780471215042.
4. McQuarrie, D. A., & Simon, J. D. (1997). Physical Chemistry: A Molecular Approach. University Science Books. ISBN: 9780935702996.
5. Castellan, G. W. (1983). Physical Chemistry (3rd ed.). Addison-Wesley. ISBN: 9780201068948.
6. Barrow, G. M. (1996). Physical Chemistry (6th ed.). McGraw-Hill Education. ISBN: 9780070051119.

Semester-VI

Course Code	Course Name	Credits
CHY2610N	CHEMISTRY-VI LAB	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
-	02	-	-	01	-	01

Practical						Total
Internal Assessment				External		
Lab Journal	**Performance**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. To provide knowledge of using pH meter and potentiometer and their uses.
2. To learn how to classify solution into acidic basic and buffer solution.
3. To gain the experimental skill to study equilibrium
4. To develop the concept of strong and weak acids and bases and their basicity and acidity.
5. To learn about solubility and how it is affected.
6. To learn the basic lab practices of a chemistry lab.

Course Outcomes

1. Students will develop skill to use of pH meter
2. Students will have knowledge of acidic basic and neutral salts and solutions and buffer solutions.
3. Students will learn concept of chemical equilibrium and equilibrium study.
4. Students will develop skill to use potentiometer.
5. Students will learn concept and types of titrations.
6. Students will understand solubility and solubility product.

Detailed Syllabus

Module	Content	Hours	Marks Weightage
1	pH measurements (a) Measurement of pH of different solutions using a pH-meter. (b) Preparation of buffer solutions and comparison of their pH values (i) Sodium acetate-acetic acid (ii) Ammonium chloride-ammonium hydroxide	26	100%
2	Chemical Equilibrium (a) Study the equilibrium of at least one of the following reactions by the distribution method: (i) $I_2(aq) + I^- \rightarrow I3^-$ (aq) (ii) $Cu^{2+(}aq) + nNH_3 \rightarrow Cu(NH_3)n^{2+}$		
3	Potentiometric Titrations (a) Strong acid with strong base (b) weak acid with strong base (c) Dibasic acid with strong base (d) Potentiometric titration of Mohr's salt with potassium dichromate.		
4	Solubility Measurement (a) Study of the solubility of benzoic acid in water and determination of ΔH		
Total		**26**	**100%**

References:

1. Pandey, O. P., Bajpai, D. N., & Giri, S. (2012). Practical Chemistry: For B.Sc. I-, II- And III-Year Students. S Chand Publication. ISBN: 9788121907964.
2. Vogel, A. I., Mendham, J., Denney, R. C., Barnes, J. D., & Thomas, M. J. K. (2000). Vogel's Textbook of Quantitative Chemical Analysis (6th ed.). Pearson Education. ISBN: 9780582226289.
3. Das, R. C., & Behara, B. (1983). Experimental Physical Chemistry. Tata McGraw-Hill Education. ISBN: 9780074516119.
4. Sime, R. J. (1990). Physical Chemistry: Methods, Techniques, and Experiments. Saunders College Publishing. ISBN: 9780039227762.
5. Levitt, B. P. (1985). Findlay's Practical Physical Chemistry (9th ed.). Longman Group Ltd. ISBN: 9780582446939.
6. James, A. M., & Prichard, F. E. (1974). Practical Physical Chemistry (3rd ed.). Longman Group Ltd. ISBN: 9780582445031.
7. Gurtu, J. N., & Kapoor, R. (1987). Advanced Experimental Chemistry: Volume I – Physical. S. Chand & Company Ltd. ISBN: 9788121900965.

Semester-VI

Course Code	Course Name	Credits
STA2605N	DATA ANALYSIS & DECISION MAKING	03

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
02	-	01	02	-	01	03

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Introduce basic data modelling, descriptive statistics, and graphical techniques.
2. Cover tools for decision-making under uncertainty using tables and criteria.
3. Develop proficiency in simple and multiple regression for estimation and prediction.
4. Understand plotting, stationarity checks, ACF, PACF plots, and ARIMA modelling.
5. Apply models in scheduling, logistics, and financial scenarios.
6. Introduce methods for inventory and waiting line management.

Course Outcomes

1. Adept in data modelling and descriptive statistics.
2. Utilize tools for decision-making under uncertainty.
3. Accurate regression analysis and prediction.
4. Analyze and forecast time series data effectively.
5. Apply models to real-world scenarios.
6. Understand and apply simulation techniques effectively.

Detailed Syllabus

Module		Contents	Hours	Marks Weightage
1		**Module I: Data Analysis and Decision Making**	**07**	20%
	1.1	Introduction to data analysis and decision making: Modelling and Models, describing data, basic concepts, various graphs, time series plots, Box Plot, Stem & Leaf, exploring data with Pivot table		
	1.2	Describing Data: summary measures, getting the right data: sources of data, using excel auto filter, complex queries with advanced filter, importing external data from Access creating pivot table from external data, other data sources on the web, cleansing the data, complement and problems		
2		**Module II: Decision making under uncertainty**	**07**	16%
	2.1	Introduction, elements of decision making: Pay-off table, regret table, expected value of profit or loss. Decision under certainty- Minimax, Maximax, Hurwicz criterion, decision tree & its Uses, the precision tree, single and multi-stage decision problems		
	2.2	Bayes rule, numerical problems based on Normal, Binomial, Poisson and Exponential distributions		
3		**Module III: Simple linear regression model**	**06**	16%
	3.1	Estimation of $\beta 0$ and $\beta 1$, hypothesis testing on the slope and intercept, interval estimation in simple linear regression, prediction of new observations, coefficient of determination		
4		**Module IV: Multiple regression models**	**06**	16%
	4.1	Estimation of the model parameters, hypothesis testing in multiple linear regression, confidence intervals in multiple regression, prediction of new observations, multicollinearity.		
5		**Module V: Residual analysis Time series**	**07**	16%
	5.1	Time series plot, checking of stationary series, ACF, PACF plot, time series model ARIMA, forecasting of time series		

	5.2	Decision Modeling: Work force scheduling models, blending models, logistic models, aggregate planning models, dynamic financial models, integer programming models.		
6		**Module VI: Simulation models**	**06**	16%
	6.1	Introduction, selecting probability distributions, simulating correlated values, Random number generation, Monte Carlo Method, Inventory & Waiting line Simulation, Applications & Limitations.		
Total			**39**	**100%**

References:

1. Albright, S.C., Winston, W.L. and Zappe, C. (2003): Data Analysis & Decision making, 2nd Edn. Cengage learning Pvt. Ltd.
2. Anderson, D.R., Sweeney, D.J. and Williams, T.A. (2008): Statistics for Business and Economics, Cengage Learning Pvt. Ltd**.**
3. U. Dinesh Kumar (2020) Business Analytics
4. S. Christian Albright, Wayne L. Winston (2015): Business Analytics: Data Analysis and Decision Making
5. Foster Provost, Tom Fawcett (27 Jul 2013) : Data Science for Business
6. Barry Devlin (2013): Business UnIntelligence

Semester-VI

Course Code	Course Name	Credits
STA2606N	DATA ANALYSIS & DECISION MAKING LAB	01

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
-	02	-	-	01	-	01

Practical						Total
Internal Assessment				External		
Lab Journal	**Performance**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Develop Proficiency in Data Import and Organization
2. Enhance Data Classification and Analysis Abilities
3. Master Sampling Techniques and Their Applications
4. Apply Frequency Distribution and Visualization Techniques
5. Compute and Interpret Measures of Central Tendency and Partition Values
6. Conduct Correlation and Regression Analysis

Course Outcomes

1. Proficiently import, organize, and summarize data from various sources using statistical software.
2. Accurately classify and analyze different types of data and populations, demonstrating a clear understanding of data characteristics.
3. Successfully apply and compare sampling methods, and critically analyze the impact of different sampling techniques on data results.
4. Create and interpret frequency distributions and visualizations to effectively communicate data patterns and insights.
5. Compute and interpret key statistical measures of central tendency and partition values, and present data distributions clearly.
6. Conduct and interpret correlation and regression analyses to identify and explain relationships between variables, and effectively visualize regression results.

Detailed Syllabus

Module		Contents	Hours	Marks Weightage
1		**Introduction to Software for Data Collection**	02	6%
	1.1	mport and organize primary and secondary data from fields like industry, medical sciences, and economics. Load data from CSV files and Excel sheets, and create summaries of the dataset.		
2		**Exploration of Data Scope**	02	8%
	2.2	Explore data scope using statistical tools. Perform basic descriptive statistics (mean, variance, standard deviation) and analyze data in different fields using software functions.		
3		**Types of Data and Population and Sample Identification**	02	8%
	3.1	Classify data types (nominal, ordinal, interval, and ratio) and simulate populations. Identify and categorize variables, and simulate finite and infinite populations.		
4		**Sampling Techniques**	02	8%
	4.1	Perform and compare various sampling methods. Apply simple random sampling, stratified random sampling, and cluster sampling to a dataset and analyze variations in sample results.		
5		**Frequency Distribution**	02	8%
	5.1	Create and visualize frequency distributions. Generate grouped and ungrouped frequency distributions, and create histograms, bar charts, and frequency polygons.		
6		**Measures of Central Tendency**	02	8%
	6.1	Compute central tendency measures (A.M., G.M., H.M.). Use statistical software to compute arithmetic mean, geometric mean, and harmonic mean, and calculate combined means for multiple groups.		
7		**Trimmed Mean, Median, and Mode**	02	8%
	7.1	Calculate trimmed means, median, and mode for a dataset. Use software to compute these central		

		tendency measures and visualize them with box plots and histograms.		
8		**Partition Values**	**02**	**8%**
	8.1	Calculate and visualize quartiles, deciles, and percentiles. Compute partition values using built-in functions and visualize the distribution with cumulative frequency graphs.		
9		**Correlation Analysis**	**02**	**8%**
	9.1	Perform correlation analysis using statistical software. Generate scatter plots, calculate Pearson's correlation coefficient, and conduct rank correlation analysis (Spearman's or Kendall's).		
10		**Regression Analysis**	**02**	**8%**
	10.1	Conduct linear regression and interpret the results. Fit a linear regression model to a dataset, visualize the regression line on a scatter plot, and interpret coefficients and goodness-of-fit (R-squared).		
11		**Data Classification and Likert Scale Analysis**	**02**	**8%**
	11.1	Classify data and analyze Likert scale survey responses. Classify data (e.g., dichotomous, manifold classes) and create visual representations of Likert scale data using bar charts and heatmaps.		
12		**Consistency of Data**	**02**	**7%**
	12.1	Check data consistency for multiple attributes. Apply logical conditions and filters to verify consistency across two or more attributes in a dataset.		
13		**Association and Independence**	**02**	**7%**
	13.1	Test association and independence between categorical variables. Calculate Yule's coefficient of association, create contingency tables, perform Chi-square tests, and visualize results using mosaic plots.		
Total			**26**	**100%**

References:

1. **Practical Statistics for Data Scientists: 50 Essential Concepts** Peter Bruce, Andrew Bruce, and Peter Gedeck, 2nd Edition (2020), O'Reilly Media, ISBN-13: 978-1492072944
2. **Hands-On Programming with R: Write Your Own Functions and Simulations** Garrett Grolemund, 1st Edition (2014), O'Reilly Media, ISBN-13: 978-1491945638

3. **Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython** Wes McKinney, 2nd Edition (2018), O'Reilly Media, ISBN-13: 978-1491957662
4. **Numerical Methods for Engineers and Scientists Using MATLAB® and C** George A. Articolo, 1st Edition (2014), CRC Press, ISBN-13: 978-1466587413
5. **Data Analysis Using Regression and Multilevel/Hierarchical Models** Andrew Gelman and Jennifer Hill, 1st Edition (2007), Cambridge University Press, ISBN-13: 978-0521686891
6. **Applied Multivariate Statistical Analysis** Richard A. Johnson and Dean W. Wichern, 6th Edition (2018), Pearson, ISBN-13: 978-0134995392

Semester - VII						
	Course Code	**Course Title**	**Lecture Credits**	**Tutorial Credits**	**Practical Credits**	**Total Credits**
Discipline-I (Core)						**12**
Discipline-I	MTH2701N	Fractional Calculus	3	1	-	4
	MTH2702N	Lattice Theory	3	1	-	4
	MTH2703N	Introduction to Mathematical Biology	3	1	-	4
Total (Discipline-I)						**12**
SIP/Internship/ Project/Dissertation/ Field Visit	MTH2704N	Research Project-I	-	-	-	9
Total						**9**
Grand Total						**21**

Semester-VII

Course Code	Course Name	Credits
MTH2701N	FRACTIONAL CALCULUS	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Understand and apply Riemann-Liouville, Caputo, and Grunwald-Letnikov fractional derivatives in diverse contexts.
2. Compute fractional derivatives for fundamental functions and special functions like Bessel's and hypergeometric functions.
3. Explore Laplace and Fourier transforms of fractional derivatives, studying their properties and applications.
4. Solve linear fractional-order differential equations using various fractional derivatives and considering initial conditions.
5. Master techniques for solving homogeneous and non-homogeneous fractional differential equations, including reduction to ordinary differential equations.
6. Apply Weyl fractional calculus, including Weyl fractional derivatives and integrals, through Leibniz's formulas and practical applications.

Course Outcomes

1. Apply data visualization in big-data analytics.
2. Utilize EDA, inference, and regression techniques.
3. Utilize Matrix decomposition techniques to perform data analysis.
4. Identify the categorical and/or numerical data types in each data set
5. Apply data pre-processing techniques. And basic Machine Learning Algorithms.
6. Apply appropriate descriptive and inferential methods to summarize data and identify associations and relationships

Detailed Syllabus

Module		Content	Hours	Marks Weightage
1	**Fractional Calculus**		12	25%
	1.1	Review of basic definitions of integer-order (IO) derivatives and integrals and their geometric and physical interpretations.		
	1.2	Definition of Riemann-Liouville (RL) integration, Definitions of RL, Caputo and Grunwald-Letnikov (GL) fractional derivatives (FDs),Variousgeometrical and physical interpretations of these FDs, Computation of these FDs for some basic functions like constant, ramp, exponential, sine, cosine, etc., Laplace and Fourier transforms of FDs.		
2	**Fractional Order Differential Equations**		07	10%
	2.1	Dirichlet's Formula, Derivatives of the Fractional Integral and the Fractional Integral of Derivatives.		
	2.2	Laplace Transform of the Fractional integral, Leibniz's Formula for Fractional Integrals. Derivatives, Leibniz's Formula of Fractional Derivatives.		
3	3.1	The Weyl Fractional Calculus – Definition of Weyl Fractional Integral Weyl Fractional Derivatives, A Leibniz Formula for Weyl Fractional Integral and simple applications.	07	10%
	3.2	Study of basic functions like Gamma function, MittagLeffler function, Dawson's function, Hypergeometric function, etc.		
4	4.1	Analysis of linear fractionalorder differential equations (FDEs): formulation, Solution with different FDs, Initial conditions,	08	20%
	4.2	Problem of initialization and the remedies.		
5	5.1	Fractional Differential Equations: Introduction, Laplace Transform, Linearly Independent Solutions.	07	15%
6	**Fractional Differential Equations**		11	20%
	6.1	Solutions of the Homogeneous Equations, Solution of the Non-homogeneous Fractional Differential Equations.		
	6.2	Reduction of Fractional Differential Equations to ordinary differential equations. Semi Differential equations.		

Total	**52**	**100%**

References:

1. Miller K.S. and Ross B. (1993) An Introduction to the Fractional Calculus and Fractional Differential Equations, John Wiley and Sons, New York.
2. Oldham K.B. and Spanier J. (1974) The Fractional Calculus, Academic Press Inc., USA
3. Samko S.G., Kilbas A.A., Marichev O.I. (1987) Fractional Integrals and Derivatives, Gordon and Breach Science publishers.
4. K. B. Oldham and J. Spanier. The Fractional Calculus . Dover Publications, USA, 2006.
5. Kilbas, H. M. Srivastava, and J. J. Trujillo. Theory and Applications of Fractional Differential Equations, Elsevier, Netherlands, 2006.
6. Podlubny. Fractional Differential Equations . Academic Press, USA, 1999.

Semester-VII

Course Code	Course Name	Credits
MTH2702N	LATTICE THEORY	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Understand the fundamental concepts of partially ordered sets and lattices.
2. Analyze and characterize different types of lattices including distributive and Boolean lattices.
3. Apply lattice theory concepts to solve problems in algebraic structures and computer science.
4. Demonstrate proficiency in defining and analyzing lattice homomorphisms and isomorphisms.
5. Explore advanced topics such as congruences, quotient lattices, and their applications.
6. Investigate modern applications of lattice theory in cryptography, formal languages, and artificial intelligence.

Course Outcomes

1. Ability to identify and classify different types of lattices and partially ordered sets.
2. Proficiency in applying lattice theory concepts to analyze algebraic structures.
3. Capability to solve problems using lattice homomorphisms and isomorphisms.
4. Competence in recognizing and utilizing congruences and quotient lattices in applications.
5. Understanding of modern developments in lattice-based cryptography and their implications.
6. Skill in applying lattice-theoretic methods to problems in computer science and artificial intelligence.

Detailed Syllabus

Module		Content	Hours	Marks Weightage
1	**Module I: Introduction to lattices**		9	15%
	1.1	Introduction to partially ordered sets (posets), lattices, and complete lattices, examples, and basic properties		
2	2.1	Properties of lattices: bounded lattices, Lattice operations: join, meet,	9	15%
	2.2	Modular and Boolean lattices distributive lattices, complemented lattices		
3	3.1	Algebraic structures related to lattices: semilattices, Boolean algebras	13	30%
	3.2	Modular and distributive lattices in terms of there forbidden birkhoff and dedekind crieterion.		
4	4.1	Lattice homomorphisms, ideals, filters, and congruences	6	10%
5	5.1	Partially ordered sets (posets), chains, and antichains	10	20%
6	6.1	Properties of lattices in relation to posets Applications of lattices in computer science, algebra, and logic	5	10%
Total			**52**	**100%**

References:

1. Grätzer, George. **Lattice Theory: Foundation**. Birkhäuser, 2011.
2. Davey, B. A., and H. A. Priestley. **Introduction to Lattices and Order**. Cambridge University Press, 2002.
3. K. B. Oldham and J. Spanier. The Fractional Calculus . Dover Publications, USA, 2006.

Semester-VII

Course Code	Course Name	Credits
MTH2703N	INTRODUCTION TO MATHEMATICAL BIOLOGY	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Understand the basic principles of mathematical modeling and its applications in biological systems.
2. Analyze population dynamics using mathematical techniques such as differential equations and difference equations.
3. Model the spread of infectious diseases and analyze epidemiological data using compartmental models.
4. Apply mathematical tools to study ecological interactions and dynamics within ecosystems.
5. Develop skills in formulating and solving mathematical models to address biological questions.
6. Interpret and communicate mathematical results in the context of biological phenomena.

Course Outcomes

1. Ability to construct and interpret mathematical models of biological processes.
2. Proficiency in applying mathematical techniques to analyze population dynamics, epidemiological data, and ecological interactions.
3. Competence in using computational tools to simulate and analyze biological models.
4. Understanding of the limitations and assumptions inherent in mathematical models in biology.
5. Skills in critically evaluating and adapting existing mathematical models to new biological scenarios.
6. Capability to communicate mathematical concepts and findings effectively to biologists and other stakeholders.

Detailed Syllabus

Module		Content	Hours	Marks Weightage
	Module I Introduction to Biological Systems and Mathematical Modeling		6	12%
1	1.1	Introduction to biological systems and their complexity		
	1.2	Overview of mathematical modeling in biology		
2	2.1	Types of models: deterministic and stochastic	7	13%
	2.2	Applications of mathematical models in biology		
3	**Module II Population Dynamics**		6	12%
	3.1	Basics of population growth and regulation		
	3.2	Exponential and logistic growth models		
4	4.1	Age-structured population models	7	13%
	4.2	Predator-prey models (Lotka-Volterra model), Competition model		
5	**Module III Epidemiology**		07	15%
	5.1	Introduction to epidemiology and disease modeling		
	5.2	Basic compartmental models (SIR, SEIR)		
6	6.1	Extensions of compartmental models, Spatial epidemiology and spatial models, Vaccination strategies and epidemic control	**5**	10%
7	**Module IV Mathematical Ecology**		**7**	13%
	7.1	Ecological interactions and dynamics, Competition models in ecology		
8	8.1	Predation and food web models Spatial ecology and metapopulation models Biodiversity and conservation models	**6**	12%
Total			**52**	**100%**

References:

1. Miller K.S. and Ross B. (1993) An Introduction to the Fractional Calculus and Fractional Differential Equations, John Wiley and Sons, New York.
2. Oldham K.B. and Spanier J. (1974) The Fractional Calculus, Academic Press Inc., USA
3. Samko S.G., Kilbas A.A., Marichev O.I. (1987) Fractional Integrals and Derivatives, Gordon and Breach Science publishers.
4. K. B. Oldham and J. Spanier. The Fractional Calculus . Dover Publications, USA, 2006.
5. Kilbas, H. M. Srivastava, and J. J. Trujillo. Theory and Applications of Fractional Differential Equations, Elsevier, Netherlands, 2006.
6. Podlubny. Fractional Differential Equations . Academic Press, USA, 1999.

Semester-VII

Course Code	Course Name	Credits
MTH2704N	RESEARCH PROJECT-I	09

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
-	-	-	-	-	-	09

Research Project		Total
Report	**Presentation and Viva-Voce**	
75	75	**150**

Course Objective

The research project aims to equip students with the intellectual, practical, and personal skills necessary to succeed in their chosen field.

Course Outcomes

On completion of summer project, the student will be able to

1. apply knowledge and skills in real world problems through project,
2. function in a team and use experience related to professional and ethical issues in the work environment.

Project Theme

Research Project is to be tailored per specific interests and skills. Reach out to Professors, Research Groups, or Companies in area of interest to explore potential opportunities.

Guidelines

1	**Step-I**
	Selection of the topic for the project by taking following points into consideration: 1. Suitability of the topic. 2. Relevance of the topic.

	3. Time available at the disposal. 4. Feasibility of data collection within the given time limit. 5. Challenges involved in the data collection (time & cost involved in the data collection, possibility of getting responses, etc.)
2	**Step-II**
	Finalization of the Topic and preparation of Project Proposal in consultation with the Supervisor.
3	**Step-III**
	Collection of information and data relating to the topic and analysis of the same.
4	**Step-IV**
	Writing the report dividing it into suitable chapters, viz., Chapter 1:Introduction (10 marks), Chapter 2: Conceptual Framework / National & International Scenario (25 marks), Chapter 3: Presentation, Analysis & Findings (25 marks), Chapter 4: Conclusion and Recommendations (10 marks), Chapter-5: Bibliography (05 marks)
5	**Step-V**
	The following documents are to be attached with the Final Project Report. 1) Approval letter from the supervisor (Annexure - IA) 2) Student's declaration (Annexure - IB) 3) Certificate from the Competent Authority of the Organisation / Institution, if the student undertakes the Project Work in any Organisation / Institution.

Components of Report	
1	**Cover Page**
	This should contain the title of the project proposal, to whom it is submitted, for which degree, the name of the author, name of the supervisor, year of submission of the project work, name of the University.
2	**Acknowledgement**
	Various organizations and individuals who might have provided assistance /co-operation during the process of carrying out the study.
3	**Table of Content**
	Page-wise listing of the main contents in the report, i.e., different Chapters and its main Sections along with their page numbers.
4	**Body of the Report**
	The body of the report should have these four logical divisions

	a) ***Introduction:*** This will cover the background, rationale/ need / justification, brief review of literature, objectives, methodology (the area of the study, sample, type of study, tools for data collection, and method of analysis), Limitations of the Study, and Chapter Planning.
	b) ***Conceptual Framework / National and International Scenario*****:** (relating to the topic of the Project).
	c***) Presentation of Data, Analysis and Findings*****:** (using the tools and techniques mentioned in the methodology).
	d) ***Conclusion and Recommendations:*** In this section, the concluding observations based on the main findings and suggestions are to be provided.
5	**Bibliography or References**
	This section will include the list of books and articles which have been used in the project work, and in writing a project report.
6	**Annexures**
	Questionnaires (if any), relevant reports, etc. (The main text of the Project should normally be in the range of 5000 words. However, there may be annexure in addition to the main text)

Evaluation / Assessment
1. Each of the students has to undertake a Project individually under the supervision of a teacher and to submit the same following the guidelines stated below. 2. Language of Project Report and Viva-Voce Examination may be English. The Project Report must be typed and hard bound. 3. Failure to submit the Project Report or failure to appear at the Viva-Voce Examination will be treated as "Absent" in the Examination. He /she has to submit the Project Report and appear at the Viva-Voce Examination in the subsequent years (within the time period as per University Rules). No marks will be allotted on the Project Report unless a candidate appears at the Viva-Voce Examination. Similarly, no marks will be allotted on Viva-Voce Examination unless a candidate submits his/her Project Report. 4. Evaluation of the Project Work to be done jointly by one internal expert and one external expert with equal weightage, i.e., average marks of the internal and external experts will be allotted to the candidate.

Semester - VIII						
	Course Code	**Course Title**	**Lecture Credits**	**Tutorial Credits**	**Practical Credits**	**Total Credits**
Discipline-I (Core)						**12**
Discipline-I	MTH2801N	Spectral Graph Theory	3	1	-	4
	MTH2802N	Special Functions	3	1	-	4
	MTH2803N	Dynamical Systems	3	1	-	4
Total (Discipline-I)						**12**
SIP/Internship/ Project/Dissertation/ Field Visit	MTH2804N	Research Project-II	-	-	-	12
Total						**12**
Grand Total						**24**

Semester-VIII

Course Code	Course Name	Credits
MTH2801N	SPECTRAL GRAPH THEORY	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Introduce fundamental concepts and types of graphs with basic representations.
2. Understand essential graph properties like walks, paths, cycles, and connectivity.
3. Explore graph spectra through eigenvalues and eigenvectors of graph matrices.
4. Investigate spectral properties and techniques for graph partitioning and expansion.
5. Apply spectral methods in clustering, community detection, and random walks.
6. Study advanced spectral techniques for graph isomorphism and solving graph problems.

Course Outcomes

1. Represent graphs using adjacency, incidence, and Laplacian matrices.
2. Analyze graph structures based on degree sequences, paths, and connectivity.
3. Apply spectral graph theory techniques like eigenvalue computation.
4. Solve graph partitioning problems using spectral properties and theorems.
5. Implement spectral methods for clustering, community detection, and segmentation.
6. Use advanced spectral algorithms for solving network and graph isomorphism problems.

Detailed Syllabus

Module		Content	Hours	Marks Weightage
1	**Introduction to Graphs:**		10	20%
	1.1	Definition, types of graphs (simple, multigraphs, weighted graphs).		

	1.2	Graph Representations: Adjacency matrix, incidence matrix, Laplacian matrix.		
2	2.1	Basic Concepts: Degree sequence, walks, paths, cycles, connectivity.	10	20%
	2.2	Graph Spectra: Eigenvalues and eigenvectors of matrices associated with graphs.		
3	**Spectral Properties of Graphs.**		10	20%
	3.1	Spectral radius, eigenvalue interlacing theorem.		
	3.2	Cheeger's inequality, graph expansion, spectral partitioning.		
4	4.1	Clustering, community detection, image segmentation using spectral methods, Mixing time, hitting time, spectral bounds on random walks.	7	13%
5	**Advances in Spectral Graph Theory**		10	17%
	5.1	Spectral techniques for graph isomorphism testing.		
	5.2	Spectral methods for graph coloring, chromatic number bounds.		
6	6.1	Spectral algorithms for graph problems (e.g., matching, clustering, Network analysis, protein interaction networks, social network analysis.	7	13%
Total			**52**	**100%**

References:

1. Fan R. K. Chung, S**pectral Graph Theory**, AMS Providence, 1997.
2. Jonathan L. Gross and Jay Yellen, **Graph Theory and Its Applications**, CRC Press, 2017.
3. Daniel A. Spielman, **Spectral Graph Theor**y, CBMS Regional Conference Series in Mathematics, 2009.
4. D. M. Cvetković, M. Doob, H. Sachs, **Spectra of Graphs: Theory and Application**, Academic Press, 1980.
5. B. Mohar, W. Woess, **A Survey on Spectral Graph Theory**, AMS Contemporary Mathematics, 1991.
6. R. Merris, **Laplacian Graph Eigenvectors, Linear Algebra and its Applications**, 1994.

Semester-VIII

Course Code	Course Name	Credits
MTH2802N	SPECIAL FUNCTIONS	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. To provide essential ideas of integral transforms and their applications.
2. To explore the properties and applications of the Beta and Gamma functions.
3. To study the properties and applications of the Gauss hypergeometric function.
4. To understand the properties of Bessel functions and their uses in solving differential equations.
5. To analyze the properties and applications of Legendre polynomials.
6. To investigate the properties and applications of Hermite and Laguerre polynomials.

Course Outcomes

1. Understand the properties and applications of Beta and Gamma functions.
2. Gain knowledge of Pochhammer's symbol and hypergeometric differential equations.
3. Comprehend the properties and applications of Gauss hypergeometric functions.
4. Understand the properties and applications of Bessel functions, including recurrence relations and orthogonal properties.
5. Gain knowledge of Legendre polynomials, including generating functions, Rodrigues' formula, and orthogonal properties.
6. Understand the properties and applications of Hermite and Laguerre polynomials, including generating functions and orthogonal properties.

Detailed Syllabus

Module		Content	Hours	Marks Weightage
1	**Module I**		13	25%
	1.1	Introduction to partially ordered sets (posets), lattices, and complete lattices, examples, and basic properties		
	1.2	Pochhammer's Symbol and Properties, Hypergeometric Differential Equations		
2	2.1	Gauss Hypergeometric Function and Elementary Properties.	09	15%
3	**Module II**		10	20%
	3.1	Bessel functions, Bessel differential equation, Recurrence relation, Generating functions, Integral representation		
	3.2	Recurrence relations, Orthogonal Property of Bessel functions, Legendre polynomials, Legendre's differential equations		
4	4.1	Generating Functions, Rodrigue's Formula, Orthogonal Property of Legendre polynomials, Recurrence relations.	06	15%
5	**Module III**		08	15%
	5.1	Hermite Polynomials, Hermite Differential Equation, Generating Function, Recurrence Formulas, Rodrigue's Formula		
	5.2	Orthogonal Property, Laguerre Polynomials, Laguerre Differential Equation, Generating Function		
6	6.1	Recurrence Formulas, Rodrigue's Formula, Orthogonal Property.	06	10%
Total			**52**	**100%**

References:

1. G. E. Andrews, R. Askey, Ranjan Roy, **Special Functions, Encyclopedia of Mathematics an its Application**s, Cambridge University Press, 1999.
2. E. D. Rainville, **Special Functions**, Macmillan, New York, 1960.
3. M.D. Raisinghania, **Ordinary and Partial Differential equations**, S. Chand & Company ltd, New Delhi 2008.
4. N. M. Temme, **Special Functions: An Introduction to the Classical Functions of Mathematical Physics**, Wiley, 1996.
5. N. N. Lebedev, **Special Functions & Their Applications**, Dover Publications, 1972.
6. F. W. J. Olver, D. W. Lozier, R. F. Boisvert, C. W. Clark, **NIST Handbook of Mathematical Functions**, Cambridge University Press, 2010.

Semester-VIII

Course Code	Course Name	Credits
MTH2803N	DYNAMICAL SYSTEMS	04

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
03	-	01	03	-	01	04

Theory						Total
Internal Assessment				External		
Test	**Continuous Assessment**	**Attendance**	**Total**	**End Sem Exam**	**Duration of End Sem Exam**	
15	10	05	**30**	**70**	3 Hours	**100**

Course Objectives

1. Introduce continuous and discrete dynamical systems with examples and phase space concepts.
2. Understand stability and equilibrium points using Lyapunov stability theory and related theorems.
3. Explore chaos theory and its applications in nonlinear systems, including the Lorenz system.
4. Study phase plane analysis and classification of fixed points in nonlinear systems.
5. Examine periodic points, cycles, and their stability through maps like the logistic map.
6. Develop a mathematical foundation for analyzing real-world dynamical systems, including SIR models.

Course Outcomes

1. Define and analyze continuous and discrete dynamical systems using phase space and trajectories.
2. Assess stability of equilibrium points using Lyapunov theory and the Hartman-Grobman theorem.
3. Investigate chaotic behavior in nonlinear systems and apply chaos theory principles.
4. Classify fixed points and analyze their stability in nonlinear dynamical systems.
5. Analyze periodic points and cycles through maps, understanding stability using diagrams.
6. Apply mathematical models to real-world systems, such as epidemic models (SIR, SEIR).

Detailed Syllabus

Module		Content	Hours	Marks Weightage
	Module I Introduction to Dynamical Systems		**13**	25%
1	1.1	Definitions and examples of dynamical systems: continuous and discrete.		
	1.2	Phase space and trajectories.		
	1.3	Linear systems: eigenvalues and eigenvectors.		
	1.4	Nonlinear systems and linearization.		
2	**Module II Stability and Equilibrium Points**		**13**	25%
	2.1	Stability of equilibrium points: definitions and types.		
	2.2	Lyapunov stability theory.		
	2.3	Hartman-Grobman theorem.		
	2.4	Examples and applications in physical systems.		
3	**Module III Chaos and Applications**		**9**	15%
	3.1	Introduction, Investigation of Differential Equations via its Direction Field, Linear Systems, Phase Plane, Classification of Fixed Points of Non-linear Systems by Linearization, Examples		
4	4.1	Limit Cycles, Gradient System, Liapunov Functions, Dulac's Criteria, Poincare-Bendixon Theorem, Lorenz System and its Properties, Chaos, Necessary Condition for Chaos, Examples. Basic compartmental models (SIR, SEIR)	**4**	10%
5	**Module IV**		**9**	15%
	5.1	Maps and Flow, Composition of Maps, Orbits, Fixed Points, Stable and Unstable Fixed Points, Basin of Attraction and Basin Boundary, Linear Stability Analysis, Cobweb Diagram, Examples.		

6	6.1	Periodic Point, Periodic Cycles, Stability of Periodic Points and Periodic Cycles, Tent Map, Logistic Map. Properties of Logistic Map. Examples.	**4**	10%
Total			**52**	**100%**

References:

1. S. H. Strogatz : **Nonlinear Dynamics and Chaos.**
2. G .C. Layek : **An Introduction to Dynamical Systems and Chaos.**
3. J. Berry : **Introduction to Non-Linear Systems**
4. D. Kaplan and L. Gloss : **Understanding Nonlinear Dynamics**.
5. M. W. Hirsch, S. Smale, and R. L. Devaney : **Differential Equations, Dynamical Systems, and an Introduction to Chaos**.
6. S. Wiggins : **Introduction to Applied Nonlinear Dynamical Systems and Chaos**.

Semester-VIII

Course Code	Course Name	Credits
MTH2804N	RESEARCH PROJECT-II	12

Contact Hours			Credits Assigned			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorial**	**Total**
-	-	-	-	-	-	12

Internship/Project		Total
Report	**Presentation and Viva-Voce**	
100	100	**200**

Course Objective

The research project aims to equip students with the intellectual, practical, and personal skills necessary to succeed in their chosen field.

Course Outcomes

On completion of summer project, the student will be able to

1. apply knowledge and skills in real world problems through project,
2. function in a team and use experience related to professional and ethical issues in the work environment.

Guidelines

1	**Step-I**
	Selection of the topic for the project by taking following points into consideration: 1. Suitability of the topic. 2. Relevance of the topic. 3. Time available at the disposal. 4. Feasibility of data collection within the given time limit. 5. Challenges involved in the data collection (time & cost involved in the data collection, possibility of getting responses, etc.)

2	**Step-II**
	Finalization of the Topic and preparation of Project Proposal in consultation with the Supervisor.
3	**Step-III**
	Collection of information and data relating to the topic and analysis of the same.
4	**Step-IV**
	Writing the report dividing it into suitable chapters, viz., Chapter 1:Introduction (20 marks), Chapter 2: Conceptual Framework / National & International Scenario (25 marks), Chapter 3: Presentation, Analysis & Findings (25 marks), Chapter 4: Conclusion and Recommendations (20 marks), Chapter-5: Bibliography (10 marks)
5	**Step-V**
	The following documents are to be attached with the Final Project Report. 1) Approval letter from the supervisor (Annexure - IA) 2) Student's declaration (Annexure - IB) 3) Certificate from the Competent Authority of the Organisation / Institution, if the student undertakes the Project Work in any Organisation / Institution.

Components of Report	
1	**Cover Page**
	This should contain the title of the project proposal, to whom it is submitted, for which degree, the name of the author, name of the supervisor, year of submission of the project work, name of the University.
2	**Acknowledgement**
	Various organizations and individuals who might have provided assistance /co-operation during the process of carrying out the study.
3	**Table of Content**
	Page-wise listing of the main contents in the report, i.e., different Chapters and its main Sections along with their page numbers.
4	**Body of the Report**
	The body of the report should have these four logical divisions
	a) ***Introduction:*** This will cover the background, rationale/ need / justification, brief review of literature, objectives, methodology (the area of the study, sample, type of study, tools for data collection, and method of analysis), Limitations of the Study, and Chapter Planning.

	b) ***Conceptual Framework / National and International Scenario*:** (relating to the topic of the Project).
	c***) Presentation of Data, Analysis and Findings*:** (using the tools and techniques mentioned in the methodology).
	d) ***Conclusion and Recommendations:*** In this section, the concluding observations based on the main findings and suggestions are to be provided.
5	**Bibliography or References**
	This section will include the list of books and articles which have been used in the project work, and in writing a project report.
6	**Annexures**
	Questionnaires (if any), relevant reports, etc. (The main text of the Project should normally be in the range of 5000 words. However, there may be annexure in addition to the main text)

Evaluation / Assessment

1. Each of the students has to undertake a Project individually under the supervision of a teacher and to submit the same following the guidelines stated below.

2. Language of Project Report and Viva-Voce Examination may be English. The Project Report must be typed and hard bound.

3. Failure to submit the Project Report or failure to appear at the Viva-Voce Examination will be treated as "Absent" in the Examination. He /she has to submit the Project Report and appear at the Viva-Voce Examination in the subsequent years (within the time period as per University Rules). No marks will be allotted on the Project Report unless a candidate appears at the Viva-Voce Examination. Similarly, no marks will be allotted on Viva-Voce Examination unless a candidate submits his/her Project Report.

4. Evaluation of the Project Work to be done jointly by one internal expert and one external expert with equal weightage, i.e., average marks of the internal and external experts will be allotted to the candidate.

Dr. Bharti V. Nathwani
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