

APPENDIX – CM

MADURAI KAMARAJ UNIVERSITY

(University with Potential for excellence)

M.Sc., Mathematics (Semester)

CHOICE BASED CREDIT SYSTEM REGULATIONS AND SYLLABUS

(This will come into effect from the academic year 2023 onwards)

CONTENTS

- 1. Preamble**
- 2. Structure of Course**
- 3. Learning and Teaching Activities**
- 4. Tutorial Activities**
- 5. Laboratory Activities**
- 6. Field Study Activities**
- 7. Assessment Activities**
 - 7.1 Assessment principles**
 - 7.2 Assessment Details**
- 8. Teaching methodologies**
- 9. Faculty Course File**
- 10. Template for PG Programme in Mathematics**
- 11. Template for Semester**
- 12. Instructions for Course Transaction**
- 13. Testing Pattern**
- 14. Different Types of Courses**
- 15. Elective Courses (ED from other Department Experts)**
- 16. Skill Development Courses**
- 17. Institution-Industry-Interaction**
- 18. Model Syllabus**

1. Preamble

In pursuit of the Higher Education Department Policy Note 2022-23 Demand 20, Section 1.4, Tamil Nādu State Council for Higher Education took initiative to revamp the curriculum. On 27 July 2022, a meeting was convened by the Member-Secretary Dr. S. Krishnasamy enlightening the need of the hour to restructure the curriculum of both Under-graduate and Post-graduate programmes based on the speeches at the Tamil Nādu Legislative Assembly Budget meeting by the Honourable Higher Education Minister Dr K. Ponmudy and Honourable Finance Minister Dr. P. Thiagarajan. At present there are three different modes of imparting education in most of the educational institutions throughout the globe. Outcome Based Education, Problem Based Education, and Project Based Education.

Now our Honourable Higher Education Minister announced Industry Aligned Education. During discussion, Member Secretary announced the importance of question papers and evaluation as envisaged by the Honourable Chief Secretary to Government Dr, V. IraiAnbu. This is very well imbedded in Revised Bloom's Taxonomy.

Taxonomy forms three learning domains: the cognitive (knowledge), affective(attitude), and psychomotor (skill). This classification enables to estimate the learning capabilities of students. Briefly, it is aimed to restructure the curriculum as student-oriented, skill-based, and institution-industry-interaction curriculum with the various courses under

"Outcome Based Education with Problem Based Courses, Project Based Courses, and Industry Aligned Programmes" having revised Bloom's Taxonomy for evaluating students skills.

Three domains:

(i)Cognitive Domain

(Lower levels: K1: Remembering ; K2: Understanding ; K3: Applying;

Higher levels: K4: Analysing ; K5: Evaluating; K6: Creating)

(ii) Affective Domain

(iii) Psychomotor Domain

2 Post Graduate Programme

Eligibility for Admission:

A candidate with a pass in B.Sc., Mathematics degree or other degree accepted by Madurai Kamaraj University as equivalent to B. Sc., Mathematics is eligible to join the course.

Duration of the Programme : 2 years

Medium of Instructions : English

TANSICHE REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR POSTGRADUATE EDUCATION	
Programme	M.Sc., Mathematics
Programme Code	
Duration	PG - 2 years
Programme Outcomes (Pos)	PO1: Problem Solving Skill Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context. PO2: Decision Making Skill Foster analytical and critical thinking abilities for data-based decision-making. PO3: Ethical Value Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities. PO4: Communication Skill Ability to develop communication, managerial and interpersonal skills. PO5: Individual and Team Leadership Skill Capability to lead themselves and the team to achieve organizational goals. PO6: Employability Skill Inculcate contemporary business practices to enhance employability skills in the competitive environment.

	PO7: Entrepreneurial Skill Equip with skills and competencies to become an entrepreneur. PO8: Contribution to Society Succeed in career endeavours and contribute significantly to society. PO 9 Multicultural competence Possess knowledge of the values and beliefs of multiple cultures and a global perspective. PO 10: Moral and ethical awareness/reasoning Ability to embrace moral/ethical values in conducting one's life.
Programme Specific Outcomes (PSOs)	PSO1 – Placement To prepare the students who will demonstrate respectful engagement with others' ideas, behaviours, beliefs and apply diverse frames of reference to decisions and actions. PSO 2 - Entrepreneur To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations. PSO3 – Research and Development Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development. PSO4 – Contribution to Business World To produce employable, ethical and innovative professionals to sustain in the dynamic business world. PSO 5 – Contribution to the Society To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

Credit Distribution for PG Programme

Semester-I	Credit	Semester-II	Credit	Semester-III	Credit	Semester-IV	Credit
1.1. Core-I	4	2.1. Core-IV	4	3.1. Core-VII	4	4.1. Core-X	4
1.2 Core-II	4	2.2 Core-V	4	3.2 Core-VII	4	4.2 Core-XI	4
1.3 Core – III	4	2.3 Core – VI	4	3.3 Core – IX	4	4.3 Core – XII	4
1.4 Elective (Generic / Discipline Centric)- I	3	2.4 Elective (Generic / Discipline Centric) – III	3	3.4 Elective (Generic / Discipline Centric) – V	3	4.4 Elective (Generic / Discipline Centric) – VI	3
1.5 Elective (Generic / Discipline Centric)-II	3	2.5 Elective (Generic / Discipline Centric)-IV	3	3.5 Core Industry Module	3	4.5 Project with Viva-Voce	3
1.6 Ability Enhancement Course- Soft Skill -1	2	2.6 Ability Enhancement Course - Soft Skill -2	2	3.6 Ability Enhancement Course- Soft Skill -3	2	4.6 Ability Enhancement Course- Soft Skill -4	2
Skill Enhancement Course SEC 1	2	2.7 Skill Enhancement Course SEC 2	2	3.7 Skill Enhancement Course – Term Paper and Seminar Presentation SEC 3	2	4.7 Skill Enhancement Course - Professional Competency Skill	2
				3.8 Internship/ Industrial Activity	2	4.8 Extension Activity	1
	22		22		24		23
Total Credit Points							91

Core- Papers	12 x 4 = 48
Elective (Generic / Discipline Centric)	8 x 3 = 24
Ability Enhancement Course- Soft Skill -	8 x 2 = 16
Internship/ Industrial Activity	1 x 2 = 2
Extension Activity	1 x 1 = 1
Total Credits	91

ComponentwiseCreditDistribution

Credits	SemI	SemII	SemII I	SemI V	Total
PartA	18	18	18	18	72
Part B					
(i)Discipline– Centric/GenericSkill	2	2	2	2	8
(ii)SoftSkill	2	2	2	2	10
(iii)SummerInternship/Industrial Training			2		
PartC				1	1
Total	22	22	24	23	91

Part A component and Part B (i) will be taken into account for CGPA calculation for the postgraduate programme and the other components Part B and Part C have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the PG degree

M.Sc., Mathematics

Programme Specific Outcomes:

PSO1: Acquire good knowledge and understanding, to solve specific theoretical & applied problems in different area of mathematics & statistics.

PSO2: Understand, formulate, develop mathematical arguments, logically and use quantitative models to address issues arising in social sciences, business and other context /fields.

PSO3: To prepare the students who will demonstrate respectful engagement with other's ideas, behaviors, beliefs and apply diverse frames of references to decisions and actions.

To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.

To encourage practices grounded in research that comply with employment laws, leading the organization towards growth and development.

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) can be carried out accordingly, assigning the appropriate level in the grids:

	Pos							PSOs		
	1	2	3	4	5	6	...	1	2	...
CLO1										
CLO2										
CLO3										
CLO4										
CLO5										

2 b. Structure of Course

Course Code	Course Name		Credits
Lecture Hours: (L) per week	Tutorial Hours : (T) per week	Lab Practice Hours: (P)per week	Total: (L+T+P) per week
Course Category :	Year & Semester:		Admission Year:
Pre-requisite			
Links to other Courses			
Learning Objectives: (for teachers: what they have to do in the class/lab/field)			
Course Outcomes: (for students: To know what they are going to learn) CO1: CO2: CO3: CO4: CO5:			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			

Units	Contents	Required Hours
I		18
II		18
III		18
IV		18
V		18
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	
Learning Resources: • Recommended Texts • Reference Books • Web resources		
Board of Studies Date:		

3. Learning and Teaching Activities

3.1 Topic wise Delivery method

Hour Count	Topic	Unit	Mode of Delivery

3.2 Work Load

The information below is provided as a guide to assist students in engaging appropriately with the course requirements.

Activity	Quantity	Workload periods
Lectures	60	60
Tutorials	15	15
Assignments	5	5
Cycle Test or similar	2	4

Model Test or similar	1	3
University Exam Preparation	1	3
Total		90 periods

1. Tutorial Activities

Tutorial Count	Topic

2. Laboratory Activities

3. Field Study Activities

4. Assessment Activities

Assessment Principles:

Assessment for this course is based on the following principles

1. Assessment must encourage and reinforce learning.
2. Assessment must measure achievement of the stated learning objectives.
3. Assessment must enable robust and fair judgments about student performance.
4. Assessment practice must be fair and equitable to students and give them the opportunity to demonstrate what they learned.
5. Assessment must maintain academic standards.

Assessment Details:

Assessment Item	Distributed Due Date	Weightage	Cumulative Weightage
Assignment 1	3 rd week	2%	2%
Assignment 2	6 th Week	2%	4%
Cycle Test – I	7 th Week	6%	10%
Assignment 3	8 th Week	2%	12%
Assignment 4	11 th Week	2%	14%
Cycle Test – II	12 th Week	6%	20%
Assignment 5	14 th Week	2%	22%
Model Exam	15 th Week	13%	35%

Attendance	All weeks as per the Academic Calendar	5%	40%
University Exam	17 th Week	60%	100%

CONTENTS

- a. Academic Schedule
- b. Students Name List
- c. Time Table
- d. Syllabus
- e. Lesson Plan
- f. Staff Workload
- g. Course Design(content, Course Outcomes(COs), Delivery method, mapping of COs with Programme Outcomes(POs), Assessment Pattern in terms of Revised Bloom's Taxonomy)
- h. Sample CO Assessment Tools.
- i. Faculty Course Assessment Report(FCAR)
- j. Course Evaluation Sheet
- k. Teaching Materials(PPT, OHP etc)
- l. Lecture Notes
- m. Home Assignment Questions
- n. Tutorial Sheets
- o. Remedial Class Record, if any.
- p. Projects related to the Course
- q. Laboratory Experiments related to the Courses
- r. Internal Question Paper
- s. External Question Paper
- t. Sample Home Assignment Answer Sheets
- u. Three best, three middle level and three average Answer sheets
- v. Result Analysis (CO wise and whole class)
- w. Question Bank for Higher studies Preparation (GATE/Placement)
- x. List of mentees and their academic achievements

Credit Distribution for PG Programme in Mathematics

M.Sc Mathematics

First Year

Semester-I

	Courses	Credit	Hours per Week(L/T/P)
PartA	Core Courses3 (CC1, CC2, CC3)	12	15
	Elective Courses 2(Generic / Discipline Specific)EC1, EC2	6	10
Part B	Skill Enhancement Course -SEC 1 (One from Group G)	2	3
	Ability Enhancement Compulsory Course(AECC 1) Soft Skill-1	2	2
		22	30

Semester-II

	Courses	Credit	Hours per Week(L/T/P)
PartA	Core Courses3 (CC4, CC5, CC6)	12	15
	Elective Course 2(Generic / Discipline Specific) EC3, EC4	6	10
PartB	Skill Enhancement Course -SEC 2 (One from Group G)	2	3
	Ability Enhancement Compulsory Course(AECC 2) Soft Skill-2	2	2
		22	30

Second Year -Semester-III

	Courses	Credit	Hours per Week(L/T/P)
PartA	Core Courses3 (CC7, CC8, CC9)	12	15
	Elective Course 1 (Generic / Discipline Specific)EC5	3	5
	Core Industry Module	3	4
PartB	Skill Enhancement Course -SEC 3 Professional Communication Skill (Term Paper & Seminar Presentation)	2	4
	Ability Enhancement Compulsory Course(AECC 3) Soft Skill-3	2	2
	Internship / Industrial Activity (Carried out in Summer Vacation at the end of I year – 30 hours)	2	
		24	30

Semester-IV

Part	Courses	Credit	Hours per Week(L/T/P)
PartA	Core Courses3 (CC10, CC11, CC12)	12	15
	Elective Course 1 (Generic / Discipline Specific) EC6	3	5
	Project with Viva voce (CC13)	3	4
Part B	Professional Competency Skill Enhancement Course: — Training for Competitive Examinations - Mathematics for NET / UGC - CSIR/ SET / TRB Competitive Examinations (2 hours) - General Studies for UPSC / TNPSC / Other Competitive Examinations (2 hours) OR Mathematics for Advanced Research Studies (4 hours)	2	4
	Ability Enhancement Compulsory Course(AECC 4) Soft Skill-4	2	2
Part C	Extension Activity (Can be carried out from Sem II to Sem IV)	1	
		23	30

Credit Distribution for PG Programme in Mathematics

M.Sc Mathematics

Illustration – I

	First Year Semester-I	Credit	Hours per week(L/T/P)
Part A	CC1 - Algebraic Structures	4	5(4L + 1T)
	CC2 - Real Analysis I	4	5(4L + 1T)
	CC3 - Ordinary Differential Equations	4	5(4L + 1T)
	Elective I(Generic / Discipline Specific)(One from GroupA) Number theory and Cryptography	3	5(4L + 1T)
	Elective II(Generic / Discipline Specific)(One from Group B) Mathematical Programming	3	5(4L + 1T)

Part B	Ability Enhancement Compulsory Course(AECC 1) Soft Skill-1	2	2
	Skill Enhancement Course -SEC 1 (One from Group G)	2	3
	Total	22	30

	Semester-II	Credit	Hours per week(L/T/P)
Part A	CC4 – Advanced Algebra	4	5(4L + 1T)
	CC5 – Real Analysis II	4	5(4L + 1T)
	CC6 - Partial Differential Equations	4	5(4L + 1T)
	ElectiveIII (Generic / Discipline Specific)(One from Group C) Mathematical Statistics	3	5(4L + 1T)
	Elective-IV(Computer / IT related) (One from Group D) Modelling and Simulation with Excel	3	5 (3L+ 2 P)
Part B	Skill Enhancement Course -SEC 2 (One from Group G)	2	3
	Ability Enhancement Compulsory Course(AECC 2) Soft Skill-2	2	2
	Total	22	30

	Second Year - Semester-III	Credit	Hours per week(L/T/P)
Part A	CC7 - Complex Analysis	4	5(4L + 1T)
	CC8 - Probability Theory	4	5(4L + 1T)
	CC9 – Topology	4	5(4L + 1T)
	Elective V(Generic / Discipline Specific)(One from Group E) Mathematical Python	3	5(4L + 1T)
	CC10-Core Industry Module	3	5(4L + 1T)
Part B	Internship / Industrial Activity (Carried out in Summer Vacation at the end of I year – 30 hours)	2	
	Skill Enhancement Course -SEC 3 :Professional Communication Skill -Term paper & Seminar presentation	2	3
	Ability Enhancement Compulsory Course(AECC 3) Soft Skill-3	2	2
	Total	24	30

	Semester-IV	Credit	Hours per week(L/T/P)
Part A	CC11–Functional Analysis	4	5(4L + 1T)
	CC12 - Differential Geometry	4	5(4L + 1T)
	CC13 - Mechanics	4	5(4L + 1T)
	Elective VI(Generic / Discipline Specific)(One from Group F) Resource Management Techniques	3	5(4L + 1T)
	CC14 - Core Project with viva voce	3	4
Part B	Professional Competency Skill Enhancement Course Training for Competitive Examinations • Mathematics for NET / UGC - CSIR/ SET / TRB Competitive Examinations (2 hours) • General Studies for UPSC / TNPSC / Other Competitive Examinations (2 hours) OR Mathematics for Advanced Research Studies (4 hours)	2	4
	Ability Enhancement Compulsory Course(AECC 4) Soft Skill-4	2	2
Part C	Extension Activity	1	
	Total	23	30

TOTAL CREDITS: 91

Consolidated Table for Credits Distribution

	Category of Courses	Credits for each Course	Number of Courses	Number of Credits in each Category of Courses	Total Credits	Total Credits for the Programme
PART A	Core	4	12	48	72	
	Project with viva voce	3	1	3		
	Industry aligned Programmes-	3	1	3		
	Elective (Generic and Discipline Centric)	3	6	18		
PART B (i)	Skill Enhancement (Term paper and Seminar & Generic / Discipline - Centric Skill Courses) (Internal Assessment Only)	2	4	8	8	80 (CGPA)
PART B (ii)	Ability Enhancement (Soft skill)	2	4	8	10	11 (Non CGPA)
PART B (iii)	Summer Internship	1	2	2		
PART C	Extension Activity	1	1	1	1	
						91

Template for Semester

Code	Category	Title of the Paper	Marks (Max 100)		Duration for UE	Credits
			CIA	UE		
Semester –I						
Part A	Core I		25	75	3 Hrs	4
	Core II		25	75	3 Hrs	4
	Core III		25	75	3 Hrs	4
	Elective I	Elective-I (Choose one from Group-A)	25	75	3 Hrs	3
	Elective II	Elective-I I (Choose one from Group-B)	25	75	3 Hrs	3
Part B	Skill Enhancement Course -SEC 1	(Choose One from group G)	Internal Assessment			2
	Ability Enhancement Course(AECC1)	Soft Skill I	Performance based assessment			2
Semester-II						
Part A	Core IV		25	75	3 Hrs	4
	Core V		25	75	3 Hrs	4
	Core VI		25	75	3 Hrs	4
	Elective III	Elective-III (Choose one from Group-C)	25	75	3 Hrs	3
	Elective IV	Elective-IV (Choose one from Group-D)	25	75	3 Hrs	3
Part B	Skill Enhancement Course -SEC 2	(Choose one from Group-G)	Internal Assessment			2
	Ability Enhancement Course(AECC 2)	Soft Skill II	Performance based assessment			2

Semester-III						
Part A	Core VII		25	75	3 Hrs	4
	Core VIII		25	75	3 Hrs	4
	Core IX		25	75	3 Hrs	4
	Elective / ED V	Elective-VI /ED-V (Choose one from Group-E)	25	75	3 Hrs	3
	Core Industry Module	ED-IV (Choose from outside the Department)	25	75	3 Hrs	3
Part B						
	Skill based (Term paper and Seminar)	Assignment of problem by the faculty Lecture -I (by the student) 25% Lecture-II (by the student) 25% Lecture-III (by the student) 25% Submission of a write-up (10-15 pages using LaTeX) 25% Marks / Grade Point/ Letter Grade as per the Regulation)				2
	Ability Enhancement Course(AECC 3)	Soft Skill III	Performance based assessment			2
	Internship / Industrial - Vacation Activity					2
Semester-IV						
Part A	Core X		25	75	3 Hrs	4
	Core XI		25	75	3 Hrs	4
	Core XII		25	75	3 Hrs	4
	Project with viva voce XIII		25	75	3 Hrs	3
	Elective VI	Elective-VI (Choose one from Group – F)	25	75	3 Hrs	3
Part B	Skill Enhancement Course -SEC 4	Professional Competency Skill Enhancement Course	Internal Assessment			2
	Ability Enhancement Course(AECC4)	Soft Skill IV	Performance based assessment			2
Part C	Extension Activity	Performance based assessment				1
Total Credits						91

Elective Courses

Courses are grouped (Group A to Group F) so as to include topics from Pure Mathematics(PM), Applied Mathematics(AM), Industrial Components(IC) and IT Oriented(ITC) courses for flexibility of choice by the stakeholders / institutions.

Semester I : Elective I and Elective II

Elective I to be chosen from Group A and **Elective II** to be chosen from Group B

Group A: (PM/AP/IC/ITC)

1. Number Theory and Cryptography
2. Graph Theory and Applications
3. Formal Languages and Automata Theory
4. Programming in C++ and Numerical Methods

Group B:(PM/AP/IC/ITC)

1. Lie Groups and Lie Algebras
2. Mathematical Programming
3. Fuzzy Sets and Their Applications
4. Discrete Mathematics

Semester II : Elective III & Elective IV

Elective III to be chosen from **Group C** and **Elective IV** to be chosen from **Group D**

Group C:(PM/AP/IC/ITC)

1. Algebraic Topology
2. Mathematical Statistics
3. Statistical Data Analysis using R Programming
4. Tensor Analysis and Relativity

Group D :(PM/AP/IC/ITC)

1. Wavelets
2. Modeling and Simulation with Excel
3. Machine Learning and Artificial Intelligence
4. Neural Networks

Semester III : Elective V

Elective V to be chosen from Group E.

Group E: (PM/AP/IC/ITC)

1. Algebraic Number Theory
2. Fluid Dynamics
3. Stochastic Processes
4. Mathematical Python

Semester IV : Elective VI

Elective VI to be chosen from Group F.

Group F:(PM/AP/IC/ITC)

1. Algebraic Geometry
2. Financial Mathematics
3. Resource Management Techniques
4. Mathematical Python

Skill Enhancement Courses

Skill Enhancement Courses are chosen so as to keep in pace with the latest developments in the academic / industrial front and provides flexibility of choice by the stakeholders / institutions.

Group G (Skill Enhancement Courses) SEC:

- Computational Mathematics using SageMath
- Mathematical documentation using LATEX / other packages
- Office Automation and ICT Tools
- Numerical analysis using SCILAB
- Differential equations using SCILAB
- Industrial Mathematics /Statistics using latest programming packages
- Research Tools and Techniques

Ability Enhancement Courses

- Soft Skill courses

Extra Disciplinary Courses for other Departments (not for Mathematics students)

Students from other Departments may also choose any one of the following as Extra Disciplinary Course.

ED-I: Mathematics for Life Sciences

ED-II: Mathematics for Social Sciences

ED-III: Statistics for Life and Social Sciences

ED-IV: Game Theory and Strategy

ED-V: History of Mathematics

Instructions for Course Transaction

Courses	Lecture hrs	Tutorial hrs	Lab Practice	Total hrs
Core	75	15	--	90
Electives	75	15	--	90
ED	75	15	--	90
Lab Practice Courses	45	15	30	90
Project	20	--	70	90

Testing Pattern (25+75)**Internal Assessment**

Theory Course: For theory courses there shall be three tests conducted by the faculty concerned and the average of the best two can be taken as the Continuous Internal Assessment (CIA) for a maximum of 25 marks. The duration of each test shall be one / one and a half hour.

Computer Laboratory Courses: For Computer Laboratory oriented Courses, there shall be two tests in Theory part and two tests in Laboratory part. Choose one best from Theory part and other best from the two Laboratory part. The average of the best two can be treated as the CIA for a maximum of 25 marks. The duration of each test shall be one / one and a half hour.

There is no improvement for CIA of both theory and laboratory, and, also for University End Semester Examination.

Written Examination : Theory Paper (Bloom's Taxonomy based)**Question paper Model**

Intended Learning Skills	Maximum 75 Marks Passing Minimum: 50% Duration : Three Hours
	Part –A(10x 2 = 20 Marks) Answer ALL questions Each Question carries 2mark
Memory Recall / Example/ Counter Example / Knowledge about the Concepts/ Understanding	Two questions from each UNIT
	Question 1 to Question 10
	Part – B (5 x 5 = 25 Marks) Answer ALL questions Each questions carries 5 Marks
Descriptions/ Application (problems)	Either-or Type Both parts of each question from the same UNIT
	Question 11(a) or 11(b) To Question 15(a) or 15(b)
	Part-C (3x 10 = 30 Marks) Answer any THREE questions Each question carries 10 Marks
Analysis /Synthesis / Evaluation	There shall be FIVE questions covering all the five units
	Question 16 to Question 20

Each question should carry the course outcome and cognitive level

For instance,

1. [CO1 : K2] Question xxxx
2. [CO3 : K1]Question xxxx

Different Types of Courses

(i) Core Courses (Illustrative)

1. Algebra
2. Real Analysis
3. Ordinary Differential Equations
4. Partial Differential Equations
5. Topology
6. Complex Analysis
7. Mechanics
8. Functional Analysis
9. Differential Geometry and more

(ii) Elective Courses (ED within the Department Experts)(Illustrative)

1. Discrete Mathematics
2. Number Theory and Cryptography
3. Formal Languages and Automata Theory
4. Programming in C++ and Numerical Methods
5. Fuzzy Sets and Their Applications
6. Mathematical Programming
7. Algebraic Number Theory
8. Java Programming
9. Analytical Number Theory
10. Tensor Analysis and Relativity
11. Stochastic Processes
12. Algebraic Geometry
13. Fluid Dynamics
14. Financial Mathematics
15. Wavelets
16. Mathematical Statistics and more

(iii) Elective Courses (ED from other Department Experts)

(iv) Skill Development Courses

(v) Institution-Industry-Interaction(Industry aligned Courses)

Programmes /course work/ field study/ Modelling the Industry Problem/ Statistical Analysis /
Commerce-Industry related problems / MoU with Industry and the like activities.

Model Syllabus for different Courses of M.Sc Mathematics

Title of the Course		ALGEBRAIC STRUCTURES					
Paper Number		CORE I					
Category	Core	Year	I	Credits	4	Course Code	
		Semester	I				
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		4	1		--	5	
Pre-requisite		UG level Modern Algebra					
Objectives of the Course		To introduce the concepts and to develop working knowledge on class equation, solvability of groups, finite abelian groups, linear transformations, real quadratic forms					
Course Outline		UNIT-I : Counting Principle - Class equation for finite groups and its applications - Sylow's theorems (For theorem 2.12.1, First proof only). Chapter 2: Sections 2.11 and 2.12 (Omit Lemma 2.12.5)					
		UNIT-II : Solvable groups - Direct products - Finite abelian groups- Modules Chapter 5 : Section 5.7 (Lemma 5.7.1, Lemma 5.7.2, Theorem 5.7.1) Chapter 2: Section 2.13 and 2.14 (Theorem 2.14.1 only) Chapter 4: Section 4.5					
		UNIT-III :Linear Transformations: Canonical forms –Triangular form - Nilpotent transformations. Chapter 6: Sections 6.4, 6.5					
		UNIT-IV :Jordan form - rational canonical form. Chapter 6 : Sections 6.6 and 6.7					
		UNIT-V: Trace and transpose - Hermitian, unitary, normal transformations, real quadratic form. Chapter 6 : Sections 6.8, 6.10 and 6.11 (Omit 6.9)					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)					
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					

Recommended Text	I.N. Herstein. <i>Topics in Algebra</i> (II Edition) Wiley Eastern Limited, New Delhi, 1975.
Reference Books	1. M.Artin, <i>Algebra</i>, Prentice Hall of India, 1991. 2. P.B.Bhattacharya, S.K.Jain, and S.R.Nagpaul, <i>Basic Abstract Algebra</i> (II Edition) Cambridge University Press, 1997. (Indian Edition) 3. I.S.Luther and I.B.S.Passi, <i>Algebra</i>, Vol. I –Groups(1996); Vol. II Rings, Narosa Publishing House , New Delhi, 1999 4. D.S.Malik, J.N. Mordeson and M.K.Sen, <i>Fundamental of Abstract Algebra</i>, McGraw Hill (International Edition), New York. 1997. 5. N.Jacobson, <i>Basic Algebra</i>, Vol. I & II W.H.Freeman (1980); also published by Hindustan Publishing Company, New Delhi.
Website and e-Learning Source	http://mathforum.org , http://ocw.mit.edu/ocwwweb/Mathematics , http://www.opensource.org , www.algebra.com

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Recall basic counting principle, define class equations to solve problems, explain Sylow's theorems and apply the theorem to find number of Sylow subgroups

CLO 2: Define Solvable groups, define direct products, examine the properties of finite abelian groups, define modules

CLO 3: Define similar Transformations, define invariant subspace, explore the properties of triangular matrix, to find the index of nilpotence to decompose a space into invariant subspaces, to find invariants of linear transformation, to explore the properties of nilpotent transformation relating nilpotence with invariants.

CLO 4: Define Jordan, canonical form, Jordan blocks, define rational canonical form, define companion matrix of polynomial, find the elementary devices of transformation, apply the concepts to find characteristic polynomial of linear transformation.

CLO 5: Define trace, define transpose of a matrix, explain the properties of trace and transpose, to find trace, to find transpose of matrix, to prove Jacobson lemma using the triangular form, define symmetric matrix, skew symmetric matrix, adjoint, to define Hermitian, unitary, normal transformations and to verify whether the transformation is Hermitian, unitary and normal

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

Strong:

Medium:

Low:

Title of the Course		REAL ANALYSIS I					
Paper Number		CORE II					
Category	Core	Year	I	Credits	4	Course Code	
		Semester	I				
Instructional Hours per week		Lecture		Tutorial		Lab Practice	Total
		4		1		--	5
Pre-requisite		UG level real analysis concepts					
Objectives of the Course		To work comfortably with functions of bounded variation, Riemann-Stieltjes Integration, convergence of infinite series, infinite product and uniform convergence and its interplay between various limiting operations.					
Course Outline		UNIT-I : Functions of bounded variation - Introduction - Properties of monotonic functions - Functions of bounded variation - Total variation - Additive property of total variation - Total variation on $[a, x]$ as a function of x - Functions of bounded variation expressed as the difference of two increasing functions - Continuous functions of bounded variation. Chapter – 6 : Sections 6.1 to 6.8 Infinite Series : Absolute and conditional convergence - Dirichlet's test and Abel's test - Rearrangement of series - Riemann's theorem on conditionally convergent series. Chapter 8 : Sections 8.8, 8.15, 8.17, 8.18					
		UNIT-II :The Riemann - Stieltjes Integral - Introduction - Notation - The definition of the Riemann - Stieltjes integral - Linear Properties - Integration by parts- Change of variable in a Riemann - Stieltjes integral - Reduction to a Riemann Integral – Euler's summation formula - Monotonically increasing integrators, Upper and lower integrals - Additive and linearity properties of upper, lower integrals - Riemann's condition - Comparison theorems. Chapter - 7 : Sections 7.1 to 7.14					
		UNIT-III : The Riemann-Stieltjes Integral - Integrators of bounded variation-Sufficient conditions for the existence of Riemann-Stieltjes integrals-Necessary conditions for the existence of RS integrals- Mean value theorems -integrals as a function of the interval – Second fundamental theorem of integral calculus-Change of variable -Second Mean Value Theorem for Riemann integral- Riemann-Stieltjes integrals depending on a parameter-Differentiation under integralsign-Lebesgue criteriaon for existence of Riemann integrals. Chapter - 7 : 7.15 to 7.26					

	UNIT-IV :Infinite Series and infinite Products - Double sequences - Double series - Rearrangement theorem for double series - A sufficient condition for equality of iterated series - Multiplication of series – Cesarosummability - Infinite products. Chapter - 8 Sec, 8.20, 8.21 to 8.26 Power series - Multiplication of power series - The Taylor's series generated by a function - Bernstein's theorem - Abel's limit theorem - Tauber's theorem Chapter 9 : Sections 9.14 9.15, 9.19, 9.20, 9.22, 9.23
	UNIT-V: Sequences of Functions – Pointwise convergence of sequences of functions - Examples of sequences of real - valued functions - Uniform convergence and continuity - Cauchy condition for uniform convergence - Uniform convergence of infinite series of functions - Riemann - Stieltjes integration – Non-uniform Convergence and Term-by-term Integration - Uniform convergence and differentiation - Sufficient condition for uniform convergence of a series - Mean convergence. Chapter -9 Sec 9.1 to 9.6, 9.8,9.9,9.10,9.11, 9.13
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Tom M.Apostol : <i>Mathematical Analysis</i>, 2nd Edition, Addison-Wesley Publishing Company Inc. New York, 1974.

Reference Books	1. Bartle, R.G. <i>Real Analysis</i> , John Wiley and Sons Inc., 1976. 2. Rudin, W. <i>Principles of Mathematical Analysis</i> , 3 rd Edition. McGraw Hill Company, New York, 1976. 3. Malik, S.C. and Savita Arora. <i>Mathematical Analysis</i> , Wiley Eastern Limited, New Delhi, 1991. 4. Sanjay Arora and Bansi Lal, <i>Introduction to Real Analysis</i> , Satya Prakashan, New Delhi, 1991. 5. Gelbaum, B.R. and J. Olmsted, <i>Counter Examples in Analysis</i> , Holden day, San Francisco, 1964. 6. A.L.Gupta and N.R.Gupta, <i>Principles of Real Analysis</i> , Pearson Education, (Indian print) 2003.
Website and e-Learning Source	http://mathforum.org , http://ocw.mit.edu/ocwweb/Mathematics , http://www.opensource.org , www.mathpages.com

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1:Analyze and evaluate functions of bounded variation and Rectifiable Curves.

CLO2:Describe the concept of Riemann-Stieltjes integral and its properties.

CLO3:Demonstrate the concept of step function, upper function, Lebesgue function and their integrals.

CLO4:Construct various mathematical proofs using the properties of Lebesgue integrals and establish the Levi monotone convergence theorem.

CLO5: Formulate the concept and properties of inner products, norms and measurable functions.

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

Title of the Course		ORDINARY DIFFERENTIAL EQUATIONS					
Paper Number		CORE III					
Category	Core	Year	I	Credits	4	Course Code	
		Semester	I				
Instructional Hours per week		Lecture		Tutorial		Lab Practice	Total
		4		1		--	5
Pre-requisite		UG level Calculus and Differential Equations					
Objectives of the Course		To develop strong background on finding solutions to linear differential equations with constant and variable coefficients and also with singular points, to study existence and uniqueness of the solutions of first order differential equations					
Course Outline		UNIT-I : Linear equations with constant coefficients Second order homogeneous equations-Initial value problems-Linear dependence and independence-Wronskian and a formula for Wronskian-Non-homogeneous equation of order two. Chapter 2: Sections 1 to 6					
		UNIT-II : Linear equations with constant coefficients Homogeneous and non-homogeneous equation of order n –Initial value problems- Annihilator method to solve non-homogeneous equation- Algebra of constant coefficient operators. Chapter 2 : Sections 7 to 12.					
		UNIT-III :Linear equation with variable coefficients Initial value problems -Existence and uniqueness theorems – Solutions to solve a non-homogeneous equation – Wronskian and linear dependence – reduction of the order of a homogeneous equation – homogeneous equation with analytic coefficients-The Legendre equation. Chapter : 3 Sections 1 to 8 (Omit section 9)					
		UNIT-IV :Linear equation with regular singular points Euler equation – Second order equations with regular singular points – Exceptional cases – Bessel Function. Chapter 4 : Sections 1 to 4 and 6 to 8 (Omit sections 5 and 9)					
		UNIT-V : Existence and uniqueness of solutions to first order equations: Equation with variable separated – Exact equation – method of successive approximations – the Lipschitz condition – convergence of the successive approximations and the existence theorem. Chapter 5 : Sections 1 to 6 (Omit Sections 7 to 9)					

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	E.A.Coddington, <i>A introduction to ordinary differential equations</i> (3 rd Printing) Prentice-Hall of India Ltd., New Delhi, 1987.
Reference Books	1. Williams E. Boyce and Richard C. DI Prima, <i>Elementary differential equations and boundary value problems</i>, John Wiley and sons, New York, 1967. 2. George F Simmons, <i>Differential equations with applications and historical notes</i>, Tata McGraw Hill, New Delhi, 1974. 3. N.N. Lebedev, <i>Special functions and their applications</i>, Prentice Hall of India, New Delhi, 1965. 4. W.T. Reid. <i>Ordinary Differential Equations</i>, John Wiley and Sons, New York, 1971 5. M.D.Raisinghania, <i>Advanced Differential Equations</i>, S.Chand & Company Ltd. New Delhi 2001 6. B.Rai, D.P.Choudary and H.I. Freedman, <i>A Course in Ordinary Differential Equations</i>, Narosa Publishing House, New Delhi, 2002.
Website and e-Learning Source	http://mathforum.org , http://ocw.mit.edu/ocwweb/Mathematics , http://www.opensource.org , www.mathpages.com

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Establish the qualitative behavior of solutions of systems of differential equations .

CLO2: Recognize the physical phenomena modeled by differential equations and dynamical systems.

CLO3: Analyze solutions using appropriate methods and give examples.

CLO4: Formulate Green's function for boundary value problems.

CLO5: Understand and use various theoretical ideas and results that underlie the mathematics in this course.

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

Title of the Course		ADVANCED ALGEBRA						
Paper Number		CORE IV						
Category	Core	Year	I	Credits	4	Course Code		
		Semester	II					
Instructional Hours per week		Lecture		Tutorial		Lab Practice		Total
		5		1		--		5
Pre-requisite		Algebraic Structures						
Objectives of the Course		To study field extension, roots of polynomials, Galois Theory, finite fields, division rings, solvability by radicals and to develop computational skill in abstract algebra.						
Course Outline		UNIT-I :Extension fields – Transcendence of e. Chapter 5: Section 5.1 and 5.2						
		UNIT-II : Roots or Polynomials.- More about roots Chapter 5: Sections 5.3 and 5.5						
		UNIT-III : Elements of Galois theory. Chapter 5 : Section 5.6						
		UNIT-IV : Finite fields - Wedderburn's theorem on finite division rings. Chapter 7: Sections 7.1 and 7.2 (Theorem 7.2.1 only)						
		UNIT-V :Solvability by radicals - A theorem of Frobenius - Integral Quaternions and the Four - Square theorem. Chapter 5: Section 5.7 (omit Lemma 5.7.1, Lemma 5.7.2 and Theorem 5.7.1) Chapter 7 : Sections 7.3 and 7.4						
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)						
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill						
Recommended Text		I.N. Herstein. <i>Topics in Algebra</i> (II Edition) Wiley Eastern Limited, New Delhi, 1975.						

Reference Books	1. M.Artin, <i>Algebra</i>, Prentice Hall of India, 1991. 2. P.B.Bhattacharya, S.K.Jain, and S.R.Nagpaul, <i>Basic Abstract Algebra</i> (II Edition) Cambridge University Press, 1997. (Indian Edition) 3. I.S.Luther and I.B.S.Passi, <i>Algebra</i>, Vol. I –Groups(1996); Vol. II <i>Rings</i>, Narosa Publishing House , New Delhi, 1999 4. D.S.Malik, J.N. Mordeson and M.K.Sen, <i>Fundamental of Abstract Algebra</i>, McGraw Hill (International Edition), New York. 1997. 5. N.Jacobson, <i>Basic Algebra</i>, Vol. I & II Hindustan Publishing Company, New Delhi.
Website and e-Learning Source	http://mathforum.org , http://ocw.mit.edu/ocwweb/Mathematics , http://www.opensource.org , www.algebra.com

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Prove theorems applying algebraic ways of thinking.

CLO2: Connect groups with graphs and understanding about Hamiltonian graphs.

CLO3: Compose clear and accurate proofs using the concepts of Galois Theory.

CLO4: Bring out insight into Abstract Algebra with focus on axiomatic theories.

CLO5: Demonstrate knowledge and understanding of fundamental concepts including extension fields, Algebraic extensions, Finite fields, Class equations and Sylow's theorem.

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

Title of the Course		REAL ANALYSIS II					
Paper Number		CORE V					
Category	Core	Year	I	Credits	4	Course Code	
		Semester	II				
Instructional Hours per week	Lecture		Tutorial		Lab Practice		Total
	4		1		--		5
Pre-requisite		Elements of Real Analysis					
Objectives of the Course		To introduce measure on the real line, Lebesgue measurability and integrability, Fourier Series and Integrals, in-depth study in multivariable calculus.					
Course Outline		UNIT-I :Measure on the Real line - Lebesgue Outer Measure - Measurable sets - Regularity - Measurable Functions - Borel and Lebesgue Measurability Chapter - 2 Sec 2.1 to 2.5 (de Barra)					
		UNIT-II : Integration of Functions of a Real variable - Integration of Non- negative functions - The General Integral - Riemann and Lebesgue Integrals Chapter - 3 Sec 3.1,3.2 and 3.4 (de Barra)					
		UNIT-III : Fourier Series and Fourier Integrals - Introduction - Orthogonal system of functions - The theorem on best approximation - The Fourier series of a function relative to an orthonormal system - Properties of Fourier Coefficients - The Riesz-Fischer Thorem - The convergence and representation problems in for trigonometric series - The Riemann - Lebesgue Lemma - The Dirichlet Integrals - An integral representation for the partial sums of Fourier series - Riemann's localization theorem - Sufficient conditions for convergence of a Fourier series at a particular point –Cesarosummability of Fourier series- Consequences of Fejes's theorem - The Weierstrass approximation theorem Chapter 11 : Sections 11.1 to 11.15 (Apostol)					
		UNIT-IV : Multivariable Differential Calculus - Introduction - The Directional derivative - Directional derivative and continuity - The total derivative - The total derivative expressed in terms of partial derivatives - The matrix of linear function - The Jacobian matrix - The chain rule - Matrix form of chain rule - The mean - value theorem for differentiable functions - A sufficient condition for differentiability - A sufficient condition for equality of mixed partial derivatives - Taylor's theorem for functions of $\mathbb{R}^n$ to $\mathbb{R}^1$ Chapter 12 : Section 12.1 to 12.14 (Apostol)					

	UNIT-V : Implicit Functions and Extremum Problems : Functions with non-zero Jacobian determinants – The inverse function theorem-The Implicit function theorem-Extrema of real valued functions of severable variables-Extremum problems with side conditions. Chapter 13 : Sections 13.1 to 13.7 (Apostol)
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. G. de Barra, <i>Measure Theory and Integration</i> , Wiley Eastern Ltd., New Delhi, 1981. (for Units I and II) 2. Tom M.Apostol : <i>Mathematical Analysis</i> , 2 nd Edition, Addison-Wesley Publishing Company Inc. New York, 1974. (for Units III, IV and V)
Reference Books	1. Burkill,J.C. <i>The Lebesgue Integral</i> , Cambridge University Press, 1951. 2. Munroe,M.E. <i>Measure and Integration</i> . Addison-Wesley, Mass.1971. 3. Roydon,H.L. <i>Real Analysis</i> , Macmillan Pub. Company, New York, 1988. 4. Rudin, W. <i>Principles of Mathematical Analysis</i> , McGraw Hill Company, New York,1979. 5. Malik,S.C. and Savita Arora. <i>Mathematical Analysis</i> , Wiley Eastern Limited. New Delhi, 1991. 6. Sanjay Arora and Bansilal, <i>Introduction to Real Analysis</i> , Satya Prakashan, New Delhi, 1991
Website and e-Learning Source	http://mathforum.org , http://ocw.mit.edu/ocwweb/Mathematics , http://www.opensource.org

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Understand and describe the basic concepts of Fourier series and Fourier integrals with respect to orthogonal system.

CLO2: Analyze the representation and convergence problems of Fourier series.

CLO3: Analyze and evaluate the difference between transforms of various functions.

CLO4: Formulate and evaluate complex contour integrals directly and by the fundamental theorem.

CLO5: Apply the Cauchy integral theorem in its various versions to compute contour integration.

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

Title of the Course		PARTIAL DIFFERENTIAL EQUATIONS					
Paper Number		CORE VI					
Category	Core	Year	I	Credits	4	Course Code	
		Semester	I				
Instructional Hours per week	Lecture		Tutorial		Lab Practice		Total
	4		1		--		5
Pre-requisite		UG level partial differential equations					
Objectives of the Course		To classify the second order partial differential equations and to study Cauchy problem, method of separation of variables, boundary value problems.					
Course Outline		UNIT-I :Mathematical Models and Classification of second order equation : Classical equations-Vibrating string – Vibrating membrane – waves in elastic medium – Conduction of heat in solids – Gravitational potential – Second order equations in two independent variables – canonical forms – equations with constant coefficients – general solution Chapter 2 : Sections 2.1 to 2.6 Chapter 3 : Sections 3.1 to 3.4 (Omit 3.5)					
		UNIT-II :Cauchy Problem : The Cauchy problem – Cauchy-Kowalewsky theorem – Homogeneous wave equation – Initial Boundary value problem- Non-homogeneous boundary conditions – Finite string with fixed ends – Non-homogeneous wave equation – Riemann method – Goursat problem – spherical wave equation – cylindrical wave equation. Chapter 4 : Sections 4.1 to 4.11					
		UNIT-III :Method of separation of variables: Separation of variable-Vibrating string problem – Existence and uniqueness of solution of vibrating string problem- Heat conduction problem – Existence and uniqueness of solution of heat conduction problem – Laplace and beam equations Chapter 6 : Sections 6.1 to 6.6 (Omit section 6.7)					
		UNIT-IV : Boundary Value Problems : Boundary value problems – Maximum and minimum principles – Uniqueness and continuity theorem – Dirichlet Problem for a circle , a circular annulus, a rectangle – Dirichlet problem involving Poisson equation – Neumann problem for a circle and a rectangle. Chapter 8 : Sections 8.1 to 8.9					

	UNIT-V : Green's Function: The Delta function – Green's function – Method of Green's function – Dirichlet Problem for the Laplace and Helmholtz operators – Method of images and eigen functions – Higher dimensional problem – Neumann Problem. Chapter 10 : Section 10.1 to 10.9
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	TynMyint-U and Lokenath Debnath, <i>Partial Differential Equations for Scientists and Engineers</i> (Third Edition), North Hollan, New York, 1987.
Reference Books	1. M.M.Smirnov, <i>Second Order partial Differential Equations</i> , Leningrad, 1964. 2. I.N.Sneddon, <i>Elements of Partial Differential Equations</i> , McGraw Hill, New Delhi, 1983. 3. R. Dennemeyer, <i>Introduction to Partial Differential Equations and Boundary Value Problems</i> , McGraw Hill, New York, 1968. 4. M.D.Raisinghania, <i>Advanced Differential Equations</i> , S.Chand & Company Ltd., New Delhi, 2001. 5. S, Sankar Rao, <i>Partial Differential Equations</i> , 2 nd Edition, Prentice Hall of India, New Delhi. 2004
Website and e-Learning Source	http://mathforum.org , http://ocw.mit.edu/ocwweb/Mathematics , http://www.opensource.org , www.mathpages.com

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: To understand and classify second order equations and find general solutions

CLO2: To analyse and solve wave equations in different polar coordinates

CLO3: To solve Vibrating string problem, Heat conduction problem, to identify and solve Laplace and beam equations

CLO4: To apply maximum and minimum principle's and solve Dirichlet, Neumann problems for various boundary conditions

CLO5:To apply Green's function and solve Dirichlet, Laplace problems, to apply Helmholtz operation and to solve Higher dimensional problem

.

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

Title of the Course		COMPLEX ANALYSIS						
Paper Number		CORE VII						
Category	Core	Year	II	Credits	4	Course Code		
		Semester	III					
Instructional Hours per week		Lecture		Tutorial		Lab Practice		Total
		4		1		--		5
Pre-requisite		UG level Complex Analysis						
Objectives of the Course		To Study Cauchy integral formula, local properties of analytic functions, general form of Cauchy's theorem and evaluation of definite integral and harmonic functions						
Course Outline		UNIT-I :Cauchy's Integral Formula: The Index of a point with respect to a closed curve – The Integral formula – Higher derivatives. Local Properties of analytical Functions: Removable Singularities-Taylor's Theorem – Zeros and poles – The local Mapping – The Maximum Principle. Chapter 4 : Section 2 : 2.1 to 2.3 Chapter 4 : Section 3 : 3.1 to 3.4						
		UNIT-II :The general form of Cauchy's Theorem : Chains and cycles- Simple Continuity - Homology - The General statement of Cauchy's Theorem - Proof of Cauchy's theorem - Locally exact differentials- Multiply connected regions - Residue theorem - The argument principle. Chapter 4 : Section 4 : 4.1 to 4.7 Chapter 4 : Section 5: 5.1 and 5.2						
		UNIT-III :Evaluation of Definite Integrals and Harmonic Functions Evaluation of definite integrals - Definition of Harmonic function and basic properties - Mean value property - Poisson formula. Chapter 4 : Section 5 : 5.3 Chapter 4 : Sections 6 : 6.1 to 6.3						
		UNIT-IV :Harmonic Functions and Power Series Expansions: Schwarz theorem - The reflection principle - Weierstrass theorem – Taylor's Series – Laurent series . Chapter 4 : Sections 6.4 and 6.5 Chapter 5 : Sections 1.1 to 1.3						
		UNIT-V: Partial Fractions and Entire Functions: Partial fractions - Infinite products – Canonical products – Gamma Function- Jensen's formula – Hadamard's Theorem Chapter 5 : Sections 2.1 to 2.4 Chapter 5 : Sections 3.1 and 3.2						

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Lars V. Ahlfors, <i>Complex Analysis</i> , (3 rd edition) McGraw Hill Co., New York, 1979
Reference Books	1. H.A. Presfly, <i>Introduction to complex Analysis</i>, Clarendon Press, oxford, 1990. 2. J.B. Conway, <i>Functions of one complex variables</i> Springer - Verlag, International student Edition, Naroser Publishing Co.1978 3. E. Hille, <i>Analytic function Thorey</i>(2 vols.), Gonm& Co, 1959. 4. M.Heins, <i>Complex function Theory</i>, Academic Press, New York,1968.
Website and e-Learning Source	http://mathforum.org , http://ocw.mit.edu/ocwwweb/Mathematics , http://www.opensource.org , http://en.wikipedia.org

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1:Analyze and evaluate local properties of analytical functions and definite integrals.

CLO2:Describe the concept of definite integral and harmonic functions.

CLO3:Demonstrate the concept of the general form of Cauchy's theorem

CLO4:Develop Taylor and Laurent series .

CLO5Explain the infinite products, canonical products and jensen's formula .

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

Title of the Course		PROBABILITY THEORY					
Paper Number		CORE VIII					
Category	Core	Year	II	Credits	4	Course Code	
		Semester	III				
Instructional Hours per week		Lecture		Tutorial		Lab Practice	Total
		4		1		--	5
Pre-requisite		UG level algebra and calculus					
Objectives of the Course		To introduce axiomatic approach to probability theory, to study some statistical characteristics, discrete and continuous distribution functions and their properties, characteristic function and basic limit theorems of probability.					
Course Outline		UNIT-I : Random Events and Random Variables: Random events – Probability axioms – Combinatorial formulae – conditional probability – Bayes Theorem – Independent events – Random Variables – Distribution Function – Joint Distribution – Marginal Distribution – Conditional Distribution – Independent random variables – Functions of random variables. Chapter 1: Sections 1.1 to 1.7 Chapter 2 : Sections 2.1 to 2.9					
		UNIT-II : Parameters of the Distribution : Expectation- Moments – The Chebyshev Inequality – Absolute moments – Order parameters – Moments of random vectors – Regression of the first and second types. Chapter 3 : Sections 3.1 to 3.8					
		UNIT-III: Characteristic functions : Properties of characteristic functions – Characteristic functions and moments – semi0invariants – characteristic function of the sum of the independent random variables – Determination of distribution function by the Characteristic function – Characteristic function of multidimensional random vectors – Probability generating functions. Chapter 4 : Sections 4.1 to 4.7					
		UNIT-IV : Some Probability distributions: One point , two point , Binomial – Polya – Hypergeometric – Poisson (discrete) distributions – Uniform – normal gamma – Beta – Cauchy and Laplace (continuous) distributions. Chapter 5 : Section 5.1 to 5.10 (Omit Section 5.11)					
		UNIT-V:Limit Theorems : Stochastic convergence – Bernaulli law of large numbers – Convergence of sequence of distribution functions – Levy-Cramer Theorems – de Moivre-Laplace Theorem – Poisson, Chebyshev, Khintchine Weak law of large numbers – Lindberg Theorem – LapunovTheroem – Borel-Cantelli Lemma - Kolmogorov Inequality and Kolmogorov Strong Law of large numbers. Chapter 6 : Sections 6.1 to 6.4, 6.6 to 6.9 , 6.11 and 6.12. (Omit Sections 6.5, 6.10,6.13 to 6.15)					

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	M. Fisz, <i>Probability Theory and Mathematical Statistics</i> , John Wiley and Sons, New York, 1963.
Reference Books	1. R.B. Ash, <i>Real Analysis and Probability</i>, Academic Press, New York, 1972 2. K.L.Chung, <i>A course in Probability</i>, Academic Press, New York, 1974. 4. R.Durrett, <i>Probability : Theory and Examples</i>, (2nd Edition) Duxbury Press, New York, 1996. 5. V.K.Rohatgi <i>An Introduction to Probability Theory and Mathematical Statistics</i>, Wiley Eastern Ltd., New Delhi, 1988(3rd Print). 6. S.I.Resnick, <i>A Probability Path</i>, Birhauser, Berlin, 1999. 7. B.R.Bhat , <i>Modern Probability Theory</i> (3rd Edition), New Age International (P)Ltd, New Delhi, 1999
Website and e-Learning Source	http://mathforum.org , http://ocw.mit.edu/ocwwweb/Mathematics , http://www.opensource.org , http://www.probability.net

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: To define Random Events, Random Variables, to describe Probability, to apply Bayes, to define Distribution Function, to find Joint Distribution function, to find Marginal Distribution and Conditional Distribution function, to solve functions on random variables.

CLO2: To define Expectation, Moments and Chebyshev Inequality, to solve Regression of the first and second types.

CLO3: To define Characteristic functions, to define distribution function, to find probability generating functions, to solve problems applying characteristic functions

CLO4:To define One point, two-point, Binomial distributions,to solve problems of Hypergeometric and Poisson distributions, to define Uniform, normal, gamma, Beta distributions, to solve problems on Cauchy and Laplace distributions

CLO5:To discuss Stochastic convergence,Bernaulli law of large numbers, to elaborate Convergence of sequence of distribution functions, to prove Levy-Cramer Theorems and de Moivre-Laplace Theorems, to explain Poisson, Chebyshev, Khintchine Weak law of large numbers, to explain and solve problems on Kolmogorov Inequality and Kolmogorov Strong Law of large numbers.

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

Title of the Course		TOPOLOGY					
Paper Number		CORE IX					
Category	Core	Year	II	Credits	4	Course Code	
		Semester	III				
Instructional Hours per week		Lecture		Tutorial		Lab Practice	Total
		4		1		--	5
Pre-requisite		Real Analysis					
Objectives of the Course		To study topological spaces, continuous functions, connectedness, compactness, countability and separation axioms.					
Course Outline		UNIT-I : Topological spaces : Topological spaces – Basis for a topology – The order topology – The product topology on $X \times Y$ – The subspace topology – Closed sets and limit points. Chapter 2 : Sections 12 to 17					
		UNIT-II :Continuous functions: Continuous functions – the product topology – The metric topology. Chapter 2 : Sections 18 to 21 (Omit Section 22)					
		UNIT-III :Connectedness: Connected spaces- connected subspaces of the Real line – Components and local connectedness. Chapter 3 : Sections 23 to 25.					
		UNIT-IV : Compactness : Compact spaces – compact subspaces of the Real line – Limit Point Compactness – Local Compactness. Chapter 3 : Sections 26 to 29.					
		UNIT-V: Countability and Separation Axiom: The Countability Axioms – The separation Axioms – Normal spaces – The Urysohn Lemma – The Urysohnmetrization Theorem – The Tietz extension theorem. Chapter 4 : Sections 30 to 35.					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)					
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					
Recommended Text		James R. Munkres, <i>Topology</i> (2 nd Edition) Pearson Education Pve. Ltd., Delhi-2002 (Third Indian Reprint)					

Reference Books	1. J. Dugundji , <i>Topology</i> , Prentice Hall of India, New Delhi, 1975. 2. George F.Sinmons, <i>Introduction to Topology and Modern Analysis</i> , McGraw Hill Book Co., 1963 3. J.L. Kelly, <i>General Topology</i> , Van Nostrand, Reinhold Co., New York 4. L.Steenand J.Subhash, Counter Examples in Topology, Holt, Rinehart and Winston, New York, 1970. 5. S.Willard, <i>General Topology</i> , Addison - Wesley, Mass., 1970
Website and e-Learning Source	http://mathforum.org , http://ocw.mit.edu/ocwwweb/Mathematics , http://www.opensource.org , http://en.wikipedia.org

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1:Define and illustrate the concept of topological spaces and the basic definitions of open sets, neighbourhood, interior, exterior, closure and their axioms for defining topological space.

CLO2:Understand continuity, compactness, connectedness, homeomorphism and topological properties.

CLO3:Analyze and apply the topological concepts in Functional Analysis.

CLO4:Ability to determine that a given point in a topological space is either a limit point or not for a given subset of a topological space.

CLO5:Develop qualitative tools to characterize connectedness, compactness, second countable, Hausdorff and develop tools to identify when two are equivalent(homeomorphic).

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

Title of the Course: CORE INDUSTRY MODULES

Paper Number: CORE X

Suggestive topics for Core Industry Modules:

1. Industrial Statistics

Recommended Text:

1. Papoulis A. Probability, Random Variables and Stochastic process, Tata McGraw Hill Education Pvt. Ltd., New Delhi
2. Baisnab A., Jas M., Elements of Probability and Statistics, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 1993
3. Fruend John E, Mathematical Statistics, Prentice Hall of India, New Delhi

(iv) Industrial Processes

Recommended Text:

1. H.A.Strobel, Chemical Instrumentation: A Systematic approach, 2nd Edition (1973) Addition Wesley, Reading, Mass
2. R.L.Pecsok, L.D. Shields, T.Cavins and L.C.Mcwilliam, 2nd Edition (1976), John Wiley & Sons, New York
3. E.W.Berg, Chemical Methods of Separations, 1st Edition (1963), McGraw Hill, New York

(v) Chemometrics and quality control in industry

Recommended Text:

1. G.D.Christian, Analytical chemistry, 5th edition (1994), John Wiley & Sons, New York
2. M.A. Sharat and D.L. Illuran, Chemometrics, John Wiley, New York
3. Canlcutt and R. Roddy, Statistics for Analytical Chemists, Chapman and Hall, New York

4. Mathematics of Finance and Insurance

Recommended Text:

1. John C.Hull, Options, Futures and Other Derivatives, Prentice Hall of India Private Limited
2. Sheldon M Ross, An Introduction to the Mathematical Finance, Cambridge University Press
3. Salih N. Netci, An introduction to the Mathematics of Financial Derivatives, Academic Press, Inc.
4. Robert J.Ellicott and P.Ekkehardkopp, Mathematics of Financial Markets, Springer-Verlag, New York

5. C.D. Daykin, T. Pentikainen and M. Pesonen, Practical Risk Theory for Actuaries, Chapman & Hall.
6. Tomasz Rolski, Hanspeter Schmidli, Volker Schmidt and Jozef Teugels, Stochastic Processes for insurance and Finance, John Wiley & Sons Limited

5. Performance modelling of communication networks

Recommended Text:

1. Thomas Robertazzi, Computer Networks and Systems: Queuing theory and Performance Evaluation, Springer-Verlag, 2000
2. B.R. Haverkort, Performance of Computer Communication systems (A model based approach), Wiley, 1998

and more.

Title of the Course		Functional Analysis					
Paper Number		CORE XI					
Category	Core	Year	II	Credits	4	Course Code	
		Semester	IV				
Instructional Hours per week	Lecture		Tutorial		Lab Practice		Total
	4		1		--		5
Pre-requisite		Elements of Real Analysis					
Objectives of the Course		To provide students with a strong foundation in functional analysis, focusing on spaces, operators and fundamental theorems. To develop student's skills and confidence in mathematical analysis and proof techniques.					
Course Outline		UNIT-I :Banach Spaces: The definition and some examples – Continuous linear transformations – The Hahn-Banach theorem – The natural imbedding of N in N^{**} - The open mapping theorem – The conjugate of an Operator. Chapter 9:Sections 46-51					
		UNIT-II :Hilbert Spaces: The definition and some simple properties – Orthogonal complements – Orthonormal sets – The conjugate space H^* - The adjoint of an operator – self-adjoint operators - Normal and unitary operators – Projections. Chapter 10:Sections 52-59					
		UNIT-III :Finite-Dimensional Spectral Theory: Matrices – Determinants and the spectrum of an operator –The spectral theorem. Chapter 11:Sections 60-62					
		UNIT-IV :General Preliminaries on Banach Algebras: The definition and some examples – Regular and singular elements – Topological divisors of zero – The spectrum – The formula for the spectral radius– The radical and semi-simplicity. Chapter 12:Sections 64-69					
		UNIT-V: The Structure of Commutative Banach Algebras: The Gelfand mapping – Application of the formula $r(x) = \lim \ x^n\ ^{1/n}$ – Involutions in Banach algebras -The Gelfand-Neumark theorem. Chapter 13:Sections 70-73					

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	G.F.Simmons, Introduction to Topology and Modern Analysis, McGraw Hill Education (India) Private Limited, New Delhi, 1963.
Reference Books	1. W.Rudin, Functional Analysis, McGraw Hill Education (India) Private Limited, New Delhi, 1973. 2. B.V. Limaye, Functional Analysis, New Age International, 1996. 3. C. Goffman and G. Pedrick, First course in Functional Analysis, Prentice Hall of India, New Delhi, 1987. 4. E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley & Sons, New York, 1978. 5. M. Thamban Nair, Functional Analysis, A First course, Prentice Hall of India, New Delhi, 2002.
Website and e-Learning Source	http://mathforum.org , http://ocw.mit.edu/ocwweb/Mathematics , http://www.opensource.org , http://en.wikipedia.org

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Understand the Banach spaces and Transformations on Banach Spaces.

CLO2: Prove Hahn Banach theorem and open mapping theorem.

CLO3: Describe operators and fundamental theorems.

CLO4: Validate orthogonal and orthonormal sets.

CLO5: Analyze and establish the regular and singular elements.

	POs						PSOs		
	1	2	3	4	5	6	1	2	3

CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1
Title of the Course		DIFFERENTIAL GEOMETRY							
Paper Number		CORE XII							
Category	Core	Year	II	Credits	4	Course Code			
		Semester	IV						
Instructional Hours per week	Lecture		Tutorial		Lab Practice		Total		
	4		1		--		5		
Pre-requisite		Linear Algebra concepts and Calculus							
Objectives of the Course		This course introduces space curves and their intrinsic properties of a surface and geodesics. Further the non-intrinsic properties of surface and the differential geometry of surfaces are explored							
Course Outline		UNIT-I : Space curves: Definition of a space curve – Arc length – tangent – normal and binormal – curvature and torsion – contact between curves and surfaces- tangent surface- involutes and evolutes- Intrinsic equations – Fundamental Existence Theorem for space curves- Helies. Chapter I : Sections 1 to 9.							
		UNIT-II :Intrinsic properties of a surface: Definition of a surface – curves on a surface – Surface of revolution – Helicoids – Metric- Direction coefficients – families of curves- Isometric correspondence- Intrinsic properties. Chapter II: Sections 1 to 9.							
		UNIT-III : Geodesics: Geodesics – Canonical geodesic equations – Normal property of geodesics- Existence Theorems – Geodesic parallels – Geodesics curvature- Gauss- Bonnet Theorem – Gaussian curvature- surface of constant curvature. Chapter II: Sections 10 to 18.							
		UNIT-IV : Non Intrinsic properties of a surface: The second fundamental form- Principle curvature – Lines of curvature – Developable - Developable associated with space curves and with curves on surface - Minimal surfaces – Ruled surfaces. Chapter III: Sections 1 to 8.							

	UNIT-V :Differential Geometry of Surfaces : Compact surfaces whose points are umbilics- Hilbert's lemma – Compact surface of constant curvature – Complete surface and their characterization – Hilbert's Theorem – Conjugate points on geodesics. Chapter IV : Sections 1 to 8 (Omit 9 to 15).
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	T.J.Willmore, <i>An Introduction to Differential Geometry</i> , Oxford University Press,(17 th Impression) New Delhi 2002. (Indian Print)
RefereEce Books	1. Struik, D.T. <i>Lectures on Classical Differential Geometry</i>, Addison – Wesley, Mass. 1950. 2. Kobayashi. S. and Nomizu. K. <i>Foundations of Differential Geometry</i>, Interscience Publishers, 1963. 3. Wilhelm Klingenberg: <i>A course in Differential Geometry</i>, Graduate Texts in Mathematics, Springer-Verlag 1978. 4. J.A. Thorpe <i>Elementary topics in Differential Geometry</i>, Under-graduate Texts in Mathematics, Springer - Verlag 1979.
Website and e-Learning Source	http://mathforum.org , http://ocw.mit.edu/ocwweb/Mathematics , http://www.opensource.org , www.physicsforum.com

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Explain space curves, Curves between surfaces, metrics on a surface, fundamental form of a surface and Geodesics.

CLO2: Evaluate these concepts with related examples.

CLO3: Compose problems on geodesics.

CLO4: Recognize applicability of developable.

CLO5: Construct and analyze the problems on curvature and minimal surfaces

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

Title of the Course		MECHANICS						
Paper Number		CORE XIII						
Category	Core	Year	II		Credits	4	Course Code	
		Semester	IV					
Instructional Hours per week		Lecture		Tutorial		Lab Practice		Total
		4		1		--		5
Pre-requisite		UG level Calculus and Differential equations.						
Objectives of the Course		To study mechanical systems under generalized coordinate systems, virtual work, energy and momentum, to study mechanics developed by Newton, Langrange, Hamilton Jacobi and Theory of Relativity due to Einstein.						
Course Outline		UNIT-I : Mechanical Systems : The Mechanical system- Generalised coordinates – Constraints - Virtual work - Energy and Momentum Chapter 1 : Sections 1.1 to 1.5						
		UNIT-II : Lagrange's Equations: Derivation of Lagrange's equations- Examples- Integrals of motion. Chapter 2 : Sections 2.1 to 2.3 (Omit Section 2.4)						
		UNIT-III : Hamilton's Equations : Hamilton's Principle - Hamilton's Equation - Other variational principle. Chapter 4 : Sections 4.1 to 4.3 (Omit section 4.4)						
		UNIT – IV : Hamilton-Jacobi Theory : Hamilton Principle function – Hamilton-Jacobi Equation - Separability Chapter 5 : Sections 5.1 to 5.3						
		UNIT-V : Canonical Transformation : Differential forms and generating functions – Special Transformations– Lagrange and Poisson brackets. Chapter 6 : Sections 6.1, 6.2 and 6.3 (omit sections 6.4, 6.5 and 6.6)						
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)						
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill						
Recommended Text		D. Greenwood, <i>Classical Dynamics</i> , Prentice Hall of India, New Delhi, 1985.						

Reference Books	1. H. Goldstein, <i>Classical Mechanics</i> , (2 nd Edition) Narosa Publishing House, New Delhi. 2. N.C.Rane and P.S.C.Joag, <i>Classical Mechanics</i> , Tata McGraw Hill, 1991. 3. J.L.Synge and B.A.Griffth, <i>Principles of Mechanics</i> (3 rd Edition) McGraw Hill Book Co., New York, 1970.
Website and e-Learning Source	http://mathforum.org , http://ocw.mit.edu/ocwwweb/Mathematics , http://www.opensource.org , www.physicsforum.com

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Demonstrate the knowledge of core principles in mechanics.

CLO2: Interpret and consider complex problems of classical dynamics in a systematic way.

CLO3: Apply the variation principle for real physical situations.

CLO4: Explore different applications of these concepts in the mechanical and electromagnetic fields.

CLO5: Describe and apply the concept of Angular momentum, Kinetic energy and Moment of inertia of a particle

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

Title of the Course		PROJECT WITH VIVA VOCE					
Paper Number		CORE IVX					
Category	Core	Year	II	Credits	4	Course Code	
		Semester	IV				
Instructional Hours per week		Lecture		Tutorial		Lab Practice	Total
		4				--	5
Pre-requisite		UG Level Mathematics					