THIRUVALLUVAR UNIVERSITY

SERKKADU, VELLORE–632115

M.Sc. MATHEMATICS

SYLLABUS

FROM THE ACADEMIC YEAR
2023 – 2024

P20

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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

TANSCHE 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 endeavors 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, behaviors, 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.

Template for P.G., Programmes

Semester–I	Credit	Hours	Semester-II	Credit	Hours	Semester-III	Credit	Hours	Semester–IV	Credit	Hours
Core-I	5	7	.Core-IV	5	6	Core-VII	5	6	Core-XI	5	6
Core-II	5	7	Core-V	5	6	Core-VIII	5	6	Core-XII	5	6
Core – III	4	6	Core–VI	4	6	Core – IX	5	6	Projectwithvivavoce	7	10
Elective-I Discipline Centric	3	5	Elective–III Discipline Centric	3	3	Core –X	4	6	Elective-VI(Industry /Entrepreneurship) 20%Theory 80% Practical	3	4
Elective-IIGeneric:	3	5	Elective-IVGeneric:	3	3	Elective -VDiscipline Centric	3	3	Skill Enhancementcourse /Professional CompetencySkill	2	4
			SkillEnhancement I	2	4	3.6 SkillEnhancement II	2	3	Extension Activity	1	
			Human Rights	**2**	**2**	3.7 Internship/ Industrial Activity	2	-			
			MOOC Course	**2**	**-**						
	20	**30**		**26**	**30**		**26**	**30**		**23**	**30**
Total CreditPoints-95											

Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF)
Guideline Based Credits and Hours Distribution System
for all Post – Graduate Courses including Lab Hours

First Year – Semester – I

Part	List of Courses	Credits	No. of Hours
	Core – I	5	7
	Core – II	5	7
	Core – III	4	6
	Elective – I	3	5
	Elective – II	3	5
		20	**30**

Semester-II

Part	List of Courses	Credits	No. of Hours
	Core – IV	5	6
	Core – V	5	6
	Core – VI	4	6
	Elective – III	3	4
	Elective – IV	3	4
	Skill Enhancement Course [SEC] - I	2	4
	Human Rights	2	2
	Mooc Course	2	-
	Total	**26**	**30**

Second Year – Semester – III

Part	List of Courses	Credits	No. of Hours
	Core – VII	5	6
	Core – VIII	5	6
	Core – IX	5	6
	Core (Industry Module) – X	4	6
	Elective – V	3	3
	Skill Enhancement Course - II	2	3
	Internship / Industrial Activity [Credits]	2	-
		26	**30**

Semester-IV

Part	List of Courses	Credits	No. of Hours
	Core – XI	5	6
	Core – XII	5	6
	Project with VIVA VOCE	7	10
	Elective – VI (Industry Entrepreneurship)	3	4
	Skill Enhancement Course – III / Professional Competency Skill	2	4
	Extension Activity	1	-
		23	**30**

Total 95 Credits for PG Courses

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 organizationtowards 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	3rd week	2%	2%
Assignment 2	6th Week	2%	4%
Cycle Test – I	7th Week	6%	10%
Assignment 3	8th Week	2%	12%
Assignment 4	11th Week	2%	14%
Cycle Test – II	12th Week	6%	20%
Assignment 5	14th Week	2%	22%
Model Exam	15th Week	13%	35%
Attendance	All weeks as per the Academic Calendar	5%	40%
University Exam	17th Week	60%	100%

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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	**Credit**	**Hours per week(L/T/P)**
Part A	CC1 - Algebraic Structures	5	7
	CC2 - Real Analysis I	5	7
	CC3 - Ordinary Differential Equations	4	6
	Elective I(Generic / Discipline Specific)(One from Group A)	3	5(4L + 1T)
	Elective II(Generic / Discipline Specific)(One from Group B)	3	5(4L + 1T)
	Total	**20**	**30**
	Semester-II	**Credit**	**Hours per week(L/T/P)**
Part A	CC4 – Advanced Algebra	5	6
	CC5 – Real Analysis II	5	6
	CC6 - Partial Differential Equations	4	6
	Elective III (Generic / Discipline Specific)(One from Group C)	3	3
	Elective-IV(Computer / IT related) (One from Group D)	3	3
Part B	Skill Enhancement Course -SEC 2 (One from Group G)	2	4
	Human Rights	2	2
	Mooc Course	2	-
	Total	**26**	**30**
	Second Year - Semester-III	**Credit**	**Hours per week(L/T/P)**
Part A	CC7 - Complex Analysis	5	6
	CC8 - Probability Theory	5	6
	CC9 – Topology	5	6
	CC10 - Industry Modules	4	6
	Elective V(Generic / Discipline Specific)(One from Group E)	3	3
Part B	Skill Enhancement Course -SEC 3 :Professional Communication Skill -Term paper & Seminar presentation	2	3

	Internship / Industrial Activity (Carried out in Summer Vacation at the end of I year – 30 hours)	2	-
	Total	**26**	**30**
	Semester-IV	**Credit**	**Hours per week (L/T/P)**
Part A	CC11–Functional Analysis	5	6
	CC12 – Differential Geometry	5	6
	Project with viva voce	7	10
	Elective VI(Generic / Discipline Specific)(One from Group F)	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
Part C	Extension Activity	1	**-**
	Total	**23**	**30**

TOTAL CREDITS: 95

UNIVERSITY DEPARTMENT OF MATHEMATICS

M.Sc., Mathematics Syllabus (2023-2024)

Template for Semester

S.No.	Study Components	Category	Ins. Hrs./ Week	Credit	Title of the Paper	Maximum Marks		
						CIA	**Uni. Exam**	**Total**
SEMESTERI								
1	**Part-A**	**Core –I**	7	5	**CC-I** : Algebraic Structures	25	75	100
		Core-II	7	5	**CC-II** : Real Analysis - I	25	75	100
		Core-III	6	4	**CC-III** : Ordinary Differential Equations	25	75	100
Elective - I Group A: (PM/AP/IC/ITC) (Choose any one)								
2	**Part-A**	**Elective I**	5	3	A[1]: Graph Theory and Applications A[2]: Formal Languages and Automata Theory **A[3]: Programming in C++ and Numerical Methods**	25	75	100
Elective – II Group B:(PM/AP/IC/ITC)(Choose any one)								
3	**Part-A**	**Elective II**	5	3	B[1]: Mathematical Programming **B[2]: Calculus of Variations & Integral Equations** B[3]: Discrete Mathematics	25	75	100
			30	**20**				
SEMESTER II								
S.No.	**Study Components**	**Category**	**Ins. Hrs./ Week**	**Credit**	**Title of the Paper**	**Maximum Marks**		
						CIA	**Uni. Exam**	**Total**
4	**Part-A**	**Core-IV**	6	5	**CC-IV** : Advanced Algebra	25	75	100
		Core-V	6	5	**CC-V** : Real Analysis - II	25	75	100
		Core-VI	6	4	**CC-VI** : Partial Differential Equations	25	75	100
Elective – III Group C:**(PM/AP/IC/ITC)**(Choose any one)								
5	**Part-A**	**Elective III**	3	3	C[1]: Algebraic Topology **C[2]: Mathematical**	25	75	100

					Statistics C[3]: Statistical Data Analysis using R Programming			
Elective-IV Group D :(PM/AP/IC/ITC)(Choose any one)								
6	**Part-A**	**Elective IV**	3	3	**D[1]: Modelling and Simulation with Excel** D[2]: Machine Learning and Artificial Intelligence D[3]: Neural Networks	25	75	100
7	**Part-B Compulsory Paper**	Human Rights	2	2	Human Rights	25	75	100
		Mooc Course	-	2				100
Skill Enhancement Course - I								
8	**Part-B**	**SEC I**	4	2	**G[1]: Mathematical Documentation using LATEX/other packages** G[2]: Office Automation and ICT Tools G[3]: Differential equations using SCILAB	Internal assessment		
			30	**26**				
SEMESTERIII								
S.No.	**Study Components**	**Category**	**Ins. Hrs./ Week**	**Credit**	**Title of the Paper**	**Maximum Marks**		
						CIA	**Uni. Exam**	**Total**
9	**Part-A**	**Core-VII**	6	5	**CC-VII** : Complex Analysis	25	75	100
		Core-VIII	6	5	**CC-VIII** : Probability Theory	25	75	100
		Core-IX	6	5	**CC-IX** : Topology	25	75	100
		Core-X	6	4	**CC-X** : **Industry Modules - Resource Management Techniques**	25	75	100
Elective – V Group E: (PM/AP/IC/ITC)(Choose any one)								
10		**Elective V**	3	3	E[1]: Algebraic Number Theory **E[2]: Fluid Dynamics** E[3]: Stochastic Processes	25	75	100
Skill Enhancement Course - II								
11	**Part-B**	**SEC - II**	3	2	Professional Communication Skill: Term paper & Seminar presentation	Internal assessment		
12		**Internsh**	-	2	(Carried out in Summer			

		ip / Industrial Activity			Vacation at the end of I year–30 hours) Summer Internship Report to be submitted to the Department.			
			30	**26**				
SEMESTER IV								
S.No.	**Study Components**	**Category**	**Ins. Hrs./ Week**	**Credit**	**Title of the Paper**	**Maximum Marks**		
						CIA	**Uni. Exam**	**Total**
13	**Part-A**	**Core-XI**	6	5	**CC-XI** : Functional Analysis	25	75	100
		Core-XII	6	5	**CC-XII** : Differential Geometry	25	75	100
			10	7	Project with Viva Voce	25	75	100
Elective – VI Group F:(PM/AP/IC/ITC)(Choose any one)								
14	**Part-A**	**Elective VI**	4	3	F[1]: **Number Theory and Cryptography** F[2]: Financial Mathematics F[3]: Mathematical Python	25	75	100
Skill Enhancement Course – III (Choose any one)								
15	**Part-B**	**SEC-III**	4	2	Professional Competency Skill Enhancement Course 1.Mathematics for NET / UGC - CSIR/ SET / TRB Competitive Examinations (2 hours) 2.General Studies for UPSC / TNPSC / Other Competitive Examinations (2 hours) OR Mathematics for Advanced Research Studies (4 hours)	Internal assessment		
16	**Part - C**	**Extension Activity**		**1**	Performance based assessment			
			30	**23**				
Total Credits				**95**				

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)

- A[1]: Graph Theory and Applications
- A[2]: Formal Languages and Automata Theory
- **A[3]: Programming in C++ and Numerical Methods**

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

- B[1]: Mathematical Programming
- **B[2]: Calculus of Variations & Integral Equations**
- B[3]: 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)**

- C[1]: Algebraic Topology
- **C[2]: Mathematical Statistics**
- C[3]: Statistical Data Analysis using R Programming

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

- **D[1]: Modelling and Simulation with Excel**
- D[2]: Machine Learning and Artificial Intelligence
- D[3]: Neural Networks

Semester III : Elective V

Elective V to be chosen from Group E.

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

- E[1]: Algebraic Number Theory

- **E[2]: Fluid Dynamics**
- E[3]: Stochastic Processes

Semester IV : Elective VI

Elective VI to be chosen from Group F.

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

- F[1]: **Number Theory and Cryptography**
- F[2]: Financial Mathematics
- F[3]: 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:

- G[1]: Mathematical Documentation using LATEX/other packages
- G[2]: Office Automation and ICT Tools
- G[3]: Differential equations using SCILAB

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.

Syllabus for different Courses of M.Sc Mathematics

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">ALGEBRAIC STRUCTURES</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>6</td><td colspan="2">1</td><td colspan="2">--</td><td>7</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">UG level Modern Algebra</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To introduce the concepts and to develop working knowledge on class equation, solvability of groups, finite abelian groups, linear transformations, real quadratic forms</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">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)</td></tr>
<tr><td colspan="6">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</td></tr>
<tr><td colspan="6">UNIT-III : Linear Transformations: Canonical forms –Triangular form - Nilpotent transformations.
Chapter 6: Sections 6.4, 6.5</td></tr>
<tr><td colspan="6">UNIT-IV : Jordan form - rational canonical form.
Chapter 6 : Sections 6.6 and 6.7</td></tr>
<tr><td colspan="6">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)</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">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)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">I.N. Herstein. Topics in Algebra (II Edition) Wiley Eastern Limited, New Delhi, 1975.</td></tr>
</table>

Reference Books	1. M.Artin, *Algebra,* Prentice Hall of India, 1991. 2. P.B.Bhattacharya, S.K.Jain, and S.R.Nagpaul, *Basic Abstract Algebra* (II Edition) Cambridge University Press, 1997. (Indian Edition) 3. I.S.Luther and I.B.S.Passi, *Algebra,* Vol. I –Groups(1996); Vol. II Rings, Narosa Publishing House , New Delhi, 1999 4. D.S.Malik, J.N. Mordeson and M.K.Sen, *Fundamental of Abstract Algebra*, McGraw Hill (International Edition), New York. 1997. 5. N.Jacobson, *Basic Algebra,* 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/ocwweb/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 inHermitian, 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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">REAL ANALYSIS I</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
6</td><td colspan="2">Tutorial
1</td><td colspan="2">Lab Practice
--</td><td>Total
7</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">UG level real analysis concepts</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">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.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="8">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</td></tr>
<tr><td colspan="2"></td><td colspan="8">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</td></tr>
<tr><td colspan="2"></td><td colspan="8">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 integral sign-Lebesguecriteriaon for existence of Riemann integrals. Chapter - 7 : 7.15 to 7.26</td></tr>
</table>

	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 :*Mathematical Analysis*, 2nd Edition, Addison-Wesley Publishing Company Inc. New York, 1974.
Reference Books	1. Bartle, R.G. *Real Analysis*, John Wiley and Sons Inc., 1976. 2. Rudin,W. *Principles of Mathematical Analysis*, 3rd Edition. McGraw Hill Company, New York, 1976. 3. Malik,S.C. and SavitaArora. *Mathematical Anslysis*, Wiley Eastern Limited.New Delhi, 1991. 4. Sanjay Arora and BansiLal, *Introduction to Real Analysis*, SatyaPrakashan, New Delhi, 1991. 5. Gelbaum, B.R. and J. Olmsted, *Counter Examples in Analysis*, Holden day, San Francisco, 1964. 6. A.L.Gupta and N.R.Gupta, *Principles of Real Analysis*, 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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">ORDINARY DIFFERENTIAL EQUATIONS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE III</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">1</td><td colspan="2">--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">UG level Calculus and Differential Equations</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">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</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="8">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</td></tr>
<tr><td colspan="2"></td><td colspan="8">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.</td></tr>
<tr><td colspan="2"></td><td colspan="8">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)</td></tr>
<tr><td colspan="2"></td><td colspan="8">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)</td></tr>
<tr><td colspan="2"></td><td colspan="8">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)</td></tr>
</table>

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, *A introduction to ordinary differential equations* (3rd Printing) Prentice-Hall of India Ltd., New Delhi, 1987.
Reference Books	1. Williams E. Boyce and Richard C. DI Prima, *Elementary differential equations and boundary value problems*, John Wiley and sons, New York, 1967. 2. George F Simmons, *Differential equations with applications and historical notes,* Tata McGraw Hill, New Delhi, 1974. 3. N.N. Lebedev, *Special functions and their applications*, Prentice Hall of India, New Delhi, 1965. 4. W.T. Reid. *Ordinary Differential Equations*, John Wiley and Sons, New York, 1971 5. M.D.Raisinghania,*Advanced Differential Equations*, S.Chand& Company Ltd. New Delhi 2001 6. B.Rai, D.P.Choudary and H.I. Freedman, *A Course in Ordinary Differential Equations,* 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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">ADVANCED ALGEBRA</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE IV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">1</td><td colspan="2">--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">Algebraic Structures</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">To study field extension, roots of polynomials, Galois Theory, finite fields, division rings, solvability by radicals and to develop computational skill in abstract algebra.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT-I :Extension fields – Transcendence of e.
Chapter 5: Section 5.1 and 5.2</td></tr>
<tr><td colspan="8">UNIT-II : Roots or Polynomials.- More about roots
Chapter 5: Sections 5.3 and 5.5</td></tr>
<tr><td colspan="8">UNIT-III : Elements of Galois theory.
Chapter 5 : Section 5.6</td></tr>
<tr><td colspan="8">UNIT-IV : Finite fields - Wedderburn's theorem on finite division rings.
Chapter 7: Sections 7.1 and 7.2 (Theorem 7.2.1 only)</td></tr>
<tr><td colspan="8">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</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">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)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="8">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">I.N. Herstein. Topics in Algebra (II Edition) Wiley EasternLimited, New Delhi, 1975.</td></tr>
</table>

Reference Books	1. M.Artin, *Algebra,* Prentice Hall of India, 1991. 2. P.B.Bhattacharya, S.K.Jain, and S.R.Nagpaul, *Basic Abstract Algebra* (II Edition) Cambridge University Press, 1997. (Indian Edition) 3. I.S.Luther and I.B.S.Passi, *Algebra,* Vol. I –Groups(1996); Vol. II *Rings,*Narosa Publishing House , New Delhi, 1999 4. D.S.Malik, J.N. Mordeson and M.K.Sen, *Fundamental of Abstract Algebra*, McGraw Hill (International Edition), New York. 1997. 5. N.Jacobson, *Basic Algebra,* 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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">REAL ANALYSIS II</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE V</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>5</td><td colspan="2">1</td><td colspan="2">--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Elements of Real Analysis</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To introduce measure on the real line, Lebesgue measurability and integrability, Fourier Series and Integrals, in-depth study in multivariable calculus.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">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)</td></tr>
<tr><td colspan="6">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)</td></tr>
<tr><td colspan="6">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)</td></tr>
<tr><td colspan="6">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 R^n to R^1
Chapter 12 : Section 12.1 to 12.14 (Apostol)</td></tr>
<tr><td colspan="6">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)</td></tr>
</table>

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, *Measure Theory and Integration*, Wiley Eastern Ltd., New Delhi, 1981. (for Units I and II) 2. Tom M.Apostol :*Mathematical Analysis*, 2nd Edition, Addison-Wesley Publishing Company Inc. New York, 1974. (for Units III, IV and V)
Reference Books	1. Burkill,J.C.*TheLebesgue Integral*, Cambridge University Press, 1951. 2. Munroe,M.E.*Measure and Integration*. Addison-Wesley, Mass.1971. 3. Roydon,H.L.*Real Analysis*, Macmillan Pub. Company, New York, 1988. 4. Rudin, W. *Principles of Mathematical Analysis*, McGraw Hill Company, New York,1979. 5. Malik,S.C. and SavitaArora. *Mathematical Analysis,* Wiley Eastern Limited. New Delhi, 1991. 6. Sanjay Arora and BansiLal, *Introduction to Real Analysis*, SatyaPrakashan, 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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">PARTIAL DIFFERENTIAL EQUATIONS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE VI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">1</td><td>--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">UG level partial differential equations</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To classify the second order partial differential equations and to study Cauchy problem, method of separation of variables, boundary value problems.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">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)</td></tr>
<tr><td colspan="6">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</td></tr>
<tr><td colspan="6">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)</td></tr>
<tr><td colspan="6">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</td></tr>
<tr><td colspan="6">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</td></tr>
</table>

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 LokenathDebnath, *Partial Differential Equations for Scientists and Engineers* (Third Edition), North Hollan, New York, 1987.
Reference Books	1. M.M.Smirnov, *Second Order partial Differential Equations*, Leningrad, 1964. 2. I.N.Sneddon, *Elements of Partial Differential Equations,* McGraw Hill, New Delhi, 1983. 3. R. Dennemeyer, *Introduction to Partial Differential Equations and Boundary Value Problems,* McGraw Hill, New York, 1968. 4. M.D.Raisinghania,*Advanced Differential Equations,* S.Chand& Company Ltd., New Delhi, 2001. 5. S, SankarRao, *Partial Differential Equations*, 2nd 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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">COMPLEX ANALYSIS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE VII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">1</td><td colspan="2">--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">UG level Complex Analysis</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">To Study Cauchy integral formula, local properties of analytic functions, general form of Cauchy's theorem and evaluation of definite integral and harmonic functions</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="8">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-Taylors'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</td></tr>
<tr><td colspan="2"></td><td colspan="8">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</td></tr>
<tr><td colspan="2"></td><td colspan="8">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</td></tr>
<tr><td colspan="2"></td><td colspan="8">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</td></tr>
<tr><td colspan="2"></td><td colspan="8">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</td></tr>
</table>

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, *Complex Analysis*, (3rd edition) McGraw Hill Co., New York, 1979
Reference Books	1. H.A. Presfly, *Introduction to complex Analysis*, Clarendon Press, oxford, 1990. 2. J.B. Conway, *Functions of one complex variables* Springer - Verlag, International student Edition, Naroser Publishing Co.1978 3. E. Hille, *Analytic function Thorey*(2 vols.), Gonm& Co, 1959. 4. M.Heins, *Complex function Theory*, Academic Press, New York,1968.
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: 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 .

CLO5 Explain the infinite products, canonical products and jensen'sformula .

	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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">PROBABILITY THEORY</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE VIII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">1</td><td colspan="2">--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">UG level algebra and calculus</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">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.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="8">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</td></tr>
<tr><td colspan="2"></td><td colspan="8">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</td></tr>
<tr><td colspan="2"></td><td colspan="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</td></tr>
<tr><td colspan="2"></td><td colspan="8">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)</td></tr>
<tr><td colspan="2"></td><td colspan="8">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)</td></tr>
</table>

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, *Probability Theory and Mathematical Statistics,* John Wiley and Sons, New York, 1963.
Reference Books	1. R.B. Ash, *Real Analysis and Probability*, Academic Press, New York, 1972 2. K.L.Chung, *A course in Probability*, Academic Press, New York, 1974. 4. R.Durrett, *Probability : Theory and Examples*, (2^{nd} Edition) Duxbury Press, New York, 1996. 5. V.K.Rohatgi*An Introduction to Probability Theory and Mathematical Statistics*, Wiley Eastern Ltd., New Delhi, 1988(3^{rd} Print). 6. S.I.Resnick, *A Probability Path*, Birhauser, Berlin,1999. 7. B.R.Bhat , *Modern Probability Theory* (3^{rd} Edition), New Age International (P)Ltd, New Delhi, 1999
Website and e-Learning Source	http://mathforum.org, http://ocw.mit.edu/ocwweb/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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">TOPOLOGY</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE IX</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">1</td><td colspan="2">--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">Real Analysis</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">To study topological spaces, continuous functions, connectedness, compactness, countability and separation axioms.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">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</td></tr>
<tr><td colspan="8">UNIT-II :Continuous functions: Continuous functions – the product topology – The metric topology.
Chapter 2 : Sections 18 to 21 (Omit Section 22)</td></tr>
<tr><td colspan="8">UNIT-III :Connectedness: Connected spaces- connected subspaces of the Real line – Components and local connectedness.
Chapter 3 : Sections 23 to 25.</td></tr>
<tr><td colspan="8">UNIT-IV : Compactness : Compact spaces – compact subspaces of the Real line – Limit Point Compactness – Local Compactness.
Chapter 3 : Sections 26 to 29.</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">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)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="8">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">James R. Munkres, Topology (2nd Edition) Pearson Education Pve. Ltd., Delhi-2002 (Third Indian Reprint)</td></tr>
</table>

Reference Books	1. J. Dugundji ,*Topology* , Prentice Hall of India, New Delhi, 1975. 2. George F.Sinmons, *Introduction to Topology and Modern Analysis*, McGraw Hill Book Co., 1963 3. J.L. Kelly, *General Topology*, Van Nostrand, Reinhold Co., New York 4. L.Steen and J.Subhash, Counter Examples in Topology, Holt, Rinehart and Winston, New York, 1970. 5. S.Willard, *General Topology*, Addison - Wesley, Mass., 1970
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: 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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">RESOURSE MANAGEMENT TECHNIQUES</td></tr>
<tr><td colspan="2">PaperNumber</td><td colspan="7">CORE</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">CORE X</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2" rowspan="2">InstructionalHours perweek</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">LabPractice</td><td>Total</td></tr>
<tr><td>5</td><td colspan="2">1</td><td colspan="2">--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">UG Level Linear Programming</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">The main objectives of this course are to:
To introduce the methods of optimization techniques.
To understand the theory of optimization techniques for solving various types of optimization problems.
To provide with basic skills and knowledge of optimization techniques and their applications.
To make the students familiar in solving techniques, analysing the results and propose recommendations to the decision-making processes.</td></tr>
<tr><td colspan="2" rowspan="3">Course Outline</td><td colspan="7">UNIT-I :Linear programming: Formulation – graphical solution. Simplex method. Chapter 6</td></tr>
<tr><td colspan="7">UNIT-II Transportation problem: Mathematical Formulation. Basic Feasible solution. North WestCorner rule, Least Cost Method, Vogel‟s approximation. Optimal Solution. Chapter 9
.</td></tr>
<tr><td colspan="7">UNIT-III :Sequencing problem: n jobs on 2 machines – n jobs on 3 machines – two jobs on m machines – n jobs on m machines. Chapter 10</td></tr>
<tr><td colspan="2" rowspan="2"></td><td colspan="7">UNIT-IV Game theory : Two-person Zero-sum game with saddle point – without saddle point –dominance – solving 2 x n or m x 2 game by graphical method. Chapter 12</td></tr>
<tr><td colspan="7">UNIT-V :Network: Project Network diagram – CPM and PERT computations. Chapter 13</td></tr>
</table>

Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC/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
RecommendedText	: Operations Research, by R.K.Gupta , Krishna Prakashan India (p),Meerut Publications
ReferenceBooks	1. Gauss S.I. Linear programming , McGraw-Hill Book Company. 2. Gupta P.K. and Hira D.S., Problems in Operations Research ,S.Chand& Co. 3. KantiSwaroop, Gupta P.K and Manmohan , Problems in Operations Research, Sultan Chand & Sons 4. Ravindran A., Phillips D.T. and Solberg J.J., Operations Research, John wiley& Sons. 5. Taha H.A. Operation Research, Macmillan pub. Company, New York. 7. Linear Programming, Transporation, Assignment Game by Dr.Paria, Books and 6.
Websiteand e-Learning Source	http://mathforum.org,http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org,www.mathpages.com

Course Outcomes:

At the completion of the Course, the Students will able to

- **CLO1:** Formulate a real-world problem as linear programming and queuing models.
- **CLO2:** Assess the existence and uniqueness of solutions and derive necessary and sufficient optimality conditions for a given optimization problem.
- **CLO3:**Understand the mathematical tools that are needed to solve optimization problems.
- **CLO4:** Ability to apply the theory of optimization methods and algorithms to develop and solving various Types of optimization problems
- **CLO5:** Ability to apply the theory of optimization methods and algorithms to develop and for solving various types of optimization problems.

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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">Functional Analysis</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">CORE XI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">1</td><td>--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Elements of Real Analysis</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">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.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">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</td></tr>
<tr><td colspan="6">UNIT-II :Hilbert Spaces: The definition and some simple properties– Orthogonal complements–Ortho normal sets–The conjugate space H^*-The adjoint of an operator–self-adjoint operators-Normal and unitary operators – Projections.
Chapter10:Sections52-59</td></tr>
<tr><td colspan="6">UNIT-III :Finite-Dimensional Spectral Theory: Matrices – Determinants and the spectrum of an operator –The spectral theorem.
Chapter 11:Sections 60-62</td></tr>
<tr><td colspan="6">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</td></tr>
<tr><td colspan="6">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</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">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)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
</table>

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, NewDelhi,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.wikiepedia.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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">DIFFERENTIAL GEOMETRY</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE XII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">1</td><td colspan="2">--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">Linear Algebra concepts and Calculus</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">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</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">UNIT-V :Differential Geometry of Surfaces :
Compact surfaces whose points are umblics- 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).</td></tr>
</table>

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, *An Introduction to Differential Geometry,* Oxford University Press,(17th Impression) New Delhi 2002. (Indian Print)
Reference Books	5. Struik, D.T. *Lectures on Classical Differential Geometry*, Addison – Wesley, Mass. 1950. 6. Kobayashi. S. and Nomizu. K. *Foundations of Differential Geometry,* Inter science Publishers, 1963. 7. Wilhelm Klingenberg: *A course in Differential Geometry*, Graduate Texts in Mathematics, Springer-Verlag 1978. 8. J.A. Thorpe *Elementary topics in Differential Geometry*, 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 surface

	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							
Category	Core	**Year**	II	**Credits**	7	**Course Code**	
		Semester	IV				
Instructional Hours per week		**Lecture**		**Tutorial**	**Lab Practice**	**Total**	
		10		-	--	10	
Pre-requisite		UG Level Mathematics					

ELECTIVECOURSES

Coursesaregrouped(GroupAtoGroupF)soastoincludetopicsfromPureMathematics(PM),AppliedMathematics(AM),IndustrialComponents(IC)andITOriented (ITC)coursesforflexibilityof choicebythestakeholders/institutions.

ElectiveI tobe chosenfrom Group A

GroupA:**(PM/AP/IC/ITC)**

<table>
<tr><td colspan="2">TitleoftheCourse</td><td colspan="7">GRAPHTHEORYANDAPPLICATIONS</td></tr>
<tr><td colspan="2">PaperNumber</td><td colspan="7">ELECTIVE I - Group A:(PM/AP/IC/ITC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective I</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">InstructionalHours perweek</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">LabPractice</td><td>Total</td></tr>
<tr><td>4</td><td colspan="2">1</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">UGlevelGraphTheory</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">To study and develop the concepts of graphs, sub graphs, trees, connectivity,Euler tours, Hamilton cycles, matching, coloring of graphs, independent sets, cliques,vertexcoloring,andplanargraphs</td></tr>
<tr><td colspan="2">CourseOutline</td><td colspan="7">UNIT-I: Graphs,Subgraphsand Trees

Graphsandsimplegraphs-GraphIsomorphism-TheIncidenceandAdjacency Matrices- Subgraphs - Vertex Degrees - Paths and Connection - Cycles - Trees - Cut Edges andBonds-CutVertices.

Chapter1(Section1.1-1.7);Chapter2(Section2.1-2.3)</td></tr>
<tr><td colspan="2"></td><td colspan="7">UNIT-II: Connectivity,EulerTours andHamiltonCycles

Connectivity - Blocks - Euler tours – Hamilton

Chapter 3 (Section 3.1 -3.2) ;Chapter 4(Section 4.1 - 4.2)</td></tr>
<tr><td colspan="2"></td><td colspan="7">UNIT-III: Matchings, Edge Colourings
Matchings -MatchingsandCoveringsinBipartiteGraphs–

Edge ChromaticNumber- Vizing’sTheorem.

Chapter5(Section5.1-5.2);Chapter6(Section6.1-6.2)</td></tr>
<tr><td colspan="2"></td><td colspan="7">UNIT-IV:IndependentSetsandCliques,VertexColourings

Independentsets-Ramsey’sTheorem–Chromatic Number-Brooks’Theorem-ChromaticPolynomials.

Chapter7 (Section7.1– 7.2);Chapter8 (Section8.1 –8.2,8.4)</td></tr>
</table>

	UNIT-V: PlanarGraphs Plane and planar Graphs - Dual graphs - Euler's Formula - The Five-Colour Theorem andtheFour-ColourConjecture. **Chapter9(Section9.1-9.3,9.6)**
Extended ProfessionalComponent	QuestionsrelatedtotheabovetopicsfromvariouscompetitiveexaminationsUPSC/TRB/ NET/ UGC–CSIR/ GATE/TNPSC/otherstobesolved(TobediscussedduringtheTutorialhour)
Skills acquired fromthiscourse	Knowledge,ProblemSolving,Analyticalability,ProfessionalCompetency, Professional Communication andTransferrable Skill
RecommendedText	J.A.BondyandU.S.R.Murthy,GraphTheoryandApplications,Macmillan,London,1976.
ReferenceBooks	1.J.ClarkandD.A.Holton,A Firstlook at Graph Theory,AlliedPublishers,NewDelhi,1995. 2.R.Gould. GraphTheory,Benjamin/Cummings,MenloPark,1989. 3.A.Gibbons,AlgorithmicGraphTheory,CambridgeUniversityPress,Cambridge,1989. 4.R.J.WilsonandJ.J.Watkins,Graphs:AnIntroductoryApproach,JohnWileyandSons,NewYork,1989. 5.R.J.Wilson,IntroductiontoGraphTheory,PearsonEducation,4th Edition,2004,IndianPrint. 6.S.A.Choudum,AFirstCourseinGraphTheory,MacMillanIndia Ltd.1987.
Websiteand e-LearningSource	https://nptel.ac.in/courses/111106050/

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Acquirethe knowledgeof elementarygraphtheory

CLO2: Apply various cryptosystems and understand the concepts of quadratic, residuesand reciprocity

CLO3: Developtheideaofpublickeycryptography,RSA Algorithms.

CLO4: Solveproblemsusingthe continued fractionmethodandthequadraticsievemethod.

CLO5: Demonstrateabilityto applyconceptsofFermatfactorization andfactorbases.

	Pos						PSOs		
	1	2	3	4	5	6	1	2	3

CLO1	3	3	2	2	2	3	3	3	3
CLO2	3	3	2	2	2	3	3	3	3
CLO3	3	3	2	2	3	3	3	3	3
CLO4	3	3	3	3	3	3	3	3	3
CLO5	3	3	3	3	3	3	3	3	3

<table>
<tr><td colspan="2">TitleoftheCourse</td><td colspan="7">FORMALLANGUAGESANDAUTOMATATHEORY</td></tr>
<tr><td colspan="2">PaperNumber</td><td colspan="7">ELECTIVE I - Group A:(PM/AP/IC/ITC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective I</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td></td></tr>
<tr><td>Semester</td><td>I</td><td colspan="4"></td></tr>
<tr><td colspan="2">InstructionalHours perweek</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">LabPractice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td>4</td><td colspan="2">1</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Objectives of theCourse</td><td colspan="7">1.Thepurposeofthiscourseistoacquaintthestudentwithanoverview ofthetheoreticalfoundationsofcomputersciencefromtheperspective of formal languages.
2.Classifymachinesbytheirpowertorecognize languages.
Employfinitestatemachinestosolveproblemsin computing.
3.Explaindeterministicandnon-deterministic machines.</td></tr>
<tr><td colspan="2" rowspan="2">CourseOutline</td><td colspan="7">UNIT-I:Finite Automata and Regular Expressions
Finite state systems- Deterministic Finite state Automata- Non deterministic Finite Automata- Finite Automata with Epsilon-Transitions – Regular Expressions- Finite Automata and Regular Expressions.</td></tr>
<tr><td colspan="7">UNIT-II: Properties of Regular Languages
The Pumping Lemma for Regular Languages – Application of the Pumping Lemma – Closure Properties of Regular Languages – Reversal – Homomorphism – Decision properties of Regular Languages – Converting NFA’s to DFA’S – Minimization of DFA’s.</td></tr>
<tr><td colspan="2" rowspan="3"></td><td colspan="7">UNIT-III: Context Free Grammars and Languages
Context Free Grammars – Parse Trees – Normal forms for Context Free Grammars – Chomsky Normal Form – Greibach Normal Form.</td></tr>
<tr><td colspan="7">UNIT-IV: Pushdown Automata
Definition – The languages of a PDA – EquivalenceofPDA’sandCFG’s– DeterministicPushdownAutomata.</td></tr>
<tr><td colspan="7">UNIT-V:Properties of Context-Free Languages
The Pumping Lemma for Context-freeLanguages– ClosurePropertiesofContext-FreeLanguages– Decision properties of CFL’s.</td></tr>
<tr><td colspan="2">Extended ProfessionalComponent</td><td colspan="7">Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /otherstobesolved (TobediscussedduringtheTutorialhour)</td></tr>
<tr><td colspan="2">Skills acquired from thiscourse</td><td colspan="7">Knowledge,ProblemSolving,Analyticalability,ProfessionalCompetency, Professional Communication andTransferrable Skill</td></tr>
</table>

RecommendedText	1.Introductionto Automata Theory Languages and Computation‖. HopcroftH.E.and Ullman J. D.Pearson Education. 2.IntroductiontoTheoryofComputation-Sipser2ndeditionThomson
ReferenceBooks	1.LanguagesandComputation,PearsonEducation,2013. ASalomaa,FormalLanguages,Academicpress,NewYork,1973 2.John C. Martin, Introduction to Languages and theory of Computations (2nd Edn), Tata – McGraw Hill company Ltd., New Delhi, 1997. 3.Dr. Rani Siromoney, Formal Languages and Automata, The Christian LiteratureSociety, 1979.
Websiteand e-LearningSource	http://mathforum.org,http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org,www.mathpages.com

CourseLearningOutcome (forMappingwith POsandPSOs)

Studentswill be ableto

CLO1: To gain knowledge of fundamental concepts of automata.

CLO2: To know properties of regular languages.

CLO3: To know finite automata theory.

CLO4: ToUnderstand the concept of context free grammars and normal form.

CLO5: To know push down automata and context free languages.

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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">PROGRAMMING IN C++ AND NUMERICAL METHODS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">ELECTIVE I - Group A:(PM/AP/IC/ITC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective I</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">1</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">UG level C and C++</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">1. Implementation of numerical methods in computer programming using C or C++ language.
2. Apply mathematics in engineering problems.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="8">Unit I: Tokens, Expressions and Control Structures
Evolution of C++ - applications of C++ - structure of C++ program. Tokens – keywords – identifiers and constants – basic data types – constant pointers and pointers to constants – symbolic constants –type compatibility – declaration of variables – dynamic initialization of variables– operators in C++ .</td></tr>
<tr><td colspan="2"></td><td colspan="8">Unit II: Functions and classes in C++
The main function – function prototyping – call by reference – return by reference – inline functions– const arguments – function overloading. Managing Console I/O Operations: C++ streams. Specifying a class – defining member functions – making an outside function inline – nesting of member functions – private member functions – arrays within a class– arrays of objects – objects as function arguments – friend functions– const member functions.</td></tr>
<tr><td colspan="2"></td><td colspan="8">Unit III: Solving Nonlinear Equations
Newton’s method — fixed point iteration. Numerical Differentiation : Derivatives from differences tables – Higher-order derivatives – Divided difference, Central difference formulas</td></tr>
<tr><td colspan="2"></td><td colspan="8">Unit IV: Ordinary Differential Equations
Taylor series method – Euler and modified Euler methods – Runge-Kutta methods</td></tr>
</table>

	Unit V: Boundary value problems and Partial Differential Equations The shooting method – Solution through a set of equations – Derivative boundary conditions – Characteristic-value problems – Eigen values of a matrix by iteration. Representation as a difference equation – Iterative methods for Laplace equation – The Poisson equation – Derivative boundary conditions – Solving the equation for time-dependent heat flow -The Crank Nicolson method
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. Object Oriented programming with C++ - E.Balagurusamy (McGraw Hill 3rd Edition 2006.) 2. Object oriented programming in Turbo C++ - Robert Lafore (Galgotia publications Pvt.Ltd, New Delhi-,2002) 3. C.F. Gerald and P.O. Wheatley, Applied Numerical Analysis, Seventh Edition, Addison Wesley, Reading, 1998.
Reference Books	1. M.K. Jain, S.R.K. Iyengar, R.K.Jain, Numerical Methods for Scientific and Engineering Computation, Second Edition, Wiley Eastern Ltd, New Delhi 2. C.E. Froberg, Introduction to Numerical Analysis, Second Edition, Addison-Wesley Publishing Company, 1972. 3. S. AzmyAckleh , Edward James Allen , R. Baker Kearfott , PadmanabhanSeshaiyer, Classical and modern Numerical Analysis: Theory, Methods and Practice, CRC Press , Taylor& Francis Group, 2009.
Website and e-Learning Source	https://swayam.gov.in/nd2_cec20_ma11/preview https://nptel.ac.in/courses/111/106/111106101/ http://www.math.ust.hk/~mamu/courses/231/hom.htm

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Know about class structure, member functions & data members, inheritance, types and example problems.

CLO 2: Understand how **C++** improves C with object-oriented features.

CLO 3: Design, investigate and implement of numerical methods for solving different types of problems like initial and boundary value problems of ordinary and partial differential equations.

CLO 4: Determines that the numerical integration and differentiation by using some basic rules.

CLO 5: Create, select and apply appropriate numerical techniques with the understanding of their limitations so that any possible modification in these techniques could be carried out in further research

	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

GroupB:**(PM/AP/IC/ITC)**

<table>
<tr><td colspan="2">TitleoftheCourse</td><td colspan="8">MATHEMATICALPROGRAMMING</td></tr>
<tr><td colspan="2">PaperNumber</td><td colspan="8">ELECTIVE II - Group B:(PM/AP/IC/ITC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective II</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">InstructionalHours perweek</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">LabPractice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td colspan="2">1</td><td colspan="2">--</td><td colspan="2">5</td></tr>
<tr><td colspan="2">Objectives of theCourse</td><td colspan="8">Thiscourseintroducesadvancedtopicsin Linearandnon-linear Programming.</td></tr>
<tr><td colspan="2">CourseOutline</td><td colspan="8">UNIT-I:IntegerLinearProgramming
TypesofInteger Linear Programming Problems - Concept of Cutting Plane - Gomory‘sAll Integer Cutting Plane Method - Gomory‘s mixed Integer CuttingPlanemethod-BranchandBoundMethod.-Zero-OneIntegerProgramming.DynamicProgramming:CharacteristicsofDynamicProgrammingProblem-DevelopingOptimalDecisionPolicy-DynamicProgrammingUnderCertainty- DPapproachto solve LPP.
Chapter-7:7.1 -7.7 Chapter-20:20.1 -20.5</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT-II : Classical Optimization Methods
Unconstrained Optimization - Constrained Multi-variable Optimizationwith Equality Constraints - Constrained Multi-variable OptimizationwithinequalityConstraintsNon-linearProgrammingMethods:Examples of NLPP - General NLPP - Graphical solution - QuadraticProgramming-Wolfe‘smodifiedSimplexMethods-Beale‘sMethod
Chapter-23:23.1-23.4Chapter-24:24.1-24.4</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT-III:Theory of Simplex Method
Canonical and StandardformofLP-SlackandSurplusVariables-ReductionofanyFeasiblesolutiontoaBasicFeasiblesolution-AlternativeOptimalsolution-Unbounded solution - Optimality conditions - Some complications and theirresolutions-Degeneracyand its resolution.
Chapter-25: 25.1 -25.4, 25.6-25.9</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT-IV:RevisedSimplexMethod
StandardformsforRevised simplex Method - Computational procedure for Standard formI-comparisonofsimplexmethodandRevisedsimplexMethod.BoundedVariablesLPproblem:Thesimplexalgorithm
Chapter-26:26.1-26.4Chapter-28:28.1, 28.2</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT-V:Parametric Linear Programming
Variationin thecoefficientscj,VariationsintheRighthandside,bi.GoalProgramming: Difference between LP and GP approach - Concept ofGoalProgramming-GoalProgrammingModelformulation-Graphical Solution Method of Goal Programming - Modified SimplexmethodofGoal Programming.
Chapter-29:29.1-29.3</td></tr>
</table>

Extended ProfessionalComponent	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TNPSC/others tobe solved (TobediscussedduringtheTutorial hour)
Skills acquired fromthiscourse	Knowledge,ProblemSolving,Analyticalability,ProfessionalCompetency, Professional Communication andTransferrable Skill
RecommendedText	J.K.Sharma,OperationsResearch,TheoryandApplications,Third Edition(2007)MacmillanIndiaLtd.
ReferenceBooks	1. HamdyA.Taha,OperationsResearch,(seventhedition)Prentice-HallofIndia Private Limited, New Delhi, 1997. 2. F.S.Hillier&J.LiebermanIntroductiontoOperationResearch(7thEdition)TataMcGraw Hill ompany, NewDelhi, 2001. 3. Beightler.C,D.Phillips,B.Wilde,FoundationsofOptimization(2ndEdition) PrenticeHall Pvt Ltd., New York,1979 4. S.S.Rao-OptimizationTheoryandApplications,WileyEastern Ltd.NewDelhi.1990
Websiteand e-LearningSource	http://mathforum.org,http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org,www.mathpages.com

CourseLearningOutcome (forMappingwith POsandPSOs)

Studentswillbeable to

CLO 1: To know about integer programming.

CLO 2: To know about optimization methods for solving non linear programming problems.

CLO3: To know simplex method for solving linear programming problems.

CLO4: To know revised simplex method for solving linear programming problems.

CLO5: To know parametric linear programming problems.

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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">ELECTIVE II - Group B:(PM/AP/IC/ITC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective II</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">1</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">UG level Differential Equations and Integral Calculus</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">1. The aim of the course is to introduce to the students the concept of Calculus of Variation and its applications.
2. Introduce various types of integral equations and how to solve these equations.</td></tr>
<tr><td colspan="2" rowspan="4">Course Outline</td><td colspan="8">Unit I: Variational problems with fixed boundaries
The concept of variation and its properties – Euler's equation – Variational problems for Functionals – Functionals dependent on higher order derivatives – Functions of several independent variables – Some applications to problems of Mechanics.
Chapter 1: 1.1 - 1.7 (Text Book - 1)</td></tr>
<tr><td colspan="8">Unit II: Variational problems with moving boundaries
Movable boundary for a functional dependent on two functions – one-sided variations – Reflection and Refraction of extremals – Diffraction of light rays.
Chapter 2: 2.1 - 2.5 (Text Book - 1)</td></tr>
<tr><td colspan="8">Unit III: Integral Equation
Introduction – Types of Kernals – Eigen values and Eigen functions – connection with differential equations – Solution of an integral equation – Initial value problems – Boundary value problem.
Chapter 1: 1.1 - 1.3 & 1.5 - 1.8 (Text Book - 2)</td></tr>
<tr><td colspan="8">Unit IV: Solution of Fredholmintergral equation
Second kind with separable kernel – Orthogonality and reality eigen function – Fredholm Integral equation with separable kernel – Solution of Fredholm Integral Equation by successive substitution – Successive approximation – Volterra integral equation – Solution by successive substitution.
Chapter 2: 2.1 - 2.3 and Chapter 4: 4.1 - 4.5 (Text Book - 2)</td></tr>
</table>

	Unit V: Hilbert – Schmidt Theory Complex Hilbert space – Orthogonal system of function – Gram-Schmitorthognalization process – Hilbert-Schmidt theorems – Solutions of Fredholm of integral equation of first kind. **Chapter 3: 3.1 - 3.4 & 3.8 - 3.9 (Text Book - 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	1. A.S. Gupta, Calculus of Variations with Application, Prentice Hall of India, New Delhi, 2005. 2. Sudir K. Pundir and RimplePundir, Integral Equations and Boundary Value Problems, PragatiPrakasam, Meerut, 2005.
Reference Books	1. L. Elsgolts, Differential Equations and the Calculus of Variations Mir Publishers, Moscow, 1973. 2. Ram P. Kanwal, Linear Integral Equations. Academic Press, New York, 1971.
Website and e-Learning Source	https://www.classcentral.com/course/youtube-mathematics-calculus-of-variations-and-integral-equations-47612, https://www.open.edu/openlearn/science-maths-technology/introduction-the-calculus-variations/content-section-0, http://www.infocobuild.com/education/audio-video-courses/mathematics/CalculusOfVariations-IIT-Kanpur/lecture-23.html, https://www.online.colostate.edu/courses/MATH/MATH535.dot,

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Students know the concept and properties of variational problems with fixed and moving boundaries, functions of dependent and independent variables and also solve some applications problems in mechanics.

CLO 2: Able to solve differential equations and integral equation problems. Find the solution of eigen value, eigen functions.

CLO 3: Implementation of various methods to solve FredholmIntergral equation.

CLO 4: Students gain acquire knowledge about Hilbert – Schmidt Theory

CLO 5: Deriving the complex Hilbert space – Orthogonal system of function and Solutions of Fredholm of Integral equation of first kind

	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

<table>
<tr><td colspan="2">TitleoftheCourse</td><td colspan="8">DISCRETEMATHEMATICS</td></tr>
<tr><td colspan="2">PaperNumber</td><td colspan="8">ELECTIVE II - Group B:(PM/AP/IC/ITC)</td></tr>
<tr><td>Category</td><td>Elective III</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td colspan="2"></td></tr>
<tr><td colspan="2"></td><td>Semester</td><td>I</td><td colspan="5"></td></tr>
<tr><td colspan="2">InstructionalHours perweek</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">LabPractice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2"></td><td>4</td><td colspan="2">1</td><td colspan="2">--</td><td colspan="2">5</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">1.IntroducethealgebraicstructuresoflatticesandBooleanalgebra. Constructtheswitchingcircuits withapplications.
2.Educatethe finite fieldsandits mathematicsproperties.
3.Inculcatethepolynomialsoverfinitefields,Irreducibilityandfactorizationofpolynomials.
4.Indoctrinatethecodingtheorywith thelinearandcycliccodes.</td></tr>
<tr><td colspan="2">CourseOutline</td><td colspan="8">UNIT-I:Lattices
PropertiesandExamplesofLattices–DistributiveLattices–BooleanAlgebras–BooleanPolynomials -Minimal Forms of Boolean Polynomials.
Chapter1:Sections1–6</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT- II:ApplicationsofLattices
SwitchingCircuits–Applications ofSwitchingCircuits.
Chapter2:Sections7–8</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT-III:FiniteFields
FiniteFields.
Chapter3:Sections13</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT-IV:Polynomials
IrreduciblePolynomials overFiniteFields-FactorizationofPolynomialsoverFiniteFields.
Chapter3:Sections 14–15</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT-V:Coding Theory
LinearCodes– CyclicCodes.
Chapter4:Sections 17–18</td></tr>
<tr><td colspan="2">Extended Professional Component</td><td colspan="8">QuestionsrelatedtotheabovetopicsfromvariouscompetitiveexaminationsUPSC/TNPSC/others tobe solved (TobediscussedduringtheTutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired fromthis course</td><td colspan="8">Knowledge,ProblemSolving,Analyticalability,ProfessionalCompetency, Professional Communication andTransferrable Skill</td></tr>
<tr><td colspan="2">RecommendedText</td><td colspan="8">RudolfLidlandGunterPilz,AppliedAbstractAlgebra,2nd IndianReprint,SpringerVerlag,NewYork,2006.</td></tr>
</table>

Reference Books	1.A.Gill, Applied Algebra for Computer Science, Prentice Hall Inc., New Jersey. 2.J.L.Gersting, Mathematical Structures for Computer Science, 3rdEdn., ComputerScience Press, New York. 3.S.Wiitala,Discrete Mathematics - A Unified Approach, McGraw Hill Book Co.
Website and e-Learning Source	1.http://www.discrete-math-hub.com/resources-and-help.html 2.https://onlinecourses.nptel.ac.in/noc22_cs123/preview 3. https://onlinecourses.nptel.ac.in/noc22_cs85/preview

CourseLearningOutcome (forMappingwith POsandPSOs)

Studentswillbeableto

CLO1:KnowthealgebraicstructuresoflatticesandBooleanalgebra,andsketchtheminimizationofBoolean polynomials.

CLO2: Modeltheswitchingcircuitswithapplications.

CLO3: Understandthefinitefieldsanditsmathematicsproperties.

CLO4: Acquirethenotionsofthepolynomialsoverfinitefields,Irreducibilityandfactorizationof polynomials.

CLO5: Applythecodingtheorywith thelinearand cycliccodesin cryptography.

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

ElectiveIIItobechosenfromGroupC

GroupC:**(PM/AP/IC/ITC)**

<table>
<tr><td colspan="2">TitleoftheCourse</td><td colspan="7">ALGEBRAICTOPOLOGY</td></tr>
<tr><td colspan="2">PaperNumber</td><td colspan="7">ELECTIVE III - Group C:(PM/AP/IC/ITC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective III</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">InstructionalHours perweek</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">LabPractice</td><td>Total</td></tr>
<tr><td>2</td><td colspan="2">1</td><td colspan="2">--</td><td>3</td></tr>
<tr><td colspan="2">Objectives of theCourse</td><td colspan="6">Tointroducethe ideas ofalgebraictopologyto other branches of Mathematics</td></tr>
<tr><td colspan="2">CourseOutline</td><td colspan="6">UNIT-I:CalculusinthePlane
PathIntegrals:Anglesand Deformations - Differential forms and path Integrals - Independence of Path - Criterionforexactness.AnglesandDeformations:AnglefunctionsandWindingnumbers-ReparametrizingandDeformingthePaths.WindingNumbers.Definition-HomotopyandReparametrization-VaryingthePoint -Degreesand Local Degrees
Chapter1:(a)to (c);Chapter2:only(a) and(b)Chapter3 :(a) to(d)
UNIT- II:CohomologyandHomology
De RhamCohomology and the Jordan Curve Theorem. Definition of the DeRhamGraphs-TheCoboundarymap-theJordonCurveTheorem-ApplicationsandVariations.Homology:Chains,Cycles,andH0U-Boundaries, H1U , and Winding Numbers - Chains on Grids - Maps andHomology-TheFirstHomology GroupforGeneralSpaces.Chapter5:(a)to (d) ; Chapter 6: (a)to(e)
UNIT-III:HolesandIntegrals
Multiplyconnectedregions-IntegrationsovercontinuousPathsandChains-PeriodsofIntegrals-Complex Integration Mayer-Victoris: The Boundary map- Mayer-VictorisforHomology-Variationsandapplications-Mayer-VictorisforCohomology.
Chapter9: (a)to(d)Chapter10:(a)to(d)
UNIT-IV:CoveringSpacesandFundamentalGroups
Covering Spaces: Definition - Lifting paths and Homotopies - G-coverings -Covering Transformations. The Fundamental Groups: Definitions and BasicProperties - Homotopy - Fundamental Group and Homology.
FundamentalGroupsandCoveringSpaces:FundamentalGroupandCoverings-AutomorphismsofCoverings- TheUniversalCovering-CoveringsandSubgroupsoftheFundamentalGroup.
Chapter11:(a)to(d)Chapter12:(a) to(c) Chapter 13: (a)to(d)
UNIT-V:TheVanKampenTheorem
G-CoveringsfromtheUniversalCovering-PatchingCoveringstogether-TheVanKampenTheorem Cohomology: Patching Coverings and Cechcohomology - CechCohomology and Homology - De RhamCohomology and Homology - ProofofMayer-VictorisforDeRhamCohomology.
Chapter14:(a)to(d);Chapter15: (a)to(d)</td></tr>
</table>

Extended ProfessionalComponent	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TNPSC/others tobe solved(TobediscussedduringtheTutorial hour)
Skills acquired fromthiscourse	Knowledge,ProblemSolving,Analyticalability,ProfessionalCompetency, Professional Communication andTransferrable Skill
RecommendedText	William Fulton,AlgebraicTopology-AFirstCourse,Springer-Verlag,New York,1995
ReferenceBooks	1. M.K.Agoston,Algebraictopology-AFirstCourse,MarcelDekker,1962. 2. SatyaDeo,AlgebraicTopology,HindustanBookAgency,NewDelhi,2003. 3. M.Greenberg and Harper, Algebraic Topology-A First course,Benjamin/Cummings,1981. 4. C.F.Maunder,Algebraictopology,VanNastrand,NewYork,19705.J.R. Mukres,Topology,PrenticaHall ofIndia,NewDelhi,2002(3rdIndianPrint)
Websiteand e-LearningSource	http://mathforum.org,http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org,www.mathpages.com

CourseLearningOutcome (forMappingwith POsandPSOs)
Studentswillbeable to

CLO1: To Know about the differentiation and integration in planes.

CLO2: To understand the homology group.

CLO3: To Understandthe integrals over continuous paths in space.

CLO4: To know about fundamental groups and covering spaces.

CLO5: To understand G-Coveringsand PatchingCoverings.

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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">MATHEMATICAL STATISTICS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">ELECTIVE III - Group C:(PM/AP/IC/ITC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective III</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">2</td><td colspan="2">1</td><td colspan="2">--</td><td>3</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">Basic Probability Theory</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">This course introduces collection, bar diagrams and to understand the measure of central tendencies, correlation and Regression lines.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT-I : Sample Moments and their Functions: Notion of a _ sample and a statistic – Distribution functions of X, S2 and _ (X , S2) - χ 2 distribution – Student t-distribution – Fisher’s Z-distribution – Snedecor’sFdistribution – Distribution of sample mean from non-normal populations Chapter 9 : Sections 9.1 to 9.8</td></tr>
<tr><td colspan="8">UNIT-II: Significance Test: Concept of a statistical test – Parametric tests for small samples and large samples - χ 2 test – Kolmogorov Theorem – Smirnov Theorem – Tests of Kolmogorov and Smirnov type – The Wald-Wolfovitz and Wilcoxon-Mann-Whitney tests – Independence Tests by contingency tables. Chapter 10 : Sections 10.11 Chapter 11 : 12.1 to 12.7..</td></tr>
<tr><td colspan="8">UNIT-III: Estimation : Preliminary notion – Consistency estimation – Unbiased estimates – Sufficiency – Efficiency – Asymptotically most efficient estimates – methods of finding estimates – confidence Interval. Chapter 13 : Sections 13.1 to 13.8 (Omit Section 13.9)</td></tr>
<tr><td colspan="8">UNIT-IV:Analysis of Variance : One way classification and two-way classification. Hypotheses Testing: Poser functions – OC function- Most Powerful test – Uniformly most powerful test – unbiased test. Chapter 15 : Sections 15.1 and 15.2 (Omit Section 15.3) Chapter 16 : Sections 16.1 to 16.5 (Omit Section 16.6 and 16.7).</td></tr>
<tr><td colspan="8">UNIT-V :Sequential Analysis : SPRT – Auxiliary Theorem – Wald’s fundamental identity – OC function and SPRT – E(n) and Determination of A and B – Testing a hypothesis concerning p on 0-1 distribution and m in Normal distribution. Chapter 17 : Sections 17.1 to 17.9 (Omit Section 17.10)</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">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)</td></tr>
</table>

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	M. Fisz , Probability Theory and Mathematical Statistics, John Wiley and sons, New Your, 1963.
Reference Books	1. E.J.Dudewicz and S.N.Mishra , Modern Mathematical Statistics, John Wiley and Sons, New York, 1988. 2. V.K.Rohatgi An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern New Delhi, 1988(3rd Edn) 3. G.G.Roussas, A First Course in Mathematical Statistics, Addison Wesley Publishing Company, 1973 4. B.L.Van der Waerden, Mathematical Statistics, G.Allen&Unwin Ltd., London, 1968..
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: Understand the Sampling moments and their functions

CLO2: Analysis and evaluate the significance of test.

CLO3: Analysis of Estimation.

CLO4: Understand the analysis of variance.

CLO5: To understand the sequential analysis

	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

<table>
<tr><td colspan="2">TitleoftheCourse</td><td colspan="6">STATISTICALDATAANALYSISUSINGR-PROGRAMMING</td></tr>
<tr><td colspan="2">PaperNumber</td><td colspan="6">ELECTIVE III - Group C:(PM/AP/IC/ITC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective III</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td></td><td></td></tr>
<tr><td>Semester</td><td>II</td><td></td><td></td><td>Course Code</td><td></td></tr>
<tr><td colspan="2" rowspan="2">InstructionalHours perweek</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">LabPractice</td><td>Total</td></tr>
<tr><td>2</td><td colspan="2">1</td><td colspan="2">--</td><td>3</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">BasicknowledgeinComputerandStatistics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. To master the use of R interactive environment with an understanding of the use of R documentation.
2. To use R for descriptive statisticsandwrite multivariate models in R.</td></tr>
<tr><td colspan="2" rowspan="5">CourseOutline</td><td colspan="6">UNIT- I:Introduction to R language
Starting and quitting in R, Basic features in R - Built-in functions and online help - Logical vectors - Rational operators - Changing Directories, redirecting R output, Lists Data frames.</td></tr>
<tr><td colspan="6">UNIT-II:Programming Statistical Graph
Plotting bar charts, dot charts - Plotting Pie charts - Plotting Histograms - Plotting Box plots -Plotting scatter plots- Plotting QQ plots.</td></tr>
<tr><td colspan="6">UNIT-III:Programming with R
For loop - If statement -- while loop - Newton’s method for finding root - Repeat loop, break and next statements - Problems and Exercises.</td></tr>
<tr><td colspan="6">UNIT-IV:Simulation in R
Monte Carlo simulation - Generation of pseudo-random numbers - Bernoulli random variables - Binomial random variables - Poisson random variables - Exponential random numbers.</td></tr>
<tr><td colspan="6">UNIT-V:Computational Linear Algebra in R
Vectors and matrices in R - Constructing matrix objects - Accessing matrix elements - Row and column names - Matrix properties,Matrix multiplication and inversion - Eigen values and Eigen vectors.</td></tr>
<tr><td colspan="2">Extended ProfessionalComponent</td><td colspan="6">Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TNPSC/others tobe solved (TobediscussedduringtheTutorial hour)</td></tr>
<tr><td colspan="2">RecommendedText</td><td colspan="6">W. John Braun, Duncan J. Murdoch, A first course in statistical programming with R, Cambridge University Press, 2007.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="6">1. Gardener, M.Beginning R: The statistical programming language, John Wiley & Sons 2012.
2. Martin, T. The Undergraduate Guide to R. A beginner’s introduction to R programming Language, 2009.
3. Chambers, J. Software for data analysis: programming with R. Springer Science & Business Media, 2008.</td></tr>
</table>

Websiteand e-LearningSource	1. http://assets.cambridge.org/97805218/72652/frontmatter/9780521872652_frontmatter.pdf 2. http://students.aiu.edu/submissions/profiles/resources/onlineBook/A7E7d8_Beginning%20R%20statistics.pdf 3. https://www.cs.upc.edu/~robert/teaching/estadistica/rprogramming.pdf 4. https://www.cs.upc.edu/~robert/teaching/estadistica/TheRBook.pdf 5. https://nptel.ac.in/ 6. https://swayam.gov.in/nc_details/NPTEL 7. https://www.coursera.org/ 8. https://spoken-tutorial.org/

CourseLearningOutcome (forMappingwith POsandPSOs)

Studentswillbeable to

CLO1: Familiarize with basics of R software and built in function of R.

CLO2: Identify the characteristics of datasets and plot the datasets in R using graphical methods.

CLO3: Demonstrate understanding and use of for loop, if statement and break.

CLO4: Implement the learning techniques and computing environment that are suitable for the applications under consideration.

CLO5: Compute vectors and matrices, matrix inverse, eigen values and eigen vectors.

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

Elective – IV: GroupD:**(PM/AP/IC/ITC)**

<table>
<tr><td colspan="2">TitleoftheCourse</td><td colspan="6">MODELINGANDSIMULATIONWITHEXCEL</td></tr>
<tr><td colspan="2">PaperNumber</td><td colspan="6">Elective – IV: GroupD:(PM/AP/IC/ITC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective IV</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td></td></tr>
<tr><td>Semester</td><td>II</td><td colspan="4"></td></tr>
<tr><td colspan="2" rowspan="2">InstructionalHours perweek</td><td>Lecture</td><td colspan="2">Tutorial</td><td>LabPractice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td colspan="2">1</td><td>--</td><td colspan="2">3</td></tr>
<tr><td colspan="2">CourseOutline</td><td colspan="6">UNIT–I : Presentation Of Quantitative Data
Introduction-Data Classification-Data Context and Data Orientation-Types of Charts and Graphs-An Example of Graphical Data Analysis and Presentation.
Analysis of Quantitative Data :Introduction-Data Analysis Tools-Data Analysis for Two Data Sets-Analysis of Time Series Data—Forecasting/Data Relationship Tools-Analysis of Cross-Sectional Data—Forecasting/Data Relationship Tools.</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT- II : Presentation Of Qualitative Data
Introduction-Essentials of Effective Qualitative Data Presentation-Data Entry and Manipulation-Data queries with Sort, Filter, and Advanced Filter.
Analysis of Qualitative Data
Introduction-Essentials of Qualitative Data Analysis-PivotChart or PivotTable Reports.</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT–III : Inferential Statistical Analysis Of Data
Introduction-χ 2—Chi-Square Test of Independence for Categorical Data-z-Test and t-Test of Categorical and Interval Data-An Example-ANOVA-Experimental Design.</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT–IV : Modeling And Simulation: Part 1 Introduction-An Example of Deterministic Modeling-Understanding the Important Elements of a Model-Model Building with Excel.</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-V : Modeling And Simulation: Part 2
Types of Simulation and Uncertainty-The Monte Carlo Sampling Methodology-A Financial Example—Income Statement-An Operations Example—Autohaus.</td></tr>
<tr><td colspan="2">Extended ProfessionalComponent</td><td colspan="6">Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TNPSC/others tobe solved(TobediscussedduringtheTutorialhour)</td></tr>
<tr><td colspan="2">Skills acquired from thiscourse</td><td colspan="6">Knowledge,ProblemSolving,Analyticalability,ProfessionalCompetency, Professional Communication andTransferrable Skill</td></tr>
<tr><td colspan="2">RecommendedText</td><td colspan="6">Excel data analysis modelling and simulation, Hector Guerrero, Springer-Verlag Berlin Heiddelberg 2010.</td></tr>
<tr><td colspan="2">Websiteand e-LearningSource</td><td colspan="6">http://mathforum.org,http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org,www.mathpages.com</td></tr>
</table>

CourseLearningOutcome (forMappingwith POsandPSOs)

Studentswillbeable to

CLO1: Know to present and analyzequantitive data.

CLO 2: Know to present and analyze qualitative data.

CLO3: Knowinferential statistical analysis of data.

CLO4: Know modeling and simulation for deterministic data.

CLO5: Know modeling and simulation for non deterministic data.

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

<table>
<tr><td colspan="2">TitleoftheCourse</td><td colspan="6">MACHINE LEARNINGANDARTIFICAL INTELLIGENCE</td></tr>
<tr><td colspan="2">PaperNumber</td><td colspan="6">Elective – IV: GroupD:(PM/AP/IC/ITC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective IV</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td></td></tr>
<tr><td>Semester</td><td>II</td><td colspan="4"></td></tr>
<tr><td colspan="2">InstructionalHours perweek</td><td>Lecture</td><td colspan="2">Tutorial</td><td>LabPractice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2"></td><td>2</td><td colspan="2">1</td><td>--</td><td colspan="2">3</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6"></td></tr>
<tr><td colspan="2">Objectives of theCourse</td><td colspan="6">1.ToLearnaboutMachineIntelligenceandMachineLearningapplications
2.To implement and apply machine learning algorithms to real-worldapplications.
3.To identify and apply the appropriate machine learning technique toclassification, pattern recognition, optimization and decision problems.To understand how to perform evaluation of learning algorithms andmodelselection.
4.Tounderstandaboutthebasictheoryofproblemsolvingparadigmsandsearch strategies in artificial intelligence
5.Tomakethestudentsfamiliarwithknowledgerepresentation,planning,learning, natural languageprocessing and robotics</td></tr>
<tr><td colspan="2">CourseOutline</td><td colspan="6">UNIT-I: Introduction
Learning Problems – Perspectives andIssues–ConceptLearning–VersionSpacesandCandidateEliminations–Inductivebias–DecisionTreelearning–Representation –Algorithm –Heuristic SpaceSearch.</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-II: Neural Networks and Genetic Algorithms
NeuralNetworkRepresentation–Problems–Perceptrons–MultilayerNetworksandBackPropagationAlgorithms –AdvancedTopics–GeneticAlgorithms–HypothesisSpaceSearch–Geneticprogramming–ModelsofEvaluationandLearning.</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-III:BayesianandComputationalLearning
BayesTheorem–ConceptLearning–MaximumLikelihood–Minimum Description Length Principle – Bayes Optimal Classifier –Gibbs Algorithm – Naïve Bayes Classifier –Bayesian Belief Network –EM Algorithm – Probability Learning – Sample Complexity – FiniteandInfinite Hypothesis Spaces– MistakeBoundModel.</td></tr>
</table>

	UNIT – IV: Introduction - Intelligent Agents- Problem Solving - bySearching-InformedSearchStrategies-OptimizationProblems-AdversarialSearch-KnowledgeandReasoning-LogicalAgents-First-OrderLogic-InferenceinFirst-OrderLogic-KnowledgeRepresentation
	UNIT – V: Planning – Planning and Acting in the Real World - Uncertainknowledgeandreasoning-Uncertainty-ProbabilisticReasoning-ProbabilisticReasoningoverTime-MakingSimpleDecisions -Making Complex Decisions
Extended Professional Component	Questions related to the above topics, from various competitive examination UPSC /TNPSC / others to be solved (To be discussedduringtheTutorialhour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
RecommendedText	1.Tom M. Mitchell,―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013. 2.Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach," Third Edition, Prentice Hall of India, New Delhi, 2010.
ReferenceBooks	1. EthemAlpaydin,―IntroductiontoMachineLearning(AdaptiveComputationand MachineLearning),TheMITPress 2004. 2. StephenMarsland,―MachineLearning:AnAlgorithmicPerspective, CRC Press,2009. 3. MichaelAffenzeller,StephanWinkler,StefanWagner,AndreasBeham, ―Genetic Algorithms and Genetic Programming‖,CRCPress Taylorand Francis Group. 4. Elaine Rich, Kevin Knight, B. Nair, "Artificial Intelligence," ThirdEdition,TataMcGraw-Hill, NewDelhi, 2017. 5. EugeneCharniak,DrewMcDermott,"IntroductiontoArtificial Intelligence,"Pearson,2002.
Websiteand e-LearningSource	http://mathforum.org,http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org,www.mathpages.com

CourseLearningOutcome (forMappingwith POsandPSOs)

Studentswillbeable to

CLO1: Tounderstandfundamentalissuesandchallengesofmachine learning.

CLO2: Haveanunderstandingofthestrengthsandweaknessesofmanypopularmachinelearningapproaches

CLO3: Appreciatetheunderlyingmathematicalrelationshipswithinandacross MachineLearninga lgorithms andtheparadigms of supervisedand unsupervised learning

CLO4: Understandthecomputationintelligence

CLO5: ApplybasicprinciplesofAIinsolutionsthatrequireproblemsolving,inference,

perception,knowledgerepresentation, and learning

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

<table>
<tr><td colspan="2">TitleoftheCourse</td><td colspan="7">NEURALNETWORKS</td></tr>
<tr><td colspan="2">PaperNumber</td><td colspan="7">Elective – IV: GroupD:(PM/AP/IC/ITC)</td></tr>
<tr><td>Category</td><td>Elective IV</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td></td></tr>
<tr><td colspan="2"></td><td>Semester</td><td>II</td><td colspan="4"></td></tr>
<tr><td colspan="2">InstructionalHours perweek</td><td>Lecture</td><td colspan="2">Tutorial</td><td>LabPractice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2"></td><td>2</td><td colspan="2">1</td><td>--</td><td colspan="2">3</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">UGlevel</td></tr>
<tr><td colspan="2">Objectives of theCourse</td><td colspan="7">To know the main fundamental principles and techniques of neural network systems and investigate the principal neural network models and applications.</td></tr>
<tr><td colspan="2">CourseOutline</td><td colspan="7">UNIT-I : Neuron Model and NetworkArchitectures
Mathematical Neural Model-Network Architectures-Perceptron-Hamming Network-Hopfield Network-Learning Rules.</td></tr>
<tr><td colspan="2"></td><td colspan="7">UNIT-II : Perceptron Architectures
Perceptron Architectures and Learning Rules with proof of convergence-Supervised Hebbian Learning-Linear Associator.</td></tr>
<tr><td colspan="2"></td><td colspan="7">UNIT-III : Supervised Hebbian Learning
The Hebb Rule-Pseudo inverse rule-Variation ofHebbian Learning-Back Propagation-Multilayer Perceptrons.</td></tr>
<tr><td colspan="2"></td><td colspan="7">UNIT-IV:Back Propagation
Back Propagation algorithm-convergence and Generalization-Performances surfaces and optimum points-Taylor series.</td></tr>
<tr><td colspan="2"></td><td colspan="7">UNIT-V:PerformanceSurfaceandPerformanceOptimizations
Directional derivatives-Minima-Necessary conditions for optimality-Quadratic functions-Performance optimizations-Steepest Descent Newton’s method-Conjugate Gradient.</td></tr>
<tr><td colspan="2">Extended Professional Component</td><td colspan="7">Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TNPSC/others tobe solved(TobediscussedduringtheTutorialhour)</td></tr>
<tr><td colspan="2">Skills acquired fromthiscourse</td><td colspan="7">Knowledge,ProblemSolving,Analyticalability,ProfessionalCompetency, Professional Communication andTransferrable Skill</td></tr>
<tr><td colspan="2">RecommendedText</td><td colspan="7">Martin T. Hagan, Howard B/Demuth and Mark Beale, Neural Network Design, Vikas Publishing House, New Delhi, 2002.</td></tr>
<tr><td colspan="2">ReferenceBooks</td><td colspan="7">1. James A.Freeman, David M.Skapura, Neural Networks Algorithms, Applications and Programming Techniques, Pearson Education, 2003.
2. Robert J. Schalkoff, Artificial Neural Network,McGraw-Hill International Edition, 1997.</td></tr>
</table>

Websiteand e-LearningSource	1.https://nptel.ac.in/courses/117/105/117105084/ 2. https://nptel.ac.in/courses/106/106/106106184/

CourseLearningOutcome (forMappingwith POsandPSOs)

Students will beableto

CLO 1: Understand and analyze different neutron network models

CLO 2: Understand the basic ideas behind most common learning algorithms for multilayer perceptions, radial basis function networks.

CLO 3: Describe Hebb rule and analyze back propagation algorithms with examples.

CLO 4: Study convergence and generalization and implement common learning algorithms.

CLO 5: Study directional derivatives and necessary conditions for optimality and to evaluate quadratic functions.

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

GroupE:**(PM/AP/IC/ITC)**

<table>
<tr><td colspan="2">TitleoftheCourse</td><td colspan="7">ALGEBRAIC NUMBER THEORY</td></tr>
<tr><td colspan="2">PaperNumber</td><td colspan="7">Elective – V: GroupE:(PM/AP/IC/ITC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective V</td><td>Year</td><td>II</td><td>Credits</td><td>3</td><td>Course Code</td><td></td></tr>
<tr><td>Semester</td><td>III</td><td colspan="4"></td></tr>
<tr><td colspan="2">InstructionalHours perweek</td><td>Lecture</td><td colspan="2">Tutorial</td><td>LabPractice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2"></td><td>2</td><td colspan="2">1</td><td>--</td><td colspan="2">3</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7"></td></tr>
<tr><td colspan="2">Objectives of theCourse</td><td colspan="7">Thecourse aims to provideastudyon modules over rings, finite fields, algebraicextensions,numberfields andcyclotomicfields,Noetherianringsand modules andDedekind rings.</td></tr>
<tr><td colspan="2">CourseOutline</td><td colspan="7">UNIT-I:AlgebraicBackground
RingsandFields-FactorizationofPolynomials-FieldExtensions-SymmetricPolynomials- Modules -FreeAbelian Groups.
Chapter1: Sec.1.1to 1.6</td></tr>
<tr><td colspan="2"></td><td colspan="7">UNIT-II:Algebraic Numbers
Algebraic numbers - Conjugatesand Discriminants - Algebraic Integers - Integral Bases - Norms andTraces -Rings ofIntegers.
Chapters2:Sec.2.1to2.6</td></tr>
<tr><td colspan="2"></td><td colspan="7">UNIT-III:Quadraticand CyclotomicFields
Quadratics and cyclotomaticfields : Factorization into Irreducibles : Trivialfactorization - Factroization into irreducibles - Examples of non-uniquefactorizationinto irreducibles.
Chapter3: Sec. 3.1 and3.2 ; Chapter4:Sec. 4.2 to 4.4</td></tr>
<tr><td colspan="2"></td><td colspan="7">UNIT-IV:
PrimeFactroization-EuclideanDomains-EuclideanQuadraticfields-Consequencesofuniquefactorization-TheRamanujan-NagellTheorem.
Chapter4: Sec. 4.5to 4.9</td></tr>
<tr><td colspan="2"></td><td colspan="7">UNIT-V :Ideals
PrimeFactorizationofIdeals-ThenormsofanIdeal -Non-uniqueFactorization in CyclotomicFields..
Chapter5 :Sec. 5.2 to 5.4</td></tr>
<tr><td colspan="2">Extended ProfessionalComponent</td><td colspan="7">QuestionsrelatedtotheabovetopicsfromvariouscompetitiveexaminationsUPSC/TNPSC/others tobe solved (TobediscussedduringtheTutorialhour)</td></tr>
<tr><td colspan="2">Skills acquired fromthiscourse</td><td colspan="7">Knowledge,ProblemSolving,Analyticalability,ProfessionalCompetency,Professional Communication andTransferrable Skill</td></tr>
<tr><td colspan="2">RecommendedText</td><td colspan="7">I.StewardandD.Tall. AlgebraicNumberTheoryandFermat‘s Last Theorem(3rdEdition)A.K.Peters Ltd.,Natrick, Mass.2002.</td></tr>
</table>

ReferenceBooks	1. Z.I.BosevicandI.R.Safarevic,NumberTheory,AcademicPress,NewYork, 1966. 2. J.W.S.Cassels and A.Frohlich, Algebraic Number Theory, AcademicPress,New York, 1967. 3. P.Ribenboim,AlgebraicNumbers, Wiley,New York,1972. 4. P.Samuel,AlgebraicTheoryofNumbers,HoughtonMifflinCompany, Boston, 1970. 5. A.Weil.BasicNumberTheory,Springer,NewYork,1967.
Websiteand e-LearningSource	http://mathforum.org,http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org,www.mathpages.com

CourseLearningOutcome (forMappingwith POsandPSOs)

Studentswillbeable to

CLO1: To know about rings, fields and factorization ofpolynomials .

CLO2: To know about norms and traces over ring of integers.

CLO3: To understand factorization to irreducible polynomials.

CLO4: To understand EuclideanQuadraticfields

CLO5: To know concepts of ideals .

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

<table>
<tr><td>Title of the Course</td><td colspan="6">FLUID DYNAMICS</td></tr>
<tr><td>Paper Number</td><td colspan="6">Elective – V: GroupE:(PM/AP/IC/ITC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective V</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td>Instructional Hours per week</td><td colspan="2">Lecture
2</td><td>Tutorial
1</td><td colspan="2">Lab Practice
--</td><td>Total
3</td></tr>
<tr><td>Pre-requisite</td><td colspan="6">Classical Dynamics</td></tr>
<tr><td>Objectives of the Course</td><td colspan="6">The aimof the course is to discuss kinematics of fluids in motion,Equationsofmotion ofafluid, threedimensional flows,twodimensionalflowsandviscous flows.</td></tr>
<tr><td>Course Outline</td><td colspan="6">UnitI:Kinematics offluids in motion:
Real fluids and ideal fluids - velocity of a fluid at a point stream lines and path lines - steadyand unsteady flows - the velocity potential - the vorticity vector - local and particle rates ofchange-theequation ofcontinuity-worked examples.Chapter2 : 2.1– 2.8

UnitII:Equationofmotionof fluid:
Pressure at a point in fluid at rest - Pressure at a point in a moving fluid - conditions at aboundaryoftwoinviscidimmisciblefluids-Euler‟sequationofmotion-Bernoulli‟sequation– workedexamples.Chapter3 :3.1 –3.6

UnitIII:Somethreedimensionalflows:
Introduction–sources– sinksanddoublets –Axissymmetricflow – Stokesstreamfunction.Chapter4 : 4.1– 4.2 &

UnitIV:Sometwo dimensional flows:
Meaningoftwodimensionalflows–useofcylindricalpolar coordinates – thestreamfunction– the potential for two dimensional – irrotational – incompressible flows – complex velocitypotential for standard two dimensional flows – the Milne-Thomson circle theorem withexamples. Chapter5 : 5.1– 5.5 &5.8

Unit V : Viscous Flows : Stress components in real fluids – relation between Cartesiancomponents of stress – translation motion of a fluid element – the rate of strain quadric andprinciplestresses–Some furtherproperties ofthe rateofstrain quadricstressanalysisinfluidmotion – relation between stress and rate of strain – the co-efficient of viscosity and laminarflow–the Navier–Stokes equations of motion ofa viscous fluid.

Chapter8 :8.1 –8.7and8.9</td></tr>
</table>

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. F.Chorlton,TextbookofFluid Dynamics,CBSPublication,NewDelhi,1985. 2. M.K.Venkataraman,AdvancedEngineering&Sciences,TheNationalPublishingCo.
Reference Books	1. G.K.Batchelor,AnIntroductionofFluidMechanics, FoundationBooks, NewDelhi,1993. 2. A.R.Paterson,AFirstCourseinFluidDynamics,Cambridge UniversityPress,NewYork,1987. 3. R.K.Rathy,AnIntroductiontoFluidDynamics,IBHPublishingCompany, NewDelhi,1976. 4. R.VonMises,O.Friedrichs,FluidDynamics,SpringerInternationalStudent Edition,NarosaPublishingHouse, NewDelhi. 5. S.W.Yuan,FoundationofFluidMechanics,PrenticeHallPrivate Ltd,NewDelhi, 1976.
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: StudentsknowwhatareRealfluidsand idealfluids,flowsandsolved problemsregardingthis.

CLO2: Solvedsomeproblemsand derivationsaboutequationofmotionoffluidand learnsomenamingtheorems.

CLO3: Studentsgotsomeknowledgeabout somethreedimensionaland two dimensionalflows.

CLO4: Studentsgotsomeknowledgeabout somethreedimensionaland two dimensionalflows.

CLO5: Analyze theStress components andrelation between Cartesiancomponents of stress, translation motion of a fluid element – the rate ofstrainquadric. Navier–Stokesequations of motion ofaviscousfluid.

	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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">Stochastic Processes</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">ELECTIVE V - Group E:(PM/AP/IC/ITC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective V</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td colspan="2">2</td><td colspan="2">1</td><td colspan="2">--</td><td>3</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">Basic knowledge on probability theory.</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">The main objectives of this course are to: 1. suffice the students to have an overall exposure to the elements of stochastic processes so as to gain a complete knowledge of stochastic processes 2. Create analytical skills and practical thinking to apply the gained knowledge in real life situation 3. sharpen the knowledge of students towards generalizing the existing results for advanced technological applications</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT-I :
Continuous-Time Markov Models
Continuous Time Markov Chain, Examples, Transient Analysis, Occupancy Times, Limiting Behaviour.</td></tr>
<tr><td colspan="8">UNIT-II
Generalized Markov Models
Renewal Process, Cumulative Process, Semi-Markov Process, Examples and Long term Analysis</td></tr>
<tr><td colspan="8">UNIT-III :
Queueing Models
Queueing Systems, Single-Station Queues, Birth and Death queues with Finite and Infinite Capacity.</td></tr>
<tr><td colspan="8">UNIT-IV :
Queues and Networks
M/G/1 and G/M/1 Queues and Network of Queues.</td></tr>
<tr><td colspan="8">UNIT-V:
Brownian Motion
Standard Brownian Motion, Brownian Motion and First Passage Times.</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">V.G. Kulkarni, Introduction to Modeling and Analysis of Stochastic Systems, Second Edition, Springer, New York, 2011.</td></tr>
</table>

Reference Books	1. S. M. Ross, Stochastic Processes , Second Edition, Wiley, New York, 1996. 2. J. Medhi, Stochastic Processes, Second Edition, New Age International, New Delhi, 2001.
Website and e-Learning Source	1. https://www.edx.org/course/introduction-to-probability 2. https://nptel.ac.in/courses/115/106/115106089/ 3. https://nptel.ac.in/courses/111/102/111102014/

Course Learning Outcome (for Mapping with POs and PSOs)

On the successful completion of the course, student will be able to:

CLO1:know the basic knowledge about stochastic processes

CLO2:acquire more detailed knowledge about Markov process with discrete and continuous state space

CLO3: Understand the different aspects of queueing systems and their significance.

CLO4: Take into consideration the impact of Brownian motion in models involving random phenomena

CLO5: master the generalized markov models and evaluate the pros and cons.

	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

Elective VI to be chosen from Group F

GroupF:**(PM/AP/IC/ITC)**

<table>
<tr><td colspan="2">TitleoftheCourse</td><td colspan="8">NUMBER THEORY AND CRYPTOGRAPHY</td></tr>
<tr><td colspan="2">PaperNumber</td><td colspan="8">Elective – VI: GroupF:(PM/AP/IC/ITC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective VI</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">InstructionalHours Perweek</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">LabPractice</td><td colspan="2">Total</td></tr>
<tr><td>3</td><td colspan="2">1</td><td colspan="2">--</td><td colspan="2">4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">The main objectives of this course are to:
1. To introduce students to some of the basic ideas of number theory, and to use this as a context inwhich to discuss the development of mathematics through examples, conjectures, theorems,
proofs and applications.
2. Illustrate different methods of proof in the context of elementary number theory, and will apply some basic techniques of number theory to cryptography.
3. To explore the working principles and utilities of various cryptographic algorithms including
secret key cryptography, hashes and message digests, and public key algorithms.
4. To introduce classical encryption techniques and concepts of modular arithmetic and number
theory. Expected Course Outcomes:</td></tr>
<tr><td colspan="2" rowspan="3">Course Outline</td><td colspan="8">UNIT-I : Divisibility and the Euclidean algorithm – Congruences
Chapter 1 sections 1,2 and 3</td></tr>
<tr><td colspan="8">UNIT-II :Some applications to factoring – Quadratic residues and reciprocity.
Chapter 1 section 4 and chapter 2 section 2
.</td></tr>
<tr><td colspan="8">UNIT-III :Some simple cryptosystems – Enciphering matrices.
Chapter 3</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT-IV The idea of public key cryptography – RSA – Discrete log – Knapsack.
Chapter 4 except section 5</td></tr>
</table>

	UNIT-V : Pseudo primes – The rho method – Fermat factorization and factor bases. Chapter 5
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC/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
RecommendedText	J Neal Koblitz, "A Course in Number Theory and Cryptography"- Second Edition, Springer Publishers.
ReferenceBooks	7. A.Menezes, P. van Oorschot and S. Vanstone, "Handbook of Applied Cryptography", CRC press, 1996. 8. Douglas R. Stinson "Cryptography theory and practice" Second Edition, Chapman and Hall / CRC.
Websiteand 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)

On the successful completion of the course, student will be able to:
CLO1: Solve problems in elementary number theory.
CLO2: Apply elementary number theory to cryptography.
CLO3: Develop a deeper conceptual understanding of the theoretical basis of number theory and cryptography.
CLO4: Identify how number theory is related to and used in cryptography.
CLO5: practice of hiding information, converting some secret information to not readable texts in real-Life situations.

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

<table>
<tr><td colspan="2">TitleoftheCourse</td><td colspan="8">FINANCIALMATHEMATICS</td></tr>
<tr><td colspan="2">PaperNumber</td><td colspan="8">Elective – VI: GroupF:(PM/AP/IC/ITC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective VI</td><td>Year</td><td>II</td><td>Credits</td><td>3</td><td>Course Code</td><td></td></tr>
<tr><td>Semester</td><td>IV</td><td colspan="4"></td></tr>
<tr><td colspan="2" rowspan="2">InstructionalHours Perweek</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">LabPractice</td><td colspan="2">Total</td></tr>
<tr><td>3</td><td colspan="2">1</td><td colspan="2">--</td><td colspan="2">4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">UG Level Finance Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">To study financial mathematics through various models and to study the various aspects of financial mathematics.</td></tr>
<tr><td colspan="2" rowspan="5">CourseOutline</td><td colspan="8">UNIT – I:
Single Period Models: Definitions from Finance - Pricing a forward - One-stepBinary Model - a ternary Model - Characterization of no arbitrage - Risk-NeutralProbability Measure.
Chapter 1</td></tr>
<tr><td colspan="8">UNIT – II:
Binomial Trees and Discrete Parameter Martingales: Multi-period Binary model - American Options - Discrete parameter martingales and Markov processes - Martingale Theorems - Binomial Representation Theorem – Overtureto Continuous models.
Chapter 2</td></tr>
<tr><td colspan="8">UNIT – III:
Brownian Motion: Definition of the process - Levy's Construction of BrownianMotion - The Reflection Principle and Scaling - Martingales in Continuous time.
Chapter 3</td></tr>
<tr><td colspan="8">UNIT – IV:
Stochastic Calculus: Non-differentiability of Stock prices - Stochastic Integration- Ito's formula - Integration by parts and Stochastic Fubini Theorem –GirsanovTheorem - Brownian Martingale Representation Theorem – Geometric BrownianMotion - The Feynman - Kac Representation.
Chapter 4</td></tr>
<tr><td colspan="8">UNIT – V:
Block-Scholes Model: Basic Block-Scholes Model - Block-Scholes price andhedge for European Options - Foreign Exchange - Dividends - Bonds – Marketprice of risk.
Chapter 5</td></tr>
</table>

ExtendedProfessionalComponent	Questions related to the above topics, from various competitive examinations UPSC/TNPSC/others to be solved (To be discussed during the Tutorial hour)
Skills acquiredfromthiscourse	Knowledge, ProblemSolving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
RecommendedText	Alison Etheridge, A Course in Financial Calculus, Cambridge University Press, Cambridge, 2002.
ReferenceBooks	1.MartinBoxter and Andrew Rennie, Financial Calculus: An Introduction toDerivatives Pricing, Cambridge University Press, Cambridge, 1996. 2. Damien Lamberton and Bernard Lapeyre, (Translated by Nicolas RabeauandFarancoisMantion), 3. Introduction to Stochastic Calculus Applied to Finance, Chapman and Hall,1996. 4. MarekMusiela and MarekRutkowski, Martingale Methods in FinancialModeling, Springer Verlag, New York, 1988. 5. Robert J.Elliott and P. Ekkehard Kopp, Mathematics of Financial Markets,SpringerVerlag, New York, 2001 (3rd Printing)
Websiteand e-LearningSource	https://archive.org/details/financialmathema032436mbp

CourseLearningOutcome (forMappingwithPOsandPSOs)

Studentswillbeable to

CLO 1: Use discrete and continuous processes in financial modeling.

CLO 2 : Gain knowledge in the relationship between stochastic and deterministic models.

CLO 3: Understand the roles of Put and Call options in risk reduction also

CLO 4 : understand hedging strategies to reduce risk.

CLO 5: Understand the role of the Black-Scholes partial differential equation and its boundary and final conditions in option pricing.

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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Mathematical Python</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">Elective – VI: GroupF:(PM/AP/IC/ITC)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective VI</td><td>Year</td><td>II</td><td>Credits</td><td>3</td><td>Course Code</td><td></td></tr>
<tr><td>Semester</td><td>IV</td><td colspan="4"></td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>3</td><td colspan="2">1</td><td colspan="2">--</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">1. To introduce the fundamentals of Python Programming.
2. To teach about the concept of Functions in Python.
3. To impart the knowledge of Lists, Tuples, Files and Directories.
4. To learn about dictionaries in python.
5. To explores the object-oriented programming, Graphical programming aspects of python with help of built in modules.</td></tr>
<tr><td colspan="2" rowspan="4">Course Outline</td><td colspan="6">UNIT-I:BASICS: Python Variables – Executing Python from the Command Line – Editing Python Files – Python Reserved Words – Basic Syntax-Comments -Standard Data Types – Relational Operators – Logical Operators -– Bit Wise Operators – Simple Input and Output</td></tr>
<tr><td colspan="6">UNIT-II :CONTROL STATEMENTS: Control Flow and Syntax – Indenting – if Statement – statements and expressions- string operations- Boolean Expressions –while Loop – break and continue – for Loop. LISTS: List-list slices – list methods – list loop – mutability – aliasing – cloning lists - list parameters. TUPLES: Tuple assignment, tuple as return value –Sets – Dictionaries.</td></tr>
<tr><td colspan="6">UNIT-III:FUNCTIONS: Definition – Passing parameters to a Function – Built-in functions- Variable Number of Arguments – Scope – Type conversion-Type coercion-Passing Functions to a Function – Mapping Functions in a Dictionary – Lambda – Modules – Standard Modules – sys – math – time – dir – help Function.</td></tr>
<tr><td colspan="6">UNIT-IV :ERROR HANDLING: Run Time Errors – Exception Model – Exception Hierarchy – Handling Multiple Exceptions – Data Streams – Access Modes Writing – Data to a File Reading – Data From a File – Additional File Methods – Using Pipes as Data Streams – Handling IO Exceptions – Working with Directories.</td></tr>
</table>

	UNIT-V:OBJECT ORIENTED FEATURES: Classes Principles of Object Orientation – Creating Classes – Instance Methods – File Organization – Special Methods – Class Variables – Inheritance – Polymorphism – Type Identification – Simple Character Matches – Special Characters – Character Classes – Quantifiers – Dot Character – Greedy Matches – Grouping – Matching at Beginning or End – Match Objects – Substituting – Splitting a String – Compiling Regular Expressions.
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. Martin C. Brown, PYTHON: The CompleteReference‖, McGraw-Hill, 2001. 2. E. Balagurusamy (2017), "Problem Solving and Python Programming", McGraw-Hill, First Edition
Reference Books	1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 2. Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011 1. Wesley J Chun, ―Core Python Applications Programming‖, Prentice Hall, 2012
Website and e-Learning Source	

Course Learning Outcome (for Mapping with POs and PSOs)

On the successful completion of the course, student will be able to:

CLO1: Understanding the concepts of Input / Output operations in file.

CLO2: Remembering the concept of operators, data types, looping statements in Python programming.
CLO3: Applying the concept of functions and exception handling.
CLO4: Analyzing the structures of list, tuples and maintaining dictionaries.
CLO5: Demonstrate significant experience with python program development environment.

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

SKILLENHANCEMENTCOURSES

SkillEnhancementCoursesarechosensoastokeepinpacewiththelatestdevelopments in the academic / industrial front and provides flexibility of choice by thestakeholders/ institutions.

Skill Enhancement Course – I to be chosen from Group G

GroupG(SkillEnhancementCourses)SEC

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">Mathematical Documentation using LATEX/other Packages</td></tr>
<tr><td colspan="2">PaperNumber</td><td colspan="7">Skill Enhancement Course – I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Skill Enhancement Course – I</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2">Instructional Hours</td><td>Lecture</td><td colspan="2">Tutorial</td><td>LabPractice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">Per week</td><td>2</td><td colspan="2">-</td><td>2</td><td colspan="2">4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">Basic knowledge of programming & Mathematics Course</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">The main objectives of this course are to:
• Introduce the Software knowledge in Latex
• Learn Mathematics structures using Latex
• Understanding the basic concepts and their properties are important for the development of the present and further courses.</td></tr>
<tr><td colspan="2" rowspan="3">Course Outline</td><td colspan="7">UNIT-I : Text formatting, TEX and its offspring</td></tr>
<tr><td colspan="7">UNIT-II: Unit:2 What’s different in LATEX2ϵ , Distinguishing LATEX2 Basic of a LATEX file LATEX2 Basic of a LATEX file .</td></tr>
<tr><td colspan="7">UNIT-III :Commands and Environments-Command names and arguments, Declarations Lengths, special Characters.</td></tr>
<tr><td colspan="2"></td><td colspan="7">UNIT-IV :Document layout and Organization-Document class, Page style, Parts of the Document.</td></tr>
</table>

	UNIT-V : Table of Contents, Fine tuning text, Footnotes and marginal notes.
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC/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
RecommendedText	: H. Kopka and P.W. Daly , "A guide to LATEX" - third Edition, Addison –Wesley , London 1999.
ReferenceBooks	Stefan Kottwitz"LaTeX Beginner's Guide: Create High-quality and Professionallooking Texts, Articles, and Books for Business and Science Using LaTeX" Packt Publishing, 2011.
Websiteand e-Learning Source	http://mathforum.org,http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org,www.mathpages.com

Course Learning Outcomes:

On the successful completion of the course, student will be able to:

- CLO1: Remember to Download and install open source software Latex
- CLO2: Understanding and formatting Latex
- CLO3: Illustrate to learn to create Latex file
- CLO4: Apply and Analyze the Latex commands to large files
- CLO5: Able to learn mathematics derivations and structures using LATEX

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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">Office Automation and ICT Tools</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">Skill Enhancement Course - I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Skill Enhancement Course – I</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">2</td><td colspan="2">-</td><td colspan="2">2</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">Basic knowledge of computers</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">➢ Describe the usage of computers and why computers are essential components in real world.
➢ Utilize the Internet Web resources to societal needs.
➢ Solve common real world problems using appropriate Information Technology applications and systems.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">Unit 1 Basic concepts of computer, functions and characteristics of computer, computer era with its generations and classifications about Windows platform, its features and versions. Introduction of Computer Networks</td></tr>
<tr><td colspan="7">Unit 2 MS-Word – Word processing application features, editing and modification of textual information features, object insertion and modification features, tabulation features, mailing merging and labeling features.Printing Documents.</td></tr>
<tr><td colspan="7">Unit 3 MS-Excel – spreadsheet application features, data representation into the cells of spreadsheet, applying basic arithmetic operations on to it, applying built-in functions and logical condition to the cell data. Filtering and Sorting features are also included. Working with sheets, Creating Charts, Printing.</td></tr>
<tr><td colspan="7">Unit 4 MS-PowerPoint – presentation application features, slide presentation features, animation and transition features to the slides, audio and video insertion features with slideshow features.Adding Effects to the Presentation,Printing Handouts.</td></tr>
<tr><td colspan="7">Unit 5 Basic of internet, working of search engine, ICT tools, video conferencing types, video conferencing platforms, online forms, Google sheets, docs, drive and visualization tools concepts. Google meet, Zoom meeting creation. Recording tool of online meeting,</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Using Web resources and modeling the on-line e-business system. Making Presentation for business and societal issues. (To be discussed during the Practical hour)
Skills acquired from this course	Possess the knowledge of basic hardware peripherals. Know and use Microsoft Office and ICT tools.
Recommended Text	3. Microsoft Office 2007: The Complete Reference, McGraw-Hill Inc 4. E Balagurusamy, Fundamentals of Computers, Tata McGraw Hill Education Private Limited.,2009.
Reference Books	7. MICROSOFT OFFICE 365 ALL-IN-ONE FOR BEGINNERS & POWER USERS: The Concise Microsoft Office 365 A-Z Mastery Guide for All Users (Word, Excel, PowerPoint, ... (OFFICE 365 MASTERY GUIDE 2022 Book 1) Kindle Edition. 8. T. C. Bartee , Computer Architecture and Logic Design, McGraw-Hill 9. Sukhwinder Singh; Gaurav Kumar and kanwalPreet , ICT Skill Development ,Twenty first Century Publications, 2014
Website and e-Learning Source	https://www.rgycsm.org/ , https://ncert.nic.in/ , https://ocw.mit.edu/

CourseLearningOutcome (forMappingwith POsandPSOs)

By learning the course, the students will be able ·

CLO1: to perform documentation ·

CLO2: to perform accounting operations ·

CLO3: to perform presentation skills

CLO4: Recognize when to use each of the Microsoft Office programs to create professional and academic documents.

CLO5: Use Microsoft Office programs to create personal, academic and business documents following current professional and/or industry standards.

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

<table>
<tr><td colspan="2">TitleoftheCourse</td><td colspan="7">DIFFERENTIALEQUATIONSUSING SCILAB</td></tr>
<tr><td colspan="2">PaperNumber</td><td colspan="7">Skill Enhancement Course - I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Skill Enhancement Course - I</td><td>Year</td><td>I</td><td>Credits</td><td>2</td><td>Course Code</td><td></td></tr>
<tr><td>Semester</td><td>II</td><td colspan="4"></td></tr>
<tr><td colspan="2" rowspan="2">InstructionalHours perweek</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">LabPractice</td><td>Total</td></tr>
<tr><td>2</td><td colspan="2">-</td><td colspan="2">2</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">Basic understanding of commands and UG Level Differential Equations</td></tr>
<tr><td colspan="2">Objectives of theCourse</td><td colspan="7">1.Understandthebasiccommands
2.Solvethesystemof equations
3.Evaluatethepolynomials
4.SolvetheOrdinarydifferential equations.</td></tr>
<tr><td colspan="2" rowspan="5">CourseOutline</td><td colspan="7">UNITI
An IntroductiontoScilab –Matrices</td></tr>
<tr><td colspan="7">UNITII
ScilabProgramming</td></tr>
<tr><td colspan="7">UNITIII
Functions–Plotting</td></tr>
<tr><td colspan="7">UNITIV
SolvingOrdinaryDifferentialEquations</td></tr>
<tr><td colspan="7">UNITV
PolynomialsinScilab</td></tr>
<tr><td colspan="2">Extended ProfessionalCompo nent</td><td colspan="7">Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminations UPSC/TNPSC/others tobe solved
(TobediscussedduringtheTutorialhour)</td></tr>
<tr><td colspan="2">Skills acquired fromthiscourse</td><td colspan="7">Knowledge,ProblemSolving,Analyticalability,ProfessionalCompetency ,Professional Communication andTransferrable Skill</td></tr>
<tr><td colspan="2">RecommendedText</td><td colspan="7">1.PROGRAMMINGUSINGSCILAB,AKHILESHKUMAR</td></tr>
<tr><td colspan="2">ReferenceBooks</td><td colspan="7">1.OrdinaryDifferential Equationswith Scilab byGilberto E.Urroz</td></tr>
<tr><td colspan="2">Websiteand e-LearningSource</td><td colspan="7">http://mathforum.org,http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org,www.mathpages.com</td></tr>
</table>

CourseLearningOutcome (forMappingwith POsandPSOs)
Studentswillbeableto

CLO1: Understand the Scilab.

CLO2: Learning the ScilabProgramming.

CLO3: Plotting the function in Scilab.

CLO4: SolvingOrdinaryDifferentialEquations using Scilab.

CLO5: Programming Scilab for Polynomials.

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

Title of the Course		TERM PAPER & SEMINAR PRESENTATION					
Paper Number		Skill Enhancement Course - II					
Category	SEC	Year	II	Credits	2	Course Code	
		Semester	III				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
		3	-	-	3		
Course outline		Professional Communication Skill : Term paper & Seminar presentation Assignment of Problem by 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 to 15 pages using LaTex) 25% Marks / Grade Points / Lecture Grade as per the Regulation)					

Title of the Course		INTERNSHIP / INDUSTRIAL ACTIVITY					
Category		Year	II	Credits	2	Course Code	
		Semester	III				
Instructional Hours per week		Lecture	Tutorial	Lab Practice			

Title of the Course		TRAINING FOR COMPETITIVE EXAMINATIONS					
Paper Number		Skill Enhancement Course - III Professional Competency Skill Enhancement					
Category	SEC	Year	II	Credits	2	Course Code	
		Semester	IV				
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total		
					4		
Course Outline		1.Training for Competitive Examinations Mathematics for NET / UGC - CSIR/ SET / TRB Competitive Examinations (2 hours) 2.General Studies for UPSC / TNPSC / Other Competitive Examinations (2 hours) OR Mathematics for Advanced Research Studies (4 hours)					

Title of the Course	EXTENSION ACTIVITY					
Paper Number						
Category	Year	II	Credits	1	Course Code	
	Semester	IV				
Instructional Hours per week	Lecture	Tutorial		Lab Practice		Total
Course Outline	Performance based assessment					