RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS),

THANJAVUR-613 005

PG AND RESEARCH

DEPARTMENT OF MATHEMATICS

FOR

B.Sc., and M.Sc., COURSES

(Applicable to the Students admitted from the academic year 2022-23)

SYLLABUS

FOR

M. Sc. MATHEMATICS

(Applicable to the Students admitted from the academic year 2022-23)

RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS), THANJAVUR -613005

M. SC., MATHEMATICS COURSE STRUCTURE

(for the candidates admitted from the academic year 2022-2023 onwards)

Sem.	Part	Course	Subject Code	Title of the Paper	In Hrs.	Credit	Exam. Hrs.	Marks		Total
								Int.	Ext.	
I	III	CC1	A1PMA1	Abstract Algebra	6	5	3	25	75	100
	III	CC2	A1PMA2	Real Analysis	6	5	3	25	75	100
	III	CC3	A1PMA3	Programming in C^{++} and LATEX	6	5	3	25	75	100
	III	CC4	A1PMA4P	C++ Programming and Latex - Practical	5	4	3	40	60	100
	III	EC1	A1PMAEL1A	Graph Theory	5	4	3	25	75	100
			A1PMAEL1B	Optimization Techniques						
			A1PMAEL1C	Random Process						
		EDEC1	Introduction to	Latex (For MSc Statistics Students)	2	2	3	25	75	100
	Total				**30**	**23**				**600**
II	III	CC5	A2PMA5	Probability and Statistics	6	5	3	25	75	100
	III	CC6	A2PMA6	Differential Equations	6	5	3	25	75	100
	III	CC7	A2PMA7	Topology	6	4	3	25	75	100
	III	CC8	A2PMA8	Complex Analysis	5	4	3	25	75	100
	III	EC2	A2PMAEL2A	Advanced Numerical Analysis	5	4	3	25	75	100
			A2PMAEL2B	Fuzzy Set Theory						
			A2PMAEL2C	MATLAB						
		EDEC2			2	2	3	25	75	100
	Total				**30**	**22**				**600**

(For students admitted from 2022- 2023)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
I	A1PMA1	Abstract Algebra	6	5	English

Aim

To provide foundation in group and to enhance the power of ideas for solving the problems in algebra.

Course Objectives

This course requires the basic knowledge on groups, rings, fields and ideals.

Course Outcomes

At the end of the Course, Students will be able to:

- Discuss Sylow's theorems with examples.
- Construct new groups from existing groups using direct products and illustrate with some examples.
- Recognize the concept of vector spaces as R-module.
- Describe some of the canonical forms of linear transformations such as triangular and nilpotent transformations.
- Solve problems based on different kinds of transformations.

UNIT I: Group Theory: Another counting principle-Sylow's Theorem – Direct Products.

UNIT II: Ring Theory: Polynomial Rings – Polynomials over the Rational Field – Polynomial Rings Over Commutative Rings. Vector Spaces and Modules: Modules.

UNIT III: Fields: Extension Fields – Roots of Polynomials – More about Roots.

UNIT IV: Fields: The Elements of Galois Theory - Selected Topics: Finite Fields.

UNIT V: Linear Transformations: Hermitian, Unitary and Normal Transformations – Real Quadratic Forms.

Book for Study

Topics in Algebra, I. N . Herstein, John Wiley & Sons, 2^{nd} Edition.

UNIT I: Chapter 2 (Sec 2.11 – 2.13)

UNIT II: Chapter 3(Sec 3.9 – 3.11) & Chapter 4 (Sec 4.5)

UNIT III: Chapter 5 (Sec 5.1 , 5.3 , 5.5)

CONTROLLER OF EXAMINATIONS
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THANJAVUR - 613 005.

Signature of the HOD

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(For students admitted from 2022- 2023)

UNIT IV: Chapter 5 (Sec 5.6) & Chapter 7(Sec 7.1)

UNIT V: Chapter 6 (Sec 6.10 , 6.11)

Book for Reference

Algebra, S. Lang, 3rd Edition, Springer (India), 2004.

Question Paper Pattern

Maximum Marks: 75 Examination Duration : 3 Hours

Part A :$10 \times 2 = 20$ (Two Questions from each unit)

Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)

Part C : $3 \times 10 = 30$ (Three out of Five - One question from each unit)

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(For students admitted from 2022- 2023)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
I	A1PMA2	Real Analysis	6	5	English

Aim

This course aims to provide students with the specialist knowledge necessary for basic concepts in Real Analysis. More precisely, it strives to enable students to learn basic concepts about continuous functions, differentiable functions, compactness and connectedness of a set, grasp basic concepts about the Rectifiable curve, learn about Riemann-Stieltjes integrals , sequences and series of functions

Course Objectives

- To test the convergence of sequences and series of functions and to study the concepts in integration.

Course Outcomes

- Discuss the basic concepts of topology and illustrate with examples.
- Apply domain knowledge for Riemann - Stieltjes integral.
- Explain the sequences and series of functions with the examples.
- Determine the partial derivatives and directional derivatives. Prove the chain rule, inverse function theorem and Implicit function theorem.

UNIT I: Basic Topology: Finite, Countable and Uncountable sets -Problems-Metric spaces-properties- Neighborhood - Open sets -Closed sets -Compact sets -Perfect sets - examples-the Cantor set - Connected sets-properties.

UNIT II: Continuity: Limits of functions- problems - continuous functions - Continuity and Compactness -Theorems-Continuity and Connectedness - Discontinuities -Monotonic functions-problems.

UNIT III: Differentiation - The Derivatives of a Real function -problems-Mean Value theorems - The Continuity of Derivatives- L'Hospital's Rule - Derivatives of Higher Order - Taylor's theorem - Differentiation of vector valued functions.

UNIT IV: Riemann – Steiljels Integral - Definition and Existence of Riemann - Stejiels Integral -Properties of the Integral-Integration and Differentiation - Integration of vector valued functions - Rectifiable curve.

UNIT V: Sequence and series of functions: Discussion of Main Problem - Uniform Convergence-problems-Uniform Convergence and Continuity - Uniform Convergence and Integration-Theorems-Uniform Convergence and Differentiation - Equicontinuous family of functions -The Stone Weierstrass theorem.

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Book for Study

Walter Rudin, Principles of Mathematical Analysis, McGraw -Hill International Book Company, New York, Third Edition.

UNIT I: Chapter 2 (Sec 2.1 - 2.47)

UNIT II: Chapter 4 (Sec 4.1 -4.30)

UNIT III: Chapter 5 (Sec 5.1 -5.19)

UNIT IV: Chapter 6 (Sec 6.1 -6.27)

UNIT V: Chapter 7 (Sec 7.1 -7.26)

Books for Reference

1 Tom Apostol, Mathematical Analysis, Adddison - Wesley Publishing Company, London, 1971.
2 R. Goldberg, Methods of Real Analysis, Oxford & IBH Publishing Company.

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A: 10 X 2 = 20 (Two Questions from each unit)
Part B: 5 X 5 = 25 (Either or type – One Question from each unit)
Part C: 3 X 10 = 30 (Three out of Five – One question from each unit)

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(For students admitted from 2022- 2023)

Semester	Subject Code	Title of the paper	Hours / Week	No. of Credits	Medium of Instruction
I	A1PMA3	Programming in C^{++} and LaTeX	6	5	English

Aim

This Course aims to give knowledge of the basic concepts of C++ and LaTeX.

Course Objectives

To understand how C++ improves C with object-oriented features, the concept of Data Abstraction and Encapsulation, learn how to overload function and operators in C++, to write inline functions and for efficiency and performance, learn how to use exception handling in C++ programs, LaTeX is a document typesetting system that is used to produce high quality scientific documents like article books, dissertations, Technical reports etc.,

Course Outcomes

Under completion of the course the student will be able to: Understand the difference between the OOP and procedural oriented language and data types in C++, Program using C++ features such as composition of objects, operator overloading, inheritance polymorphism etc., Describes the development process of TeX and LaTeX, Tells the advantages of LaTeX over other more traditional software, List LaTeX compatible operating system and explain how to obtain LaTeX.

UNIT I: Beginning with C^{++} - Applications of C^{++} - Simple programs – Structure of C^{++}program – creating the source file – compiling and linking – Declaration of variables – reference variable – Operation in C^{++} - Manipulators – Type cast Operator– Expressions and Implicit conversions – Operator overloading Operator precedence – Control structures.

UNIT II: Functions in C^{++} - Introduction – main function – Functions prototyping – Call by reference – Return by reference – In line function – Default arguments – Constant arguments – Function over Loading – Friend and virtual functions.

UNIT III: LATEX: Introduction – Simple typesetting – Fonts – Type size – The document – Page style – page numbering – Formatting length – Parts of a document – Dividing the document – Bibliography.

UNIT IV: Typesetting Mathematics – Basics – Custom commands – More on Mathematics – Mathematics miscellany-delimiters.

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UNIT V: Putting one over another- Affixing symbols –over or under -Typesetting theorems – Theorems typing in Latex – Designer theorems-The amsthm package –Housekeeping- Floats – The Figure Environment- Using graphics in LaTeX.

Books for Study

1. E. Balagurusamy, Object Oriented Programming with C^{++}, Tata McGraw – Hill Publishing Company Ltd., New Delhi.(1995).

UNIT I: Chapter 2 (Sec 2.1 – 2.8) & Chapter 3 (Sec 3.10 – 3.24)

UNIT II: Chapter 4 (Sec 4.1 – 4.10)

2. LATEX Tutorials, A PRIMER Indian TEX Users Group, Trivandrum, India (2003).

UNIT III : Tutorial I & II and Tutorial III (Section 1)

UNIT IV: Tutorial VIII (Section: 1 - 4.3)

UNIT V :Tutorial VIII (Section : 4.4 - 4.5) &Tutorial IX (Section : 1 - 2)

Tutorial XI (Section : 11.1)

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A : $10 \times 2 = 20$ (Two Questions from each unit)

Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)

Part C : $3 \times 10 = 30$ (Three out of Five - One question from each unit)

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(For students admitted from 2022- 2023)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
I	A1PMA4P	C++ Programming and Latex - Practical	5	4	English

Aim

Complete knowledge of C++ language and LATEX typesetting for project works.

Course Objectives

- Students able to construct any programme for solving mathematical problems using C++.
- To built the knowledge, to prepare the articles using LATEX
- Due to the huge number of open source packages available, the possibilities with LATEX are endless.
- The packages allow users to do even more with LATEX such as add footnotes, draw schematics, create table etc.
- Format words, lines, and paragraphs, design pages, create lists, references and figures in LATEX.

Course Outcomes

- On successful completion of this course students will be able to develop applications.
- Mathematical documents via LATEX are compiles source file, list LATEX editors ,type paragraphs, text formatting commands, create tables, floating bodies, labels and refers the equations, aligns equations.
- The basic structures of an article, style/class files of some journals.
- Preparing presentations of seminars and beamer package.

List of Programmes and LATEX document

1. Write a function in C++ to generate a Fibonacci Series of 'n' Number.

2. Develop a program in C++ for finding the largest of any three given numbers using Macro Definition.

3. Write a program in C++ using function overloading to read two matrices of different data such as integers and floating –point numbers. Find out the sum of the above two matrices separately and display the total sum of these arrays individually.

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4. Write an object – oriented program in C++ to read an integer number and find the sum of the all digits until it reduces to a single digit using constructor, destructor, default constructor and inline member functions.

5. Develop a program in C++ to add two complex numbers and display all the three number.

6. Create a Latex document for the given Mathematical Expressions.

7. Create a Latex document that contains the following: Title – Author's name – Abstract – Introduction – Sections and Bibliography.

8. Construct a Latex document for matrices.

9. Create a Latex document that import graphics, building diagrams, enhancing figures using graphic package (plots).

10. Create a Latex document that contains List of Tables.

Books for Study

1. E. Balagurusamy, Object Oriented Programming with C^{++}, Tata McGraw – Hill Publishing Company Ltd., New Delhi.(1995).
2. Diller, Latex Line by Line, published by Wiley.
3. Introduction to Latex by Tobias Oetiker.
4. Michael Downes. Short Math Guide for Latex.

Question Paper Pattern

Maximum Marks: 60 Examination Duration: 3 Hours

Observation Note	: 10 Marks
Record Note	: 20 Marks
Algorithm, Program and Result	: 30 Marks

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(For students admitted from 2022- 2023)

Semester	Subject Code	Title of the paper	Hours / Week	No. of Credits	Medium of Instruction
I	A1PMAEL1A	Graph Theory	5	4	English

Aim

Enrich the student's practical knowledge to apply in day today life.

Course Objectives

Graph Theory is a growing field of Mathematics with applications in almost all the fields. This contains the beauty of abstract mathematics and applied mathematics. This is one of the most important Research areas.

- To attain basic knowledge of operations on graphs and connectivity.
- To have sound knowledge about Trees, Eulerian and Hamiltonian Graphs.
- To obtain the Practical knowledge about Matchings, Planar & Nonplanar Graphs

Course Outcomes

- Build the knowledge of Connectivity in graphs.
- Students can Identify Eulerian and Hamiltonian graphs.
- Students attain a clear understanding about Matchings and Planarity (Planer & non-Planer).

UNIT I: Graphs: Basic concepts - Paths and connectedness - Automorphism of a simple graph - Line graphs–Operations on graphs.

UNIT II: Directed graphs: Basic concepts – Tournaments. Connectivity: Introduction - Vertex cuts and Edge cuts–Connectivity and Edge - connectivity.

UNIT III: Trees: Definition, Characterization and Simple Properties – Centers and Centroids Counting Number of spanning Trees.

UNIT IV: Independent sets and Matchings: Vertex independent sets and vertex coverings–Edge-Independent sets–Matchings and Factors. Eulerian Graphs–Hamiltonian Graphs.

UNIT V: Planarity: Planar and Nonplanar graphs – Euler formula and its consequences - and are Nonplanar Graphs-Dual of a Plane graph.

Book for Study

A Textbook of Graph Theory, R. Balakrishnan and K. Ranganathan, Springer, New Delhi.

UNIT I: Chapter 1 (Sec 1.4- 1.7)

UNIT II: Chapter 2 (Sec 2.1 &2.2) & Chapter 3 (Sec 3.0- 3.2)

UNIT III: Chapter 4 (Sec 4.1 - 4.3)

UNITIV: Chapter 5 (Sec 5.1& 5.3) & Chapter 6 (Sec 6.1 &6.2)

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UNITV: Chapter 8 (Sec 8.1- 8.4)

Books for Reference

1. J.A.Bondy and U. S.R.Murty, Graph Theory with Applications, Springer (2002).

2. V. K.Balakrishnan, Theory and Problems of Graph Theory, Schaum's outlines series , McGra Hill , New Delhi.

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A:10 x 2 = 20 (Two Questions from each unit)

Part B:5 x 5 = 25 (Either / Or type – One question from each unit)

Part C:3 x 10 = 30 (Three out of Five - One question from each unit)

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(For students admitted from 2022- 2023)

Semester	Subject Code	Title of the paper	Hours/ Week	No. Of credits	Medium of Instructions
I	A1PMAEL1B	Optimization Techniques	5	4	English

Aim

The course covers developments of advanced optimization models and solution methods for technical and economic planning problems. The basis in the course is the optimization process, from a real planning problem to interpretation of the solutions of the underlying optimization problem.

Course Objectives

To create an engineering design methodology using a mathematical formulation of a design problem to support selection of the optimal design among alternatives.

Course Outcomes

- Ability to apply the theory of optimization methods and algorithms to develop and for solving various types of optimization problems.
- Ability to go in research by applying optimization techniques in problems of engineering and technology.
- Ability to solve the mathematical results and numerical techniques of optimization theory to concrete engineering problems by using computer software.

UNIT I: Integer Programming.

UNIT II: Dynamic (Multistage) Programming.

UNIT III: Decision Theory and Games.

UNIT IV: Inventory Models.

UNIT V: Non-linear Programming algorithms.

Book for Study

Kamdy A. Taha, Operations Research, Macmillan Publishing Company, 4th Edition.

UNIT I:Chapter 8 (Sec 8.1–8.5)

UNIT II:Chapter 6 (Sec 9.1–9.5)

UNIT III: Chapter 11 (Sec 11.1–11.4)

UNIT IV: Chapter 13 (Sec 13.1–13.4)

UNIT V :Chapter 19 (Sec 19.1–19.2)

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Book for Reference

PremKumar Gupta and D.S. Hira, Operations Research: An Introduction, S. Chand & Company Ltd, New Delhi (2004).

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A: 10 x 2 = 20 (Two Questions from each unit)

Part B: 5 x 5 = 25(Either / Or type – One question from each unit)

Part C: 3 x 10 = 30 (Three out of Five - One question from each unit)

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(For students admitted from 2022- 2023)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
I	A1PMAEL1C	Random Process	5	4	English

Aim

Enrich the student's practical knowledge to apply in day today life.

Course Objectives

To make students understand the importance and necessary theoretical background of random process. This is one of the important Research areas in Mathematical Modeling.

- To understand the basic concepts of one- and two-dimensional random variables and to introduce some standard distributions applicable to real life phenomenon.
- To understand the basic concepts of random processes which are widely used in IT fields.
- To understand the concept of correlation and spectral random processes.

Course Outcomes

- Build the knowledge of random variables and functions on it.
- Students attain a clear understanding random process and Ergodic Process.

UNIT I: Random Variables: Discrete and continuous random variables – Probability Function – Probability Density Function – Cumulative Distribution Function(cdf) – Properties of cdf F(x) – Special Distribution–Discrete Distribution–Continuous Distribution.

UNIT II: Two-Dimensional Random Variables-Probability Function of (X, Y)–Joint Probability Density Function–Properties of F(x,y) - Marginal and conditional distributions–Independent RVs –Random Vectors - Functions of Random Variables: Function of One Random Variable – One Function of Two Random Variables - Two Functions of Two Random Variables.

UNIT III: Random Processes: Classification of Random Process – Methods of Description of Random Process – Special Classes of Random Process - Stationary–Analytical Representation of Random Process–Auto-correlation and Cross-Correlation Function and its Properties.

UNIT IV: Ergodicity – Mean-Ergodic Process – Mean-Ergodic Theorem – Correlation Ergodic Process – Distribution Ergodic Process – Power Spectral Density function – Properties of Power Spectral Density function- Systems in the form of Convolution – Unit Impulse Response of the System–Properties.

UNIT V: Special Random Process: Poisson Process – Probability Law for the Poisson Process {X(t)} – Second order Probability Function of a Homogeneous Poisson Process - Mean and Autocorrelation of Poisson Process – Properties of Poisson Process – Markov Process – Markov Chain–Classification of States of a Markov Chain.

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Book for Study

T. Veerarajan, Probability, Statistics and Random Processes, Tata McGraw-Hill Publishing Company Ltd. (2006).

UNIT I: Chapter 2 (Page 36– 54)

UNIT II: Chapter 2 (Page 58 – 62 & 89 – 93)

UNIT III: Chapter 7 (Page 338 – 360)

UNIT IV: Chapter 7 (Page 360 – 393)

UNIT V: Chapter 8 (Page 434 – 465)

Books for Reference

1. Peebles, P.Z., "Probability, Random Variables and Random Signal Principles ", Tata McGraw Hill, 4th Edition, New Delhi, 2002.

2. Miller. S.L. and Childers. D.G., —Probability and Random Processes with Applications to Signal Processing and Communications ", Academic Press, 2004.

3. Ibe, O.C.," Fundamentals of Applied Probability and Random Processes ", 1st Indian Reprint, Elsevier, 2007.

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A: 10 x 2 = 20 (Two Questions from each unit)

Part B:5 x 5 = 25 (Either / Or type – One question from each unit)

Part C:3 x 10 = 30 (Three out of Five - One question from each unit)

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Semester	Subject Code	Title of the paper	Hours / Week	No. of Credits	Medium of Instruction
I		Introduction to LaTeX	2	2	English

Aim

This Course aims to give knowledge of the basic concepts of LaTeX.

Course Objectives

LaTeX is a document typesetting system that is used to produce high quality scientific documents like article books, dissertations, Technical reports etc.,

Course Outcomes

Describes the development process of TeX and LaTeX, Tells the advantages of LaTeX over other more traditional software, List LaTeX compatible operating system and explain how to obtain LaTeX.

UNIT I : LATEX: Introduction – Simple typesetting – Fonts – Type size – The document – Page style – page numbering – Formatting length .

UNIT II : Parts of a document - Dividing the document – Bibliography.

UNIT III: Typesetting Mathematics – Basics – Custom commands.

UNIT IV: More on Mathematics –Mathematics miscellany-delimiters

UNIT V: Putting one over another- Affixing symbols –over or under -Typesetting theorems – Theorems typing in Latex .

Books for Study

1. LATEX Tutorials, A PRIMER Indian TEX Users Group, Trivandrum, India (2003).

UNIT I : Tutorial I & II (2.1-2.5)

UNIT II : Tutorial II (2.6-2.7) and Tutorial III(3.1)

UNIT III : Tutorial VIII (8.1-8.2)

UNIT IV: Tutorial VIII (8.3 -8.4.3), UNIT V : Tutorial VIII (8.4.4 -8.4.5)

Question Paper Pattern

Maximum Marks: 100 Examination Duration: 3 Hours

Part A : $5 \times 20 = 100$ (Five out of Eight – Must one question from each unit)

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(For students admitted from 2022- 2023)

Semester	Subject Code	Title of the paper	Hours / Week	No. of Credits	Medium of Instruction
II	A2PMA5	Probability and Statistics	6	5	English

Aim

Probability Theory is the branch of Mathematics concerned with Probability, the analysis of random phenomena. The central objects of probability theory are random variables, Stochastic Processes. As a Mathematical foundation for Statistics Probability Theory is essential to many human activities that involve quantitative analysis of large sets of data.

Course Objectives

- To provide a thorough treatment of probability ideas and techniques necessary for a firm understanding of the subject.
- To understand of the ideas in their proofs, and ability to make direct application of those results to related problems.

Course Outcomes

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

- Simulate random variables, distribution functions, probability mass functions, and probability density functions, multivariate distributions, independence, conditioning and functions of random variables.
- To compute expectations, moments, and correlation functions.
- To describe relationships between different experimental conditions and how to translate real-world problems into probability models.

Unit I: Basic Principle of Continue – Permutations – Combinations – Multinomial Coefficients – sample space and events-axioms of probability - some simple propositions- equally likely outcomes - continuity of the probability as a set function.

Unit II: Conditional probabilities - Baye's theorem – independent events– random variables – Discrete random variables-Expected value- Continuous random variables – the Uniform and normal random variables.

Unit III: Limit theorems - Chebyshev's inequality - weak law of large numbers – central limit theorems – the strong law of large numbers – other inequalities.

Unit IV: Introduction and scope- Origin and development of Statistics- Scope of Statistics - Measures of central tendency – Mean, Median, Mode, Geometric Mean, Harmonic Mean and

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Quartiles. Measures of Dispersion – Quartile deviations and Standard deviation. Measures of Skewness and Kurtosis.

Unit V: Correlation – Definition, Types of Correlation, Karl Pearso's Co-efficient of correlation, Rank Correlation Co-efficient – Linear Regression equations.

Books for Study

1. Sheldon Ross, A first course in Probability, Maxwell MacMillan International edition, Eighth Edition, the United States of America.

2. Gupta S.C. and V.K. Kapoor – Fundamentals of Mathematical Statistics, Sultan Chand and sons, New Delhi.

UNIT I: Chapter I: 1.1 -1.5 (PageNo. : 1 to 13)
Chapter II: 2.1 -2.6 (PageNo. : 22 to 45)

UNIT II : Chapter III: 3.1 -3.4 (Page No. : 58 to 67 , 79-82)
Chapter IV: 4.1 -4.3 (PageNo. : 117 to 128)
Chapter V: 5.1 -5.4 (PageNo. : 186 to 204)

UNIT III: Chapter VIII: 8.1-8.5 (PageNo. : 388 to 410)

UNIT IV: Chapter I: 1.1-1.3 , Chapter II: 2.1-2.9,2.13,2.16,2.17

UNITV: Chapter X: 10.1-10.4,10.7 , Chapter X: 11.1,11.2(11.2.1,11.2.2)

Book for Reference

Geoffery Grimmel and Domenic Welsh, Probability- An Introduction, Oxford University press(1986).

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A : $10 \times 2 = 20$ (Two Questions from each unit)

Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)

Part C : $3 \times 10 = 30$ (Three out of Five - One question from each unit)

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(For students admitted from 2022- 2023)

Semester	Subject Code	Title of the paper	Hours / Week	No. of Credits	Medium of Instruction
II	A2PMA6	Differential Equations	6	5	English

Aim

Differential equations offer a single platform bridging the areas of Mathematical analysis and Application of Mathematics in the sciences. It thus encourages and amplifies the transfer of knowledge with different backgrounds to solve the same type of equations. An application of Ordinary and partial differential equations accepts original research of highlighting the common core of ideas of the discipline.

Course Objectives

- To understand students with the basic concept of Ordinary and Partial Differential Equations, this will be used as background knowledge for the specialized courses in any field.
- To acquire knowledge an introduction to the study and solution method of solving more than two variables of Ordinary differential equations and solving higher order partial differential equations.
- To increase self confidence in conducting research independently or within a team.

Course Outcomes

- On successful completion of the course the student would be able to
- Explain the basic concept of Partial differential equations
- Describe real world system using ordinary and partial differential equations, identify, analyze and subsequently solve physical situations and have good outline of the solution process.

UNIT I: The general solution of homogeneous equation – the use of known solution to find another–the method of variation of parameter–power series solutions.

UNIT II: Regular singular points – Gauss's hyper geometric equation – the point at infinity – Legendre polynomial–Bessel function–properties of Legendre polynomials.

UNIT III: Ordinary differential equation in more than two variables – linear first order partial differential equation – integral surfaces passing through a given curve – surface orthogonal to a given system of surfaces.

UNIT IV: Compatibility systems of first order partial differential equation – Charpit's method – Jacobi's method.

UNIT V: Partial differential equation of the second order with constant coefficients - linear equations with variable coefficients.

Books for study:

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1. Differential Equations with Applications and Historical Notes, G.F. Simmons, Tata McGraw Hill,NewDelhi, 1984.

UNIT I: Chapter 3(Sec 15, 16, 19) & Chapter 5(Sec 26, 27)
UNIT II: Chapter 5 (Sec. 28 - 31) & Chapter 8 (Sec 45 - 47)
2. Elements of Partial Differential Equations, Ian Sneddon, Tata McGraw Hill,NewDelhi, 1984.

UNIT III: Chapter 1(Sec 3- 6) & Chapter 2 (Sec.4 - 6)
UNIT IV: Chapter 2 (Sec 9,10,13)
UNIT V: Chapter 3 (Sec 4, 5)

Books for Reference:

1. K.Sankara Rao, Introduction to Partial Differential Equations, 2nd Edition–Prentice–Hall of India, New Delhi 2006.
2. M.D Raisinghania, Advanced Differential Equations, S.Chand& Company Ltd., New Delhi–2001.
3. An introduction to ordinary differential equations, E.A. Coddington, Englewood Cliffs, EUA : Prentice-Hall 1961.

Question Paper Pattern

Maximum Marks:75 Examination Duration: 3 Hours

Part A: 10 x 2 = 20 (Two question from each unit)

Part B: 5 x 5 = 25 (Either /Or type–One question from each unit)

Part C: 3 x 10 = 30 (Three out of five- One question from each unit)

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(For students admitted from 2022- 2023)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
II	A2PMA7	Topology	6	4	English

Aim

This course aims to provide students with the specialist knowledge necessary for basic concepts in Topology. More precisely, it strives to enable students to learn basic concepts about open sets, closed sets, limit points, basis for a topology, sub basis, various types of topology on a real line, continuous functions, compactness and connectedness of a set, grasp basic concepts about the separation axioms, and paracompactness.

Course Objectives

In this course, students will be enable to learn the concepts of topology such as, product topology, connectedness, compactness, separation axioms, the Uryshon lemma, the Tietze Extension theorem.

Course outcomes

At the end of the course students will be able to:

- Understand the concept of basis for a topology, the order topology, the product topology on and the subspace topology, the basics and limit of connected point compactness, spaces, components the Countability and Local axioms, connectedness, the Separation the concepts axioms of compactness spaces, the classical theorems such as, the Uryshon lemma, the Tietze Extension and Normal theorem.

UNIT I: Topological Spaces : Definition - Examples - Basis for a topology - The Order topology - The Product topology - The Order topology -problems-The Product topology on X x Y the Subspace topology - Closed sets and limit points-problems and theorems.

UNIT II: Continuous functions-the Product topology-Definition - the metric topology complete metric spaces- problems and theorems.

UNIT III: Connectedness and Compactness: Connected spaces - Connected sets in the real line - problems and theorems Components and path components and - Local connectedness - Compact spaces problems and theorems.

UNIT IV: Countability and Separation axioms: The countability axioms - problems and theorems-The Separation axioms - The Urysohn's lemma - Tietze extension theorem - Completely regular spaces.

UNIT V: Paracompactness and Homotopy of paths: Local fixedness - Paracompactness-Homotopy of paths - The fundamental group-Theorems.

Book for Study

James R. Munkres, Topology, A first course, Prentice - Hall of India Pvt Ltd, 1991.

UNIT I: Chapter 2(Sec 2.1 - 2.6)

UNIT II: Chapter 2 (Sec 2.7 - 2.10) & Chapter 7 (Sec 7.1)

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UNIT III: Chapter 3 (Sec 3.1 - 3.5)

UNIT IV: Chapter 4 (Sec 4.1 to 4.3) & Chapter 5 (Sec 5.2)

UNIT V: Chapter 6 (Sec 6.1, 6.4) & Chapter 8 (Sec 8.1, 8.2)

Books for Reference

1. L. A. Steen and J .A. Seebach, Counter examples in Topology, Holt, Rinehart & Winston, Inc. ., New York (1970).
2. S. Willard, General Topology, Addison-Wesley Publishing Company, Inc Reading, Mass (1970).

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A: 10 X 2 = 20 (Two Questions from each unit)

Part B: 5 X 5 = 25 (Either or type – One Question from each unit)

Part C: 3 X 10 = 30 (Three out of Five – One question from each unit)

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(For students admitted from 2022- 2023)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
II	A2PMA8	Complex Analysis	5	4	English

Aim

The purpose is to prepare the student to independent work in these topics and especially to use the methods of complex analysis in other areas of mathematics.

Course Objectives

- To understand the modulus of a Complex valued function and results regarding, develop manipulation skills in the use of Rouche's theorem.
- To know the principal of Analytic Continuation and the concerned results, Gamma and Zeta functions, their properties and relationships.
- To understand the Harmonic functions on a disc and concerned results, the factorization of entire functions having infinite zeros and the range of analytic functions and concerned results.

Course Outcomes

After completing this course students are able to:

- Perform basic mathematical operations (arithmetic, powers, roots) with complex numbers in Cartesian and polar forms; work with multi-valued functions (logarithmic, complex power) and determine branches of these functions.
- Evaluate a contour integral using parameterization, fundamental theorem of calculus and Cauchy's integral formula.
- Explain the concepts, state and prove theorems and properties involving the above topics.

UNIT I: Arcs and Closed Curves – Analytic Functions in regions – Conformal Mappings – Elementary Riemann Surfaces – Line integrals – Rectifiable arcs – Line integrals as Functions of arcs–Cauchy's theorem for rectangle–Cauchy's theorem in disk.

UNIT II: The index of a point with Respect to Closed Curve – The integral Formula – Higher Derivatives–Morera's Theorems–Liouvelle's Theorem–Cauchy's Estimates–Fundamental Theorem of Algebra–Local properties of analytical functions–Removable Singularities–Taylor's Theorem–Zeros and Poles – Meromorphic Function – Essential Singularities – The Local Mapping – The Maximum Principle .

UNIT III: The General form of Cauchy's Theorem – Chains and Cycles – Simple Connectivity – Homology – The General Statement of Cauchy's Theorem and its Proof – Locally Exact differentials – Multiply Connected Regions – The Residue Theorem – Argument Principle – Evaluation of definite integrals .

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UNIT IV: Harmonic Functions – Definitions and Basic Properties – Polar form Mean Value Property – Poisson's Formula – Schwartz's Theorem – Reflection Principle – Weierstrass Theorem - The Taylor's series.

UNITV: Partial Fractions – Infinite Products – Canonical Products – Entire functions – Representation of entire functions – Formula for sinz – Gamma function.

Book for Study

Lars V. Ahlfors, Complex Analysis, Third Edition, McGraw Hill International, 1979.

UNIT I: Chapter 3 (Sec 2.1 -2.3) & Chapter 4 (Sec 1.1 - 1.5)

UNIT II: Chapter 4 (Sec 2.1 - 2.3, 3.1 - 3.4)

UNIT III: Chapter 4 (Sec 4.1 - 4.7, 5.1 - 5.3)

UNIT IV: Chapter 4 (Sec 6.1 - 6.5) & Chapter 5 (Sec 1.1 - 1.2)

UNIT V: Chapter 5 (Sec 2.1 - 2.4)

Book for Reference

J.B. Conway, Functions of One Complex Variable, Narosa Publishing House, Second Edition, 1978.

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A : $10 \times 2 = 20$ (Two Questions from each unit)
Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)
Part C : $3 \times 10 = 30$ (Three out of Five - One question from each unit)

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(For students admitted from 2022- 2023)

Semester	Subject Code	Title of the paper	Hours/ Week	No. of Credits	Medium of Instructions
II	A2PMAEL2A	ADVANCED NUMERICAL ANALYSIS	5	4	English

Aim

Enable students to understand analytical, development and technical principles that relate to Numerical linear algebra, Numerical methods for solving Differential equations and Numerical optimization, develop the academic abilities required to solve problems.

Course Objectives

- Adequate exposure to learn alternative methods and analyse Mathematical problems to determine the suitable numerical techniques.
- Use the concept of interpolation, Eigen value problem techniques for Mathematical problems arising in various fields.
- Solve initial value and boundary value problems which have great significance in engineering practice using ordinary and partial differential equation.
- Demonstrate elementary programming language implementation of algorithms and computer programs to solve Mathematical problems.

Course Outcomes

- Knowledge: Identify and interpret the fundamental concept of polynomials and roots of equations. Finite differences, Eigen values and Eigen vectors and corresponding algorithm and computer programs.
- Skills: To solve algebraic and transcendental equation, solution of ODE using spline interpolation, Eigen value problems numerically using computer programs.
- Distinguish the overall Mathematical knowledge gained to demonstrate and analyse the problem of finding the root of the equations, interpolation, Differential equations. Eigen value problems arising the real-life situations.

UNIT I: Errors: Errors – Significant digits and Numerical instability – Machine computation – Some comment on convergence of sequences – Mathematical preliminaries. Iteration methods based on a second-degree equation-Muller method – Chebyshev method -Polynomial equations – Birge -Vieta method–Bairstow method.

UNIT II: System of Linear Algebraic equation and Eigen value problems -Direct method – Triangularization method – Cholesky method – Partition method – Iteration methods: Jacobi iteration method – Guess Seidal iteration method – Successive Over Relaxation method (SOR) – Eigen values and Eigen vectors.

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UNIT III: Interpolation and Approximation – Hermite interpolation – Piecewise and Spline interpolation. Bivariate interpolation – Lagrange Bivariate interpolation – Newton's bivariate interpolation for equispaced points least square approximation – Gram – Schmidt orthogonalization process.

UNIT IV: Numerical Differentiation – Method based on interpolation – Methods based on finite differences – Extrapolation methods – Numerical integration – Romberg integration.

UNIT V: Ordinary Differential Equations: Numerical methods – Euler's method – Backward Euler's method – Mid – point Euler's method – Simple step methods – Runge kutta methods.

Book for Study

M.K Jain, S.R.K. Iyengar, R.K. Jain, Advanced Numerical methods. New Age International limited Publishers by 2009. (Fifth Edition).

UNIT I : Chapter1 (Sec 1.3,1.4) Chapter 2 (Sec 2.4 – 2.8) ;

UNIT II : Chapter 3 (Sec 3.2 – 3.6);

UNIT III: Chapter 4 (Sec 4.5 – 4.7, 4.9);

UNIT IV: Chapter 5 (Sec 5.2,5.4, 5.10);

UNIT V: Chapter 6 (Sec 6.3, 6.4).

Book for Reference:

S.C.Chapra and P.C Raymond, Numerical methods for engineers, Tata McGraw Hill,New Delhi(2000).

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A: 10 x 2 =20 (Two Questions from each unit)

Part B: 5 x 5 = 25 (Either / Or type – One question from each unit)

Part C: 3 x 10 = 30 (Three out of Five - One question from each unit)

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(For students admitted from 2022- 2023)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
II	A2PMAEL2B	Fuzzy Set Theory	5	4	English

Aim

To comprehend high levels of abstraction in the study of mathematics.

Objectives

To obtain the basic concepts, relations and applications of Fuzzy Algebra.

Course Outcomes

At the end of the Course, Scholars will be able to:

- Recognize the concept of fuzzy sets and their properties.
- Apply the domain knowledge for Standard fuzzy functions and their properties.
- Build the domain knowledge for the Representations of fuzzy functions.
- Analyze the various definitions of fuzzy relations.
- Knowledge the concept of various Fuzzy methods.

Unit I: Basic Definitions–Basic Set-Theoretic Operations for Fuzzy Sets-Types of Fuzzy sets–Operations on Fuzzy Sets–Algebraic Operations–Set-Theoretic Operations–criteria for Selecting Appropriate Aggregation Operation.

Unit II: Fuzzy Relations on sets and Fuzzy Sets–Composition of Fuzzy Relation–Properties of Min-Max Operation–Special Fuzzy Relation–Fuzzy Functions on Fuzzy sets–Extrema of Fuzzy Functions.

Unit III: Binary Fuzzy Relations – Binary Relations on a Single Set – Equivalence and Compatibility Relation–Ordering Relation–Morphisms–Sup-i Compositions of Fuzzy Relations - Inf-ωi Compositions of Fuzzy Relations.

Unit IV: Problem Partition - Solution Method – Fuzzy Relation Equation Based on Sup-i Compositions - Fuzzy Relation Equation Based on Inf-ωi Compositions–Approximate Solution.

Unit V: Method of Construction: A Overview–Direct Methods with one Expert–Direct Methods with Multiple Experts – Indirect Methods with one Expert – Indirect Methods with Multiple Experts–Constructions from Sample Data.

Books for Study

1. H.J. Zimmermann, Fuzzy Set Theory and its Applications, Allied Publishers Limited, New Delhi(1991).

Unit I: Chapter 2 & 3 (full)

Unit II: Chapter 6 (Sec 6.1, 6.1.1, 6.1.2 & 6.3) Chapter 7 (Sec 7.1 & 7.2)

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2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic, Prentice Hall of India, New Delhi (2004).

Unit III: Chapter 5 (Sec 5.3-5.10)

Unit IV: Chapter 6 (Sec 6.2-6.6)

Unit V: Chapter 10 (Sec 10.2-10.7)

Question Paper Pattern

Maximum Marks: 75 Examination Duration : 3 Hours

Part A :$10 \times 2 = 20$ (Two Questions from each unit)

Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)

Part C : $3 \times 10 = 30$ (Three out of Five - One question from each unit)

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(For students admitted from 2022- 2023)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
II	A2PMAEL2C	MATLAB	5	4	English

Aim

The course is targeted at those with no prior knowledge of MATLAB, and no previous programming experience with software languages.

Course Objectives

- To develop the practical skills to solve Mathematical problems using MATLAB.
- To enable the students to learn many of MATLAB commands and how to use them in programming.

Course Outcomes

- Based on the programs for higher degrees and solving Linear programming problems.
- Solving equation of higher degrees using Bisection method.
- Solving system of equations by matrix method and find the eigen values, eigen vectors of a matrix of order 4 by 4 and system of non-linear equations and Gauss Jacobi iteration Method.
- Creating and plotting 2-D and 3-D graphs.
- Find the integration using Simpsons 3/8 rule.
- Solving ordinary differential equations using Runge-Kutta Fourth order method.

Unit I: Introduction - Basics of MATLAB, Input–Output, File trypes–Platform dependence–General commands.

Unit II: Interactive Computation: Matrices and Vectors–Matrix and Array operations–Creating and Using *Inline* functions–Using Built-in Functions and On-line Help–Saving and loading data –Plotting simple graphs.

Unit III: Programming in MATLAB: Scripts and Functions – Script files – Functions files-Language specific features–Advanced Data objects.

Unit IV: Applications – Linear Algebra – Curve fitting and Interpolation – Data analysis and Statistics – Numerical Integration – Ordinary differential equations – Nonlinear Algebraic Equations.

Unit V: Graphics: Basic 2-D Plots – Using subplot to Layout multiple graphs - 3 – D Plots – Handle Graphics–Saving and printing Graphs–Errors.

Book for Study

Rudra Pratap, Getting Started with MATLAB–A Quick Introduction for Scientists and Engineers, Oxford University Press, 2003.

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Books for Reference

1. William John Palm, Introduction to Matlab 7 for Engineers, McGraw-Hill Professional,2005.
2. Dolores M. Etter, David C. Kuncicky , Introduction to MATLAB 7, Prentice Hall,2004

Question Paper Pattern

Maximum Marks: 75 Examination Duration: 3 Hours

Part A :$10 \times 2 = 20$ (Two Questions from each unit)

Part B : $5 \times 5 = 25$ (Either / Or type – One question from each unit)

Part C : $3 \times 10 = 30$ (Three out of Five - One question from each unit

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