RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS), THANJAVUR-5

PG AND RESEARCH DEPARTMENT OF MATHEMATICS

Minutes of the Board of Studies Meeting

Date: 05.01.2021

Time: 2:00 PM

Venue: Room No.:62, Staff Room, Department of Mathematics

Resolutions Passed

The committee completely revised syllabus for UG, PG and M.Phil., Mathematics courses and passed the following resolutions.

1. To rectify the new theory paper entitled "Advanced Mathematics" instead of the theory paper "Stochastic processes and Graph Theory" for M.Phil., Students from 2018-19 onwards.
2. To rectify the revised syllabus of the Non-Major Elective Theory paper entitled "Graph Theory" for III year B.Sc., physics students as specified in the enclosure.
3. Resolved to follow the content of the remaining papers as it is.

MEMBERS PRESENT

1. Dr. S. CHANDRASEKARAN (University Representative)
2. Dr. C. DURAIRAJAN (Subject Expert)
3. Dr. Ke. SATHAPPAN (Subject Expert)
4. Dr. G. NIRMALA (Alumini)

Dr.S.Chandrasekaran
Associate Professor and Head
PG & Research Department of Mathematics
Research Advisor(9606/Maths/R.A/9.5.12/Bharathidasan)
Khadir Mohideen College,Adirampattinam-614 701

5. Dr. A. SAIVARAJAN (Chairman)		
6. Prof. V. RAJAM	Assistant Professor	
7. Dr. K. ELANGOVAN	Assistant Professor	
8. Dr. P.GOMATHISUNDARI	Assistant Professor	
9. Prof. K. RATHIKA	Assistant Professor	
10. Prof. SUGANTHI MARIYAPPAN	Assistant Professor	
11. Dr. N. RAJESH	Assistant Professor	
12. Prof. K.S.KRISHNA MOHAN	Assistant Professor	
13. Dr. K. MUTHU GURU PAKKIAM	Assistant Professor	
14. Dr. B. MOHAMED HARIF	Assistant Professor	
15. Dr. P. SENTHIL KUMAR	Assistant Professor	
16. Dr. R. THANGAPPAN	Assistant Professor	
17. Dr. S. SHANMUGA PRIYA	Assistant Professor	
18. Dr. S. ANBALAGAN	Assistant Professor	

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
I	S1PMA1	Algebra	6	5	English

Course Objectives:

To provide foundation in groups, rings, fields, linear transformations and to enhance the power of ideas for solving the problems in algebra.

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 – 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.

Text Book

I. N . Herstein, Topics in Algebra,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)

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

UNIT V : Chapter 6 (Sec 6.10 & 6.11)

Reference

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

Course Outcomes:

Upon successful completion of this course, students will be able to discuss Sylow's theorems, direct product of normal group. Discuss polynomial ring, R-module with related theorems and illustrate with some examples. Recognize the concept of extension field and related theorems. Describe Galois Theory and Finite Fields. Solve problems based on different kinds of transformations.

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
I	S1PMA2	Real Analysis	6	5	English

Course Objectives:

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

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

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

UNIT III: Differentiation - The Derivatives of a Real function – 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 - SteiljelsIntegral - 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-Uniform Convergence and Continuity - Uniform Convergence and Integration-Uniform Convergence and Differentiation – Equicontinuous family of functions –The Stone-Weierstrass theorem.

Text Book

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)

References

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

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.

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)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
I	S1PMA3	Programming in C^{++} and Introduction to LATEX	6	5	English

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.,

UNIT I: Beginning with C^{++} - Applications of C^{++} - Simple programs – Structure of C^{++}program – creating the source file – compiling and linking – tokens: Expressions and control structures – Keywords – identifiers – Basic data types – User defined data types – derived data types.

UNIT II: Declaration of variables – reference variable – Operation in C^{++} - Manipulators – Type cast Operator– Expressions and Implicit conversions – Operator overloading Operator precedence – Control structures.

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

UNIT V: Typesetting Mathematics – Basics – Custom commands – More on Mathematics – Typesetting theorems – Theorems typing in Latex – Designer theorems.

Text Books

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 3.1 – 3.7)

UNIT II: Chapter 3 (Sec 3.13 – 3.24)

UNIT III: Chapter 4 (Sec 4.1 – 4.10)

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

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

UNIT V: Tutorial VIII (Section VIII.1-VIII.3) & Tutorial IX (Section IX.1 & IX.2)

Course Outcomes:

Under completion of the course the student will 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

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
I	S1PMAP	Practical in C++ and Latex	6	4	English

Course objectives:

To provide complete knowledge of C language:

Students will be able to develop logics which will help them to create programs, applications in C. The basic programming constructs they can easily switch over to any other language in future. LATEX is used all over the world to scientific documents, books, as well as many other forms publishing ,not only can it create beautifully typeset documents ,but it allows users to very quickly tackle the more complicated parts of typesetting, such as inputting Mathematics, creating tables contents, referencing and creating bibliographies and having a consistent layout across all sections. 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.

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. How to find the nC_r value which returns the factorial of a given number using the function call in the expression?

4. Develop an object oriented program in C++ to create a database of the following items of the derived class: Ward number, Name of the patient, Sex, Age, Bed Number, Nature of the illness and Date of admission. Design a base class 1, base class 2 and virtual class.

5. Write a program in C++ structure keyword to create a primitive simple bank customer object like Pin Number, Account Number, Type of account, Name of the Depositor, Current Balance and Available Balance.

6. 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.

7. 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.

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

9. Use operator overloading write a program in C++ to demonstrate function by students result.

10. Create a Latex document for the given Mathematical Expression.

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

12. Construct a Latex document using sums, integrals and limits.

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.

Question Paper Pattern

Maximum Marks: 60 Examination Duration: 3 Hours

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

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
I	S1PMAEL1A	Graph Theory	6	4	English

Course Objectives:

This course enables the students to: Cover basic concepts in graph theory and a variety of different problems in graph theory, Come across a number of theorems and proofs, Gain the knowledge of various graphs algorithms will also taught along with its analysis

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 - K_5 and $K_{3,3}$ are Nonplanar Graphs-Dual of a Plane graph.

Text Book

A Text Book 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)
UNITV: Chapter 8 (Sec 8.1- 8.4)

References

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.

Course Outcomes:

After the completion of this course students will be able to: Have a strong back ground of graph theory, Solve problems of graph theory, Identify the real life problems of graph theory. Understand the concept of planar graph.

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
I	S1PMAEL1B	Optimization Techniques	6	4	English

Course Objectives: In this course, students will be enable to understand several concepts of Operations Research such as, several algorithms in network models, Queuing theory, Non-linear programming algorithms, etc.

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.

Text Book

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)

Text Book:

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

Reference:

Operations Research: An Introduction, Prek Kumar Gupta and D.S. Hira, S. Chand.

Course Outcomes:

At the end of the course students will be able to: Understand several algorithms, such as branch and bound, Gomary's cutting plane algorithms, analyze the ideas of Multistage problems in DPP, understand the ideas of inventory models, comprehend several Queuing system models, namely single server models and multi server models, comprehend several non-linear programming algorithms such as, separable programming algorithm, quadratic programming algorithm, geometric programming algorithm.

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
I	S1PMAEL1C	Random Process	6	4	English

Course objectives:

To get the knowledge about random process and its applications.

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.

Text Book

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)

Course outcomes:

Upon completion of this course students will be able to: understand basic ideas of discrete and continuous distributions with related properties like mean and variance discuss the joint probability distributions and illustrate with simple examples, classify random process with different types, apply the random process in various systems.

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
II	S2PMA4	Probability Theory	6	5	English

Course Objectives:

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

Unit I: Basic Principle of Continue – Permutations – Combinations – Multinomial Coefficients – Distribution of Balls in Urns – 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 – distribution functions – Bernoulli, Binomial and Poisson random variables - Discrete probability distributions: Geometric Negative Binomial and Hyper Geometric random variables –Zeta distribution.

Unit III: Continuous random variables – the Uniform and normal random variables – exponential random variables – continuous distributions: the distribution of a function of a random variable - Joint distribution functions - Independent random variables – Their sums – Conditional distributions – discrete case and Continuous Case -order statistics - Joint probability distribution functions of a random variables.

Unit IV: Expectation – Function of a random variable - sums of random variables - variance - covariance – conditional expectation and prediction. – Moment Generating Functions – General Definition of Expectation.

Unit V: Limit theorems - Chebyshev's inequality - weak law of large numbers – central limit theorems – the strong law of large numbers – other inequalities - Additional Topics in Probability - The Poisson Process – Markov Chains.

Text Book

Sheldon Ross, A first course in Probability, Maxwell MacMillan International edition, Third edition, New York (1989).

UNIT I: Chapters 1 and 2 (full) UNIT II: Chapter 3 and 4 (full)
UNIT III: Chapter 5 and 6 (full) UNIT IV: Chapter 7 (full) UNIT V: Chapter 8 (full)

Reference

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

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.

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
II	S2PMA5	Differential Equations	6	5	English

Course objectives :

This course is intended to expose you to the basic ideas of Differential Equations combined with some ideas from Linear Algebra. To be successful, a student must be able understand all of the concepts relating to the order and linearity of ODEs, regular singular points, integral surfaces passing through a given curve, compatibility system of first orders PDEs etc.

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.

Text Book

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)

Reference:

E.A. Coddington, An introduction to ordinary differential equations, Englewood Cliffs, EUA, Prentice-Hall 1961.

Course outcomes: After completion of the course, the students will be able to: Find the general solution of homogeneous equation, solving PDEs using various methods and also PDEs with variable coefficient.

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
II	S2PMA6	Topology	6	4	English

Course objective:
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.

UNIT I: Topological Spaces : Definition – Examples – Basis for a topology – The Order topology – The Product topology – The Order topology – The Product topology on $X \times Y$ – the Subspace topology – Closed sets and limit points.

UNIT II: Continuous functions-the Product topology-Definition – the metric topology – complete metric spaces.

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

UNIT IV: Countability and Separation axioms: The countability axioms – 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.

Text Book:

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)
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)

References:

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).

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 of connected spaces, components and Local connectedness, the concepts of compactness and limit point compactness, the Countability axioms, the Separation axioms and Normal spaces, the classical theorems such as, the Uryshon lemma, the Tietze Extension theorem.

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)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
II	S2PMA7	Complex Analysis	6	4	English

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 use Argument Principle, 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.

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 .

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.

Text Book:

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)

Reference:

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

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.

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)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
II	S2PMAEL2A	Advanced Numerical Analysis	6	4	English

Course Objectives: In this course, students will be enable to obtain numerical solutions to problems, such as, finding roots of polynomials, solving ODE's, system of equations by different methods.

UNIT I: Iteration methods based on a second degree Equations - Muller method – Chebyshev method – Polynomial Equations - Birge-Vieta method – Bairstow method – Graffe's root Squaring method .

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

UNIT III: Interpolation and Approximation - Hermite interpolation – Piecewise and Spline interpolation . Bivariate interpolation – Lagrange Bivariate interpolation – Newton's bivariate interpolation for equispaced points Least squares approximation - Gram-Schmidt Orthoganalization process.

UNIT IV: Numerical Differentiation - Method based on interpolation – Methods based on finite differences - Length – 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.

Text Book:

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

UNIT I: Chapter 2 (Sec 2.4 - 2.9) UNIT II: Chapter 3 (Sec 3.2 – 3.5 & 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)

Reference:

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

Course Outcomes: At the end of the course students will be able to: Obtain the roots of Polynomial Equations. Solve system of equations by Direct methods and Iteration methods. Apply Hermite Interpolation, Piecewise and Spline interpolation to solve problems. Obtain numerical solutions to integration problems. Obtain numerical solutions to ODE's.

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
II	S2PMAEL2B	Fuzzy Algebra	6	4	English

Course Objectives:

To study the uncertainty environment, the fuzzy sets incorporates imprecision and subjectivity into the model formulation and solution process.

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-ω_i Compositions of Fuzzy Relations.

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

Text Books

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)

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)

Course Outcomes: Apply domain knowledge from classical sets to fuzzy sets with illustrations, Describe the fuzzy arithmetic, Linguistic variables and examine Fuzzy equations, Determine fuzzy logic and fuzzy propositions, Examine fuzzy Decision making problem and Fuzzy Linear programming problem, Classify fuzzy relations and properties of fuzzy relations.

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
II	S2PMAEL2C	MATLAB	6	4	English

Course Objectives: To develop the practical skills to solve Mathematical problems using MATLAB.

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.

Text Book:

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

References:

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

Course Objectives: 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.

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
III	S3PMA8	Classical Dynamics	6	5	English

Course Objectives: To study mechanical systems under generalized coordinate systems, virtual work, energy and momentum, to study mechanics developed by Newton, Lagrange and Hamilton Jacobi concepts.

UNIT I: Introductory Concepts – Generalized Co-ordinates – Constraints – Virtual Work – Energy and Momentum.

UNIT II: Lagrange's equations – Derivation of Lagrange's Equation – Integral of Motion.

UNITIII: Small application of Lagrange's equation – Rayleigh's dissipation function- Impulsive Motion – Gyroscopic System – Velocity Dependable Potential.

UNIT IV: Hamilton's Equations - Hamilton's principle - Hamilton's equations- Other Variational Principles.

UNIT V: Hamilton - Jacoby theory- Hamilton's principle function - The Hamilton Jacobi equation - Separability.

Text Book:

Donald T. Greenwood, Scope and Treatment as in Classical Dynamics, PHI Pvt. Ltd.,New Delhi, 1985.

UNIT I: Chapter I (Sec 1.2 -1.5) UNIT II: Chapter II (Sec 2.1 -2.3)
UNIT III: Chapter III (Sec 3.1 - 3.4) UNIT IV: Chapter IV (Sec 4.1 - 4.3)
UNIT V: Chapter V (Sec 5.1 -5.3)

Reference:

H. Goldstein, Classical Mechanics (2nd edition), Narosa Publishing House, NewDelhi.

Course Outcomes: Discuss the basic concepts of Mechanical System, Derivation of Lagrange's Equation for holonomic and non holonomic system and solve simple problems, Analyze the applications of Impulsive Motion, Examine the concept of Hamilton's principle and other variational principles, Express the ideas of separability using Stackle's Theorem and solving problems.

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
III	S3PMA9	Measure Theory and Integration	6	5	English

Course Objectives:

To treat the theory of functions of real variable form a classical point of view, to develop the student abilities through hard working.

UNIT I: Measure on the Real Line: Lebesque outer measure – Measurable sets – Regularity**.**

UNIT II: Measurable functions, Borel and Lebesque Measurabily – Integration of Functions of a Real Variable: Integration of non-negative functions.

UNIT III: Integration of Functions of a Real Variable: The General Integral – Integration of Series – Riemann and Lebesgue Integrals.

UNIT IV: Abstract measure spaces : Measures and outer measure – Extension of Measure- Uniqueness of the Extension- Completion of a measure.

UNIT V: Inequalities and the L^PSpaces: The L^P spaces – Convex Functions – Jensen's Inequality – The inequalities of Holder and Minkowski.

Text Book:

G. De Barra, Measure Theory and Integration, Addition- Wesley publishing company (1971).

UNIT I: Chapter 2 (Sec 2.1 - 2.3)
UNIT II: Chapter 2 (Sec 2.4 & 2.5), Chapter 3 (Sec. 3.1)
UNIT III: Chapter 3 (Sec 3.2 - 3.4)
UNIT IV:Chapter 5 (Sec 5.1 - 5.4)
UNIT V: Chapter 6 (Sec 6.1 - 6.4)

Reference:

I. K. Rana, An Introduction to Measure and Integration, Narosa Publishing House,Delhi, 1997.

Course Outcomes: After completion of the course students will be able to: Introduce the concept of concept of measure of a point set, the motion of Lebesgue integral, apply the basic properties of measurable functions, the various inequalities in measurable spaces.

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)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
III	S3PMA10	Functional Analysis	6	5	English

Course Objectives: To introduce students to the ideas and some of the fundamental theorem of functional analysis. To show students the use of abstract algeberic/topological structures in studying spaces of functions. To give students a working knowledge of the basic properties of Banach spaces, Hilbert spaces and bounded linear operators.

UNIT I: Banach spaces: Definition and examples - Continuous linear transformation – The Hahn – Banach theorem – Natural imbedding of N in N** - Open mapping theorem - The conjugate of an operator.

UNIT II: Hilbert spaces: Definition and some simple properties – Orthogonal complements – orthonormal sets – Conjugate space H* .

UNIT III: Conjugate of an operator – Adjoint of an operator – Self adjoint of an operator – Normal and unitary operator, the structure of commutative banach algebras – Gelfand mapping - Applications of the formula $r(x) = lim\|x^n\|^{\frac{1}{n}}$ – Involutions in banach algebras – Gelfand – Neumark theorem.

UNIT IV: Projections – Tinite dimensional spectral theory matrices- Determinants and the spectrum of an operator – Spectrum theorem.

UNIT V: General preliminaries on Banach algebras definition and some examples – Regular and singular elements – Topological divisors of zero – The spectrum – Formula for spectral radius – Radical and semi simplicity.

Text Book:

G. F. Simmons, Introduction to Topology and Modern Analysis, McGraw Hill International Edition, New Delhi.

UNIT I: Chapter 9 (Sec 46 - 51) UNIT II: Chapter 10 (Sec 52 - 55)

UNIT III: Chapter 10 (Sec 56 - 58) & Chapter 13 (Sec 70 - 73)

UNIT IV: Chapter 11 (Sec 59 - 62) UNIT V: Chapter 12 (Sec 64 - 69)

Reference :

B.V. Limaye, Functional Analysis, New Age International (p) Ltd, 2nd Edition.

Course Outcomes: On successful completion of this course students will be able to, Appreciate how functional analysis uses and unifies ideas from vector spaces, the theory of metrics and complex analysis. Understand and apply fundamental theorems from the theory of normed and Banach spaces, including the Hahn Banach theorem, the open mapping theorem , the closed graphed theorem and the stone-water stress theorem.

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
III	S3PMA11	Stochastic Processes	6	4	English

Course Objectives: This course enables the students to get the detailed idea about, Stochastic process and their classifications, Markov chain and its applications, Poisson process, its postulates and applications; also renewal and diffusion process, Brownian motion

UNIT I: Stochastic processes: Some notions – Introduction - Specification of stochastic processes – Stationary processes – Mortingales – Difference equation: Differentiable-Difference equations. Markov chain -Definition and examples – High transition probabilities.

UNIT II: Generalization of independent Bernoulli trails: sequence of chain dependent trails – Classification of states and chain: Determination of higher transition probabilities – Stability of Markov system – Graph theoretic approach – Markov chain with denumerable number of states.

UNIT III: Markov processes with discrete state space: Poisson process and its extensions: Poisson process – Poisson process and related distributions – Generalizations of Poisson process – Birth and death process.

UNIT IV: Markov processes with discrete state space (continuous time Markov chains) - Randomization Derived Markov chain – Erlang process. Markov process with continuous state space: Introduction: Brounian motion – Wiener process – Differential equations for a wiener process – Kolmogorov equation.

UNIT V: Stochastic Processes in Queueing system: General concepts – The queuing model M/M/1: Steady state behavior. Transient behavior of M/M/1 model – Birth and death processes - The model M/M/S.

Text Book:

J.Medhi, Scope and Treatment as in Stochastic Processes, Wiley Eastern Limited (Second edition)

UNIT I: Chapter 2 (Sec 2.1-2.4), Appendix A (A.2, A.2.1-A.2.4, A.3) & Chapter 3 (Sec 3.1,3.2)
UNIT II: Chapter 3 (Sec 3.3 - 3.8) UNIT III: Chapter 4 (Sec 4.1 - 4.4)
UNIT IV: Chapter 4 (Sec 4.5 - 4.7) & Chapter5 (Sec 5.1 - 5.4)
UNIT V: Chapter 10 (Sec 10.1 - 10.3, 10.4 (only 10.4.1, 10.4.2, 10.4.2.1))

References

1. S. Kqrlin and M. Taylor, A First course in Stochastic Process, Second Edition, Academic Press, Newyork (1975).
2. U,N. Bhrt, Elements of Applied Stochastic processes, 2nd edition, Wiley, New York (1968).

Course outcomes: After completion of the course, the learners will be able to: Classify a stochastic process given a real life situation. Apply Markov chain in real life problems. Apply Poisson other appropriate stochastic process in real life problems. Apply queuing theory concept in real life problems.

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
III	S3PMAEL3A	Cryptography	6	4	English

Course Objectives:

The primary goal of cryptography is to keep the plaintext secret from eaves-droppers trying to get some information about the plaintext adversaries may also be active and try to modify the message.It is expected to guarantee the integrity of messages. Given some encrypted data(ciphertext) the goal of he cryptoanalysts is to gain as much information as possible about the original uncrypted data(plaintext).Four objectives of cryptography are confidentiality, Data Integrity, Authentication and Irrerocability.

UNIT I : Cryptography - Some Simple Cryptosystems – Enciphering Matrices.

UNIT II : Public Key - The Idea of Public Key Cryptography – RSA - Discrete Log.

UNIT III: Primality And Factoring - Pseudoprimes – The rho Method – Fermat factorization and factor bases.

UNIT IV: Primality And Factoring- The Continued Fraction Method – The Quadratic Sieve Method.

UNIT V: Elliptic Curves- Basic facts – Elliptic Curve Cryptosystems – Elliptic curve Primality Test.

Text Book

Neal Koblitz, A Course in Number Theory and Cryptography, Springer, Second Edition.

UNIT I: Chapter 3 (Sec 3.1, 3.2) UNIT II: Chapter 4 (Sec 4.1 – 4.3)

UNIT III: Chapter 5 (Sec 5.1 – 5.3) UNIT IV: Chapter 5 (Sec 5.4, 5.5)

UNIT V: Chapter 6 (Sec 6.1 - 6.3)

Reference

H.C.A. Van Tilborg, An Introduction to Cryptography, Kluwer Academic Publishers, Boston/ Dordrecht/Lancaster, 1988.

Course Outcomes:

Students undergoing this course are expected to "Learn fundamentals of cryptography and its application to network security. Understand vulnerability analysis of network security. Acquire background on hash functions, authentication, firewalls intrusion detection techniques.

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
III	S3PMAEL3B	Probability and Queuing Theory	6	4	English

Course Objectives: To get the knowledge about Probability and queuing theory to acquire the knowledge of problem solving ability.

UNIT I: Random Variables: One Dimensional Random Variables – Distribution function of a Random Variable – Properties of Distribution Function – Discrete and Continuous Random Variable – Two Dimensional Random Variable – Functions of one Random Variables – One function of Two Random Variables.

UNIT II: Some Special Distibutions: Binomial Distribution – Poisson Distribution – Geometric Distributions – Exponential Distribution – Weibul Distribution – Normal Distribution.

UNIT III: Random Processes: Random Process – Bernoulli Process – Poisson Random Process – Pure Birth Process – Renewal Process – Ergodic Process.

UNIT IV: Queuing Throry: Introduction – Basic Characterestics – Inter-Arrival – Service Distribution – Representation of Queuing Models – Markovin Queue.

UNIT V: Characteristics of Infinite Capacity, Multiple Server Poisson Queue – Multiple Server, Limited Queue Model – M/G/1 Queuing System.

Text Book:

B. Praba, P.S. Arunachalam and Sujatha, Statistics, Random Processes and Queuing Theory, 2nd Edition, SciTech Publications(INDIA) Pvt. Ltd.

UNIT I: Chapter 3 (Sec 3.1-3.8)
UNIT II: Chapter 4 (Sec 4.1& 4.2, 4.5, 4.7, 4.9 & 4.10)
UNIT III: Chapter 6 (Sec 6.1-6.6)
UNIT IV: Chapter 10 (Sec 10.1-10.5)
UNIT V: Chapter 10 (Sec 10.6- 10.8)

Reference:

Robertazzi, "Computer Networks and Systems: Queuing theory and performance evaluation", Springer, 3rd Edition, 2006.

Course Outcomes: Upon completion of this course students will be able to understand Basic ideas of discrete and continuous distributions with related properties like mean and variance. Discuss the queueing models and illustrate with simple examples. Classify queueing models with different types.

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
III	S3PMAEL3C	Linear Algebra	6	4	English

Course Objectives: To understand the various aspects of Linear Algebra and to train in problem-solving skill.

UNIT I: Systems of linear Equations – Matrices and Elementary Row operations – Row-Reduced echelon Matrices – Matrix Multiplication – Invertible Matrices – Vector spaces – Subspaces – Bases and Dimension – Computations concerning Subspaces

UNIT II: Linear transformations - Algebra of linear transformations – Isomorphism of Vector Spaces – Representations of Linear Transformations by Matrices - Linear Functionals - Double Dual – Transpose of a Linear Transformation.

UNIT III: Polynomials - Algebra of polynomials – Lagrange Interpolation – Polynomial Ideals – Prime factorization of a polynomial – Determinant functions – Permutations and uniqueness of determinants – Classical Adjoint of a (Square) matrix – Inverse of an invertible matrix using determinants.

UNIT IV: Characteristic values – Annihilating polynomials – Invariant subspaces - Simultaneous triangulation and simultaneous Diagonalization.

UNIT V: Direct - Sum Decompositions – Invariant Direct sums – Primary Decomposition theorem.

Text Book

Kenneth Hoffman, Ray Alden Kunze, Linear Algebra, Prentice Hall of India Private Limited, New Delhi, Second Edition (2010).

UNIT I: Chapter I (Sec 1.2 - 1.4), Chapter II (Sec 2.1 – 2.3)
UNIT II: Chapter III (Sec 3.1 - 3.7)
UNIT III: Chapter IV (Sec4.2 - 4.5), Chapter V (Sec5.2 - 5.4)
UNIT IV: Chapter VI (Sec 6.1 - 6.5)
UNIT V: Chapter VI (Sec 6.6 - 6.8)

References

1. I. N. Herstein, Topics in Algebra, John Wiley & Sons Pvt. Ltd., Second Edition (2000).
2. S. Kumaresan, Linear Algebra: A Geometric Approach, Prentice Hall of India Ltd. (2004).

Course Outcomes: Recognize the concept of vector spaces. Describe some of the canonical forms of linear transformations such as triangular and nilpotent transformations. Discuss about triangular and diagonalization of the linear transformation. Solve problems based on different kinds of decomposition.

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
IV	S4PMA12	Differential Geometry	6	5	English

Course Objectives: To present the fundamental concepts of curves and surfaces

UNIT I: Definitions of a Space Curves – Arc length – tangent normal and bi-normal-curvature and torsion – contact between Curves and surfaces.

UNIT II: Tangent surface, Involutes and Evolutes – Intrinsic equations – Fundamental existence theorem for Space Curves, Definition of surface - Curves on surface – Surfaces of Revolution.

UNIT III: Helicoids – Metric-Direction Coefficients – Families of Curves – Isometric Correspondences – Intrinsic Properties.

UNIT IV: Geodesic- Canonical Geodesic equations- Normal Properties of Geodesic – Existence Theorems – Geodesic parallels – Geodesic Curvature – Gauss – Bonnet Theorem – Gaussian Curvature – Surfaces of a constant curvature.

UNIT V: Second Fundamental Form – Principal Curvature – Developable- Developable associated with space curves- Developable associated with curves on surfaces- minimal surfaces – Ruled surfaces.

Text Book

T.J. Willmore, Scope and treatment as in An Introduction to Differential Geometry, Oxford University Press, New Delhi.

UNIT I: Chapter 1 (Sec 1 - 6) UNIT II: Chapter 1 (Sec 7 - 9) & Chapter 2 (Sec 1 - 3)
UNIT III: Chapter 2 (Sec 4 - 9) UNIT IV: Chapter 2 (Sec 10 - 18)
UNIT V: Chapter 3 (Sec 1- 9)

Reference

J.A. Thorpe, Elementary Topics in Differential Geometry, Springer (India), 2004.

Course Outcomes: Analytical representation of tangent, normal and binomial. Discuss the first fundamental form and developable surfaces. Understand the intrinsic properties of the surfaces and second fundamental form.

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
IV	S4PMA13	Number Theory	6	5	English

Course Objectives: This course mainly focus on studying the important knowledge in the basic concepts of number theory, fundamental definitions s and theorems.

Unit I: Introduction, Divisibility, Primes.

Unit II: Congruences: Solutions of congruences - Congruences of Degree 1 - The functions φ(n) - congruences of higher degree - Prime power moduli - Prime modulus.

Unit III: Congruences degree 2 - Prime modulus - Power Residues - Number theory from an algebraic view point - Multiplicative groups - Rings and fields - Quadratic residues.

Unit IV: Quadratic reciprocity – The Jacobi Symbol – Greatest integer function.

Unit V: Arithmetic functions – The Moebius Inversion formula – The multiplication of arithmetic functions – Recurrence functions.

Text Book:

Ivan Nivan and Herberts Zucherman, An Introduction to Theory of Numbers.

UNIT I: Chapter I (Sec 1.1-1.3)

UNIT II: Chapter II (Sec 2.1-2.7)

UNIT III: Chapter II (Sec 2.8-2.11), Chapter III (Sec 3.1)

UNIT IV: Chapter III (Sec 3.2 & 3.3), Chapter IV (Sec 4.1)

UNIT V: Chapter IV (Sec 4.2 - 4.5)

References:

1. T.M. Apostol, Introduction to Analytic Number Theory, Springer Verlag,1976.
2. Kennath and Rosan, Elementary Number Theory and its Applications, Addison Wesley Pulishing Company,1968.
3. George E. Andrews, Number Theory, Hindustan Publishing, New Delhi, 1989.

Course Outcomes: On the successful completion of this course, students will be able to: Understand the concept of divisibility and primes, Solve congruence's, Describe quadratic reciprocity, arithmetic functions and recurrence functions.

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)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
IV	S4PMAEL4A	Discrete Mathematics	6	4	English

Course Objectives: The goal of this course is to introduce students to ideal and techniques from discrete mathematics that are widely used in mathematics. This course teaches the students techniques in how to think logically and mathematically and apply these techniques in solving problems. To achieve this goal, students will learn logic and proof, sets functions, as well as definition and examples of partial order mathematical reasoning.

UNIT I: Computability and Formal Languages - Introduction – Russell's paradox and Non-computability - Ordered Sets – Languages – Phrase Structure Grammars - Types of Grammars and Languages.

UNIT II: Finite State Machines - Introduction – Finite State Machines – Finite State Machine as Models of Physical Systems – Equivalent Machines – Finite State Machines as Languages Recognizers – Finite State Languages and Type-3 Languages.

UNIT III: Boolean Algebras - Lattices and Algebraic Systems – Principle of Duality – Basic Properties of Algebraic Systems Defined by Lattices – Distributive and Complemented Lattices – Boolean Lattices and Boolean Algebras – Uniqueness of Finite Boolean Algebras – Boolean Functions and Boolean Expressions.

UNIT IV: Discrete Numeric Functions and Generating Functions - Introduction – Manipulation of Numeric Functions – Asymptotic Behavior of Numeric Functions – Generating Functions – Combinatorial Problems

UNIT V: Recurrence Relations and Recursive Algorithms - Introduction - Recurrence Relations – Linear Recurrence relations with constant coefficients – Homogeneous Solutions – Particular Solutions – Total solutions – Solution by the Method of Generating Functions.

Text Book:

C.L.Liu,Elements Of Discrete Mathematics, Tata McGrawHill Publishing company Limited, New Delhi, Second Edition.

UNIT I: Chapter 2 (Sec 2.1 – 2.6) UNIT II: Chapter 7 (Sec 7.1 – 7.6)

UNIT III: Chapter 12 (Sec 12.1 – 12.7) UNIT IV: Chapter 9 (Sec 9.1 – 9.5)

UNIT V: Chapter 10 (Sec 10.1 – 10.7)

Reference:

L.R. Vermani and Shalini, A course in discrete Mathematical structures, ImperialCollege Press London (2011).

Course Outcomes: Upon completion of this course, students will be able to: Have

knowledge of the concepts needed to test the logic of a program. Have an understand in identifying structures on many levels. Use logical notation to define and reason mathematically about the fundamental data types and structures. Learn the concept of Boolean Algebras and Basic properties.

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)

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
IV	S4PMAEL4B	Fluid Dynamics	6	4	English

Course Objectives: This course focuses on the basic concepts of fluid dynamics and their applications in solving various physical problems.

Unit I: Real fluids and ideal fluids - Velocity of a fluid at a point - Streamlines and pathlines - Steady and unsteady flows. Velocity potential - Vorticity vector -Local and particle rates of change - Equation of continuity - Worked examples - Acceleration of a point of a fluid.

Unit II: Pressure at a point in a fluid at rest - Pressure at a point in a moving fluid - Conditions at a boundary of two inviscid Immissible fluids# - Euler's equations of motion - Bernoulli's equation - Worked examples - Some flows involving axial symmetry - Some special two dimensional flows - Impulsive motion.

Unit III: Some three dimensional flows - Sources, sinks and doublets - Images in a rigid infinite plane - Axis-symmetric flows - Stokes stream function - Some special forms of the stream function for Axis-symmetric irrotational motions.

UNIT IV: Two dimensional flow - Use of cylindrical polar coordinates - Stream function. Complex potential for two-dimensional irrotational - Incompressible flow - Complex velocity potential for standard two-dimensional flows - Uniform stream, line sources and line sinks, line doublets, line vortices - Worked examples.

Unit V: Two dimensional image systems – Milne-Thomson circle theorem - Some applications of the circle theorem - Extension of the circle theorem - Theorem of Blasius - Use of conformal transformation – Some hydro dynamical aspects of conformal transformation - Worked example.

Text Book

F. Chorlton, Textbook of Fluid Dynamics, CBS Publication and Distribution (2004).
UNIT I: Chapter 2 (Sec 2.1 - 2.9) UNIT II: Chapter 3 (Sec 3.1 - 3.6, 3.9 - 3.11)
UNIT III: Chapter 4 (Sec 4.1 - 4.3, 4.5, 4.5.1) UNIT IV: Chapter 5 (Sec 5.1 - 5.6)
UNIT V: Chapter 5 (Sec 5.7 - 5.10.2)

References

1. M.D. Raisinghania, Fluid Dynamics, S. Chand (2008).
2. G.K. Batchelor, An Introduction to Fluid Mechanics, Foundation Books (1984).

Course Outcomes: Upon successful completion of this course, students will be able to: Acquire fundamental knowledge in fluid dynamics, Gain the knowledge of inviscid Immissible fluids, Analyze the stream function of fluids, Analyze the standard two-dimensional flows properties of materials, Understand the concepts of some hydro dynamical aspects of conformal transformation.

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
IV	S4PMAEL4C	Fuzzy Graph Theory	6	4	English

Course Objectives: To understand the concept of fuzzy graphs with related concepts on fuzzy graph.

Unit I: Introduction – Fuzzy sets and fuzzy set operations – Fuzzy relations – Composition of fuzzy relations – Properties of fuzzy relations - Introduction to Fuzzy graph – Operations on fuzzy graphs – Complement of a fuzzy graph – Cartesian product and composition – Union and join.

Unit II : Geodesic, distance, covers and bases – Fuzzy end nodes and fuzzy trees – Medians and fuzzy trees – Triangle and Parallelogram laws.

Unit III : Fuzzy independent set and fuzzy bipartite graph – Fuzzy bipartite part and maximal bipartite part – Maximal fuzzy bipartite part algorithm.

Unit IV : Dominating set– Fuzzy Independent set – Bounds for γ (G) - More adjacency in Fuzzy graph

Unit V: Automorphism of fuzzy graphs – metric in fuzzy graphs – Center of a fuzzy tree - Regular Fuzzy Graphs

Text Book:

A.Nagoor Gani and V.T.Chandrasekaran, A first look at fuzzy Graph Theory, Allied Publishers Pvt.Ltd. Chennai, First Edition (2010).

Unit I Chapter 1 Sections 1.1 to 1.5, Chapter 2 Sections 2.1 to 2.2.3

Unit II Chapter 3 Sections 3.4 to 3.5 Unit III Chapter 4 Sections 4.1 to 4.3

Unit IV Chapter 5 Sections 5.1 to 5.4 Unit V Chapter 6 Sections 6.1 to 6.2

Reference: J.N.Moderson & P.S. Nair Fuzzy graphs and fuzzy hypergraphs. Livro da série: Studies in Fuzziness and Soft Computing, Physica-Verlag, (2000).

Course Outcomes: On successful completion of this course students will be able to discuss the concept of fuzzy graphs and their properties with examples, examine the concept of Geodesic, distance, covers, bases and Triangle, Parallelogram laws, demonstrate the concept of Fuzzy independent set and fuzzy bipartite graph with algorithm, classify the Dominating set and fuzzy independence set, transcribe the idea of Automorphism of fuzzy graphs and metric in fuzzy graphs.

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
IV	S4PMAEL5A	Transforms, Calculus of Variation and Integral Equations	6	4	English

Course Objectives: To understand the concept of Fourier and Z-Transforms, Calculus of variations and Integral equations with related concepts.

UNIT I: FOURIER TRANSFORMS: Introduction – Fourier Integral Theorem – Fourier transform-Alternative Form of Fourier Complex Integral Formula- Relationship between Fourier Transform and Laplace transform-properties of Fourier Transform – Finite Fourier Transform.

UNIT II: Z- TRANSFORMS: Introduction – properties of Z-Transforms- Z-Transforms of some basic functions – Inverse Z-Transforms – Use of Z-Transforms to Solve Finite difference equations.

UNIT III: CALCULUS OF VARIATIONS AND APPLICATION: Introduction – Strong and Weak variations – The variational notation and the first variation – commutative character of the operators –The simplest variational problem - commutative character of the operators of variation and intergration – Eulers equation(only simple problems)- Brachistochrone problem -Sturm liouville problems.

UNIT IV: INTEGRAL EQUATIONS: Introduction – Relation between differential and integral equations- Relation between linear differential and Volterra integral equations- Volterra integral equation of the second kind- The Green's function.

UNIT V: Fredholm equation with separable kernels – Illustrative examples - Fredholm equations with symmetric kernels - Hilbert- Schmidt theory –Solution of non -homogeneous integral equation in terms of the characteristic solutions of the associated homogeneous equation -Hilbert- Schmidt method – Iterative method for solving equations of the second kind –Orthogonal kernals- The Neumann series.

Text Books

1. Engineering Mathematics-III, T.Veerarajan, Second Edition, Tata McGraw Hill Education, Private Ltd., New Delhi.

UNIT I: Chapter 2 (Sec 2.1 - 2.7) **UNIT II:** Chapter 5 (Sec 5.1 - 5.5)

2. Higher Mathematics for Engineering and Science, M K.Venkataraman, Fourth Edition, The National Publishing Company.

UNIT III: Chapter 9 (Sec 1 -7, 9) **UNIT IV :** Chapter 10 (Sec 1 - 5)

UNIT V : Chapter 10 (Sec 6 - 11)

Course Outcomes: On successful completion of this course students will be able to introduce the notations of Fourier and Z- Transforms and to study its properties, discuss the calculus of variations, the linear integral equations and its applications, some of the applications of ordinary differential equations.

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
IV	S4PMAEL5B	Algebraic Topology	6	4	English

Course Objectives: Aim of this course is to gain the knowledge of fundamental groups of curves and surfaces.

UNIT I: Homotopy of Paths – The Fundamental Group – Covering spaces.

UNIT II: The Fundamental group of the circle – Representations and Fixed points- The Fundamental theorem of algebra – The Fundamental group of S^n – Fundamental group of surfaces.

UNIT III: The Jordan separation theorem – Invariance of Domain – Jordan Curve Theorem Imbedding Graphs in Plane – Winding Number of a Simple Closed Curve.

UNIT IV: Direct Sum of Abelian Group – Free Product of Group – Free Group – Seifertvan Kampen Theorem – Fundamental Group of Wedge of Circle – Adjoining a Two-cell.

UNIT V: Fundamental Groups of Surfaces – Homology of Surfaces – Classification Theorem – Constructing Compact Surface – Equivalence of Covering Space – Universal Covering Space – Existence of Covering Space.

Text Book:

James R. Munkres, Topology – A First Course, Prentice-Hall of India Pvt. Ltd., 3rd print.

UNIT I: Chapter 9 (Sec. 51 – 53)
UNIT II: Chapter 9 (Sec. 54 – 56, 59-60)
UNIT III: Chapter 10 (Sec. 61 – 65)
UNIT IV: Chapter 11 (Sec. 67 – 72)
UNIT V: Chapter 12 (Sec. 74,75,77and 78) & Chapter 13 (Sec. 79,80 and 82)

References:

1. William S Massey, A Basic course in Algebraic Topology, Springer, First Edition.
2. James R. Munkres, Elements of Algebraic Topology, Addition – Wesley, Publishing Company – 1984.

Course Outcomes: Upon successful completion of this course students can able to: Understand the basic concepts of Homotopy of Paths, Describe Fundamental group of S^n, Discuss the Jordan separation and curve theorem

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)

Signature of the HOD

Semester	Subject Code	Title of the Paper	Hours / Week	No. of Credits	Medium of Instruction
IV	S4PMAEL5C	Control Theory	6	4	English

Course Objectives: To study observability, controllability, stability and optimal control of linear systems.

UnitI : Observability:Linear Systems – ObservabilityGrammian – Constant coefficient systems –Reconstruction kernel – Nonlinear Systems

Unit II: Controllability:Linear systems – Controllability Grammian – Adjoint systems – Constant coefficientsystems – steering function – Nonlinear systems

Unit III: Stability:Stability – Uniform Stability – Asymptotic Stability of Linear Systems - Linear timevarying systems – Perturbed linear systems – Nonlinear systems

Unit IV: Stabilizability:Stabilization via linear feedback control – Bass method – Controllable subspace –Stabilization with restricted feedback

Unit V: Optimalcontrol:Linear time varying systems with quadratic performance criteria – Matrix Riccati equation – Linear time invariant systems – Nonlinear Systems

Text Book:
Elements of Control Theory by K. Balachandran and J.P.Dauer, Narosa, New Delhi, 1999.

UNIT I Chapter 2
UNIT II Chapter 3 Sections 3.1 - 3.3
UNIT III Chapter 4
UNIT IV Chapter 5
UNIT V Chapter 6

Books for Reference:
1. Linear Differential Equations and Control by R.Conti, Academic Press,London, 1976.
2. Functional Analysis and Modern Applied Mathematics by R.F.CurtainandA.J.Pritchard, Academic Press, New York, 1977.

Course Outcome: Discuss the basic concepts of Observability and illustrate the examples., Explain controllability and nonlinear systems with the examples, Apply the domain knowledge of asymptotic stability of linear systems and perturbed linear systems, Analyze the stabilization via linear feedback control, Solve the matrix Riccati equations.

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)

Signature of the HOD