15MMP101	**ALGEBRA**	**Semester – I** **L T P C** **4 0 0 4**

Course Objectives

This course enables the students to learn

- The fundamental concepts of algebraic ring theory and fields.
- The basic central ideas of Polynomial ring.
- How to test if a polynomial is irreducible Finite Field (Galois Fields).
- How to convert the various matrix forms.
- Develop capabilities with an axiomatic treatment of transformation.
- Develop an understanding of the structure of sets with operations on them.

Course Outcomes (COs)

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

1. Understand the concept and the properties of finite abelian groups.
2. Get pre-doctoral level knowledge in ring theory.
3. Attain good knowledge in field theory.
4. Define and study in details the properties of linear transformations.
5. Analyze the concept of trace and transpose.
6. Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts quadratic forms.

UNIT I

Another counting principle – application of theorems – Cauchy theorem – Sylow's theorem – Direct products – Finite Abelian groups.

UNIT II

Ring Theory- Basic definition- More ideals and quotient rings- Euclidean rings-A Particular Euclidean Rings –Polynomial Rings-Polynomial over the Rational Field.

UNIT III

Fields – Extension Fields-Finite Extension of F – Some basic Definitions and Theorem – Roots of a Polynomial – More about Roots – The elements of Galois theory.

UNIT IV

Linear Transformations-The Algebra Of Linear Transformation – Characteristic Root-Matrices-Canonical Forms –Triangular form-Nilpotent Transformations–Jordan form.

UNIT V

Trace and Transpose – Trace of T-Symmetric Matrix –Determinants–Hermitian Transformation, Unitary Transformation and Normal Transformation – Real quadratic forms.

TEXT BOOK

1. Herstein.I.N.,2010. Topics in Algebra ,Second edition, Willey and sons Pvt Ltd, Singapore.

REFERENCES

1. Artin.M., 2008. Algebra, Prentice-Hall of India, New Delhi.

2.Fraleigh.J.B., 2004. A First Course in Abstract Algebra , Seventh edition , Pearson Education Ltd, Singapore.

3. Kenneth Hoffman., Ray Kunze., 2003. Linear Algebra, Second edition, Prentice Hall of India Pvt Ltd, New Delhi.

4. Vashista.A.R., 2005. Modern Algebra, Krishna Prakashan Media Pvt Ltd, Meerut.

15MMP102	**REAL ANALYSIS**	**Semester – I** **L T P C** **4 0 0 4**

Course Objectives

This course enables the students to learn

- The basic principles of Riemann – Stieltjes Integral.
- Apply mathematical concepts and principles to infinite series.
- How to identify sets with various properties such as convergence.
- Have the knowledge of Lebesgue integral of functions and their properties.
- Understand the importance of undefined terms, definitions, and axioms.
- Use a variety of proof techniques to prove theorems using axioms, definitions, and previous results.

Course Outcomes (COs)

On successful completion of this course, students will be able to

1. Get specific skill in Riemann Stieltjes integral and Lebesgue integral.
2. Attain knowledge in infinite series.
3. Demonstrate an understanding of the uniform convergence and differentiation.
4. Enrich their knowledge of measure theory and extremum problems.
5. Solve given problems at a high level of abstraction based on Implicit function.
6. Describe the fundamental properties of the real numbers that underpin the formal development of real analysis.

UNIT I

The Riemann – Stieltjes Integral:

Introduction – Basic Definitions – Linear Properties – Integration by parts – Change of variable in a Riemann – Stieltjes Integral – Reduction to a Riemann Integral – Step functions as integrators – Reduction of a Riemann – Stieltjes Integral to a finite sum – Monotonically increasing – Additive and linear properties – Riemann condition – Comparison theorems – Integrators of bounded variation – Sufficient condition for Riemann stieltjes integral.

UNIT II

Infinite series and infinite products:

Introduction – Basic definitions – Ratio test and root test – Dirichlet test and Able's test – Rearrangement of series – Riemann's theorem on conditionally convergent series – Sub series - Double sequences – Double series – Multiplication of series – Cesaro summability.

UNIT III

Sequences of functions:

Basic definitions – Uniform convergence and continuity - Uniform convergence of infinite series of functions – Uniform convergence and Riemann – Stieltjes integration – Non uniformly convergent sequence – Uniform convergence and differentiation – Sufficient condition for uniform convergence of a series.

UNIT IV

The Lebesgue integral:
Introduction- The class of Lebesgue – integrable functions on a general interval- Basic properties of the lebesgue integral- Lebesgue integration and sets of measure zero- The Levi monotone convergence theorem- The lebesgue dominated convergence theorem-
Applications of Lebesgue dominated convergence theorem- Lebesgue integrals on unbounded intervals as limit of integrals on bounded intervals- Improper Riemann integrals- Measurable functions.

UNIT V

Implicit functions and extremum problems:
Introduction – Functions with non zero Jacobian determinant – Inverse function theorem – Implicit function theorem – Extrema of real valued functions of one variable and several variables.

TEXT BOOK

1. Rudin. W.,1976 .Principles of mathematical Analysis, Mcgraw hill, Newyork .

REFERENCES

1. Tom .M. Apostol .,2002. Mathematical Analysis, Second edition, Narosa Publishing House,New Delhi.

2. Balli. N.P., 1981. Real Analysis, Laxmi Publication Pvt Ltd, New Delhi.

3. Gupta . S.L ., and N.R. Gupta ., 2003.Principles of Real Analysis, Second edition, Pearson Education Pvt.Ltd,Singapore.

4. Royden .H.L ., 2002. Real Analysis, Third edition, Prentice hall of India,New Delhi.

5. Sterling. K. Berberian ., 2004.A First Course in Real Analysis, Springer Pvt Ltd, New Delhi.

15MMP103	**NUMERICAL ANALYSIS**	**Semester – I** **L T P C** **4 0 0 4**

Course Objectives

This course enables the students to learn

- To develop the working knowledge on different numerical techniques.
- To solve algebraic and transcendental equations.
- Appropriate numerical methods to solve differential equations.
- To provide suitable and effective methods for obtaining approximate representative numerical results of the problems.
- To solve complex mathematical problems using only simple arithmetic operations. The approach involves formulation of mathematical models of physical situations that can be solved with arithmetic operations.
- Provide a basic understanding of the derivation, analysis, and use of these numerical methods, along with a rudimentary understanding of finite precision arithmetic and the conditioning and stability of the various problems and methods.

Course Outcomes (COs)

On successful completion of this course, students will be able to

1. Identify the concept of numerical differentiation and integration.
2. Provide information on methods of iteration.
3. Solve ordinary differential equations by using Euler and modified Euler method.
4. Study in detail the concept of boundary value problems.
5. Attain mastery in the numerical solution of partial differential equations.
6. Apply numerical methods to obtain approximate solutions to mathematical problems.

UNIT I

Solutions of Non Linear Equations: Newton’s method-Convergence of Newton’s method- Bairstow’s method for quadratic factors.
Numerical Differentiation and Integration:
Derivatives from difference tables – Higher order derivatives – divided difference. Trapezoidal rule – Romberg integration – Simpson’s rules.

UNIT II

Solutions of system of Equations: The Elimination method: Gauss Elimination and Gauss Jordan Methods – LU decomposition method.
Methods of Iteration: Gauss Jacobi and Gauss seidal iteration-Relaxation method.

UNIT III

Solutions of Ordinary Differential Equations: One step method: Euler and Modified Euler methods –Rungekutta methods. Multistep methods: Adams Moulton method – Milne’s method

UNIT IV

Boundary Value Problem and Characteristic value problem : The shooting method : The linear shooting method – The shooting method for non-linear systems.
Characteristic value problems –Eigen values of a matrix by Iteration-The power method.

UNIT V

Numerical Solution of Partial Differential Equations: Classification of Partial Differential Equation of the second order – Elliptic Equations. Parabolic equations: Explicit method – The Crank Nicolson difference method. Hyperbolic equations – solving wave equation by Explicit Formula.

TEXT BOOK

1. Gerald C.F., and P.O.Wheatley., 2006. Applied Numerical Analysis, sixth edition, Dorling Kindersley (India) Pvt. Ltd.,, New Delhi.

REFERENCES

1. Jain. M.K., Iyengar. S.R.K.,and R.K .Jain., 2009. Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, New Delhi .

2. Burden R.L., and J.Douglas Faires., 2007. Numerical Analysis, Seventh edition, P.W.S.Kent Publishing Company, Boston.

3. Sastry S.S., 2008. Introductory methods of Numerical Analysis, Fourth edition, Prentice Hall of India, New Delhi.

15MMP111	**NUMERICAL ANALYSIS- PRACTICAL**	**Semester – I** **L T P C** **0 0 4 2**

Course Objectives

This course enables the students to learn

- In-depth understanding of functional, logic, and programming paradigms.
- How to implement several programs in languages other than the one emphasized in the core curriculum.
- This course provides an introduction to the basic concepts and techniques of numerical solution of algebraic equation.
- This course is to provide students with an introduction to the field of numerical analysis.
- Develop and apply the appropriate numerical techniques for your problem, interpret the results, and assess accuracy.
- This module are to make the students familiarize with the ways of solving complicated mathematical problems numerically.

Course Outcomes (COs)

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

1. Know the concepts for problem solving.
2. Acquire new knowledge in computing, including the ability to learn about new ideas and advances, techniques, tools, and languages, and to use them effectively; and to be motivated to engage in life-long learning
3. Comprehend important issues related to the development of computer-based systems in a professional context using a well-defined process.
4. Be familiar with programming with numerical packages.
5. Be aware of the use of numerical methods in modern scientific computing.
6. To develop the mathematical skills of the students in the Euler method.

List of Practical

1. Solution of non-linear equation-Bairstow's method for quadratic factors.
2. Solution of simultaneous equations-Gauss Elimination.
3. Solution of simultaneous equations-Gauss Jordan.
4. Solution of simultaneous equations-Gauss Jacobi.
5. Solution of simultaneous equations-Gauss Seidal.
6. Solution of simultaneous equations-Triangularisation.
7. Numerical integration-Trapezoidal rule.
8. Numerical integration-Simpson's rules.
9. Solution for ordinary differential equation-Euler method.

10. Solution for ordinary differential equation- Runge Kutta Second order.
11. Solution for parabolic equation - Explicit method.
12. Solution for parabolic equation - The Crank Nicolson method.

Semester – I

15MMP104 **ORDINARY DIFFERENTIAL EQUATIONS** **L T P C**
4 0 0 4

Course Objectives

This course enables the students to learn

- The formulation and solutions of second order ordinary differential equations and get exposed to physical problems with applications.
- The concept of solve the system of first order equations.
- Linear homogeneous and non homogeneous equations with constant coefficients.
- Understanding the elementary linear oscillations.
- Understand all of the concepts relating to the order and linearity of ordinary differential equations, analytic and computational solution methods for ordinary differential equations, and the real-world applications of ordinary differential equations.
- Apply your understanding of the concepts, formulas, and problem solving procedures to thoroughly investigate relevant physical models.

Course Outcomes (COs)

On successful completion of this course, students will be able to

1. Model a simple physical system to obtain a first and second order differential equation.
2. Understand the basic notions of linearity, superposition, existence and uniqueness of solution to differential equations and use these concepts in solving linear differential equations.
3. Identify homogeneous equations, homogeneous equations with constant coefficients and exact linear differential equations.
4. Solve higher order and system of differential equations of Successive approximation.
5. Understand the difficulty of solving problems for elementary linear oscillations.
6. Identify, analyze and subsequently solve physical situations whose behavior can be described by ordinary differential equations.

UNIT I

Second order linear equations with ordinary points – Legendre equation and Legendre polynomial – Second order equations with regular singular points – Bessel equation.

UNIT II

System of first order equations – existence and uniqueness theorems – fundamental matrix.

UNIT III

Non homogeneous linear system – linear systems with constant coefficient – Linear systems with periodic coefficients.

UNIT IV

Successive approximation – Picard's theorem – Non uniqueness of solution – continuation and dependence on initial conditions – existence of solution in the large existence and uniqueness of solution in the system.

UNIT V

Fundamental results – Sturms comparison theorem – elementary linear oscillations – comparison theorem of Hille winter – Oscillations of $x'' + a(t)x = 0$ elementary non linear oscillations.

TEXT BOOK

1. Earl A. Coddington, 2002, An introduction to Ordinary differential Equations, Prentice Hall of India Private limited, New Delhi.

REFERENCES

1. Deo.S.G, V.Lakshmikantham, V. Raghavendra, 2003, Text book of Ordinary differential Equations, Second edition, Tata Mc Graw –Hill Publishing Company limited, New Delhi.

2. Rai.B, D.P.Choudhury, H.I.Freedman, 2004, A course of Ordinary differential Equations, Narosa Publishing House, New Delhi.

3. George F. Simmons, Differential Equations with application and historical notes, 1991.Second edition, Mcgraw-Hill.

15MMP105	**PROGRAMMING IN JAVA**	**Semester – I** **L T P C** **4 0 0 4**

Course Objectives

This course enables the students to learn

- An introduction to the object-oriented programming paradigm in Java.
- Covers software design, implementation, and testing using Java. Introduces object-oriented design techniques and problem solving.
- Emphasizes development of secure, well-designed software projects that solve practical real-world problems.
- Why Java is useful for the design of desktop and web applications.
- How to implement object-oriented designs with Java.
- Identify Java language components and how they work together in applications.

Course Outcomes (COs)

On successful completion of this course, students will be able to

1. Expose the students to the best object-oriented programming paradigm, java and strengthen their.
2. Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs.
3. Read and make elementary modifications to collection and Utilities.
4. Know the concept of Input Output Classes.
5. Document a Java program using Javadoc.
6. Use a version control system to track source code in a project.

UNIT I

Introduction to Object Oriented Programming: Object Oriented Paradigm and Concepts-Structured versus Object Oriented Approach. Java Language: Features of Java -Environment-Java Architecture-Java Development Kit-Types of Java Program. Variable Declaration and Arrays: Data Types-Java Tokens –Variable Declaration – Type Casting and Conversion – Arrays, Operators, And Control Statements: Selection Constructs – Iteration Constructs –Jump Statements.

UNIT II

Introduction to classes: Instance variables, Class variables, Instance Methods, Constructors, Class methods, Declaring Objects, Garbage Collection, Method Overloading - Constructor Overloading - This Reference. Inheritance: Super class variables- Method Overriding - final Keyword, Abstract Classes and Interfaces.

UNIT III

Packages and Access Modifiers: Package Declaration – import statement - Access Protection. Strings: Creation – Operation on strings - Character Extraction Methods – Comparison –Searching and Modifying –String Buffer Class. Collection and Utilities: Collection of Objects – Interfaces and Classes –Iterators – List, Set, Map Implementations.

UNIT IV

Input Output Classes: I/O Operations –Hierarchy of Classes – File class – Input Stream, Output Stream, FilterInputStream, FilterOutputStream, Reader and Writer classes – Random Access File class –Stream Tokenizer. Applets: Basics – Life Cycle –Methods –Graphics Class- Color, Font, and Font Metrics Class.

UNIT V

Exception Handling: Fundamentals – Hierarchy of Classes – Types of Exception. Multithreaded Programming: Thread Model – Runnable Interface - Thread Class – Synchronization and Deadlock. AWT Components: AWT Classes – Basic Component and Container Classes – Frame Window in an Applet.

TEXT BOOK

1. ISRD Group. 2007. Introduction to Object Oriented Programming through Java, 1^{st} Edition, Tata McGraw Hill, New Delhi.

REFERENCES

1. Deitel H.M. and P.J.Deitel . 2005. Java, How to Program, 6^{th} Edition, Pearson Education.

2. Herbert Schildt. 2007. Java Complete Reference, 5^{th} Edition, Tata McGraw Hill, New Delhi.

3. Somasundaram Dr.S. 2004. Java Programming, 1^{st} Edition. Techmedia. New Delhi.

WEB SITES
java.sun.com/docs/books/tutorial/
www.en.wikipedia.org/wiki/Java

15MMP112	**PROGRAMMING IN JAVA -PRACTICAL**	**Semester – I** **L T P C** **0 0 4 2**

Course Objectives

This course enables the students to learn

- Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.
- Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and exception handling mechanisms.
- Understand the principles of inheritance, packages and interfaces.
- Understand the concepts and features of object oriented programming.
- learn java's exception handling mechanism, multithreading, packages and interfaces.
- To develop skills in internet programming using applets and swings.

Course Outcomes (COs)

On successful completion of this course, students will be able to

1. Identify classes, objects, members of a class and relationships among them needed for a specific problem.
2. Write Java application programs using OOP principles and proper program structuring.
3. Demonstrate the concepts of polymorphism and inheritance.
4. Write Java programs to implement error handling techniques using exception handling.
5. To understand fundamentals of object-oriented programming in Java which includes defining classes, invoking methods, using class libraries.
6. To create Java application programs using sound OOP practices such as interfaces, APIs and error exception handling.

List of Practical

1. Write a program to find the sum of series $1+x+x^2+x^3+\ldots$
2. Write a program to input a number in command line and find its factorial using recursion.
3. Write a program to find maximum and sum of an array.
4. Define a class for Employee with name and date of appointment. Create employee objects and sort them as per their date of appointment.
5. Write a program to perform string operations.
6. Write a program to accept strings using I/O streams and arrange them in alphabetical order.
7. Write a program to add / insert an element to ArrayList using Java ListIterator.
8. Write a program to create a window and draw cross lines.
9. Write an applet program to draw several shapes and name them.
10. Write a program for multiplication tables by multithreading.

11. Write a program to create an exception for marks out of bounds. If mark is greater than 100 throw an exception.
12. Write an applet program to create menus.
13. Write an applet program to perform operations in list box
14. Write a Java Program to design a registration Form using Applet with all the AWT controls.

15MMP201	**COMPLEX ANALYSIS**	**Semester-II** **L T P C** **5 0 0 5**

Course Objectives

This course enables the students to learn

- To learn the concepts of Oriented circles and level curves.
- Fundamental concepts of complex integration.
- To know the concepts of harmonic function.
- To develop the skill of contour integration to evaluate complicated real integrals via residue calculus.
- The development of the complex variable in boundary behaviour.
- Contour integral using parametrization, fundamental theorem of calculus and Cauchy's integral formula.

Course Outcomes (COs)

On successful completion of this course, students will be able to

1. Explain the role of the Conformal mapping.
2. Evaluate complex contour integrals and some of their consequences.
3. Determine the Taylor series or the Laurent series of an analytic function in a given region
4. Describe the convergence properties of a power series.
5. Know the basic properties of singularities of analytic functions.
6. Demonstrate familiarity with a range of examples of these concepts of conformal mapping.

UNIT I

Conformal mapping-Linear transformations- cross ratio- symmetry- Oriented circles-families of circles-level curves.

UNIT II

Complex integration-rectifiable Arcs- Cauchy's theorem for Rectangle and disc-Cauchy's integral formula-higher derivatives .

UNIT III

Harmonic functions-mean value property-Poisson's formula-Schwarz theorem, Reflection principle-Weierstrass theorem- Taylor series and Laurent series.

UNIT IV

Partial Fractions- Infinite products – Canonical products-The gamma function – Stirling's Formula – Entire functions – Jensen's formula.

UNIT V

Riemann Mapping Theorem – Boundary Behaviour – Use of Reflection Principle – Analytical arcs – Conformal mapping of polygons- The Schwartz - Christoffel formula.

TEXT BOOK

1. Lars V.Ahlfors.,1979. Complex Analysis, Third edition, Mc-Graw Hill Book Company, New Delhi.

REFERENCES

1. Ponnusamy.S, 2005. Foundation of Complex Analysis, Second edition, Narosa publishing house, NewDelhi.
2. Choudhary.B., 2003. The Elements of Complex Analysis ,New Age International Pvt.Ltd , New Delhi.
3. Vasishtha A.R ., 2005. Complex Analysis, Krishna Prakashan Media Pvt. Ltd., Meerut.
4. Walter Rudin., 2012.Real and Complex Analysis ,3rd edition, Mc Graw Hill Book Company, Newyork.

15MMP202	**TOPOLOGY**	**Semester – II** **L T P C** **5 0 0 5**

Course Objectives

This course enables the students to learn

- Topological properties of sets.
- The properties of compact spaces and connected spaces.
- To explore the foundations of linear subspace.
- The concepts of metric spaces and topological spaces.
- Metric spaces and metrizability of topological spaces; separation axioms.
- Interior, closure and boundary: applications to geographic information systems

Course Outcomes (COs)

On successful completion of this course, students will be able to

1. Know concept of metric spaces.
2. Acquire knowledge about various types of topological spaces and their properties.
3. Know the result of Compactness problems and theorems.
4. Admire the deep mathematical results like Urysohn's lemma.
5. Create examples and counterexamples in the fundamental concepts of separation space.
6. Formulate and analyze topological problems in connected space.

UNIT I

Metric spaces: Definitions and some examples. Open sets - Theorems – Closed sets- Theorems – convergence- Cantor's Intersection Theorems – completeness - Baire's theorem. continuous mappings- Some Theorems.

UNIT II

Spaces of continuous functions: Basic definition for linear subspace- normed linear space- Banach space- Euclidean and unitary spaces.
Topological spaces and continuous functions: Topological spaces: Definitions and examples – Theorems – Open bases and Open sub base.

UNIT III

Compactness: Compact spaces – Heine- Borel Theorem - Product of spaces – Tychonoff's theorem and locally compact spaces - Tychonoff's Generalized Heine-Borel Theorem – Compactness for metric spaces – Lebesgue 's covering lemma – Ascoli's theorem.

UNIT IV

Separation: T_i spaces and Hausdorff spaces – Theorems – Complete regular spaces and normal spaces – Urysohn's lemma and the Tietze extension theorem – Urysohn imbedding theorem – Stone-Cech compactification.

UNIT V

Connectedness: Connected spaces – Theorems - components of a space - Theorems – Totally disconnected spaces - Theorems – locally connected spaces - Theorems.

TEXT BOOK

1. Simmons.G.F., 2004. Introduction to Topology and Modern Analysis, Tata Mc Graw Hill, New Delhi.

REFERENCES

1. James R.Munkres., 2008. Topology, Second edition, Pearson Prentice Hall, New Delhi.
2. Deshpande.J.V., 1990. Introduction to topology, Tata Mc Graw Hill, New Delhi.
3. James Dugundji., 2002. Topology, Universal Book Stall, New Delhi.
4. Joshi.K.D., 2004. Introduction to General Topology, New Age International Pvt Ltd, New Delhi.

15MMP203	**OPTIMIZATION TECHNIQUES**	**Semester – II** **L T P C** **5 0 0 5**

Course Objectives

This course enables the students to learn

- The basic concepts of integer linear programming.
- How to solve quadratic programming problems, dynamic programming problems and non-linear programming problems.
- Classical optimization techniques and numerical methods of optimization.
- Know the basics of different evolutionary algorithms.
- Explain Integer programming techniques and apply different optimization techniques to solve various models.
- Enumerate the fundamental knowledge of Linear Programming and Dynamic Programming problems.

Course Outcomes (COs)

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

1. Understand the concept of linear programming and integer programming.
2. Develop optimal decision policy skill.
3. Familiarize with real life applications of inventory models.
4. Skill in decision analysis.
5. Mastery in Beale's method and simplex method.
6. Use classical optimization techniques and numerical methods of optimization.

UNIT I

Integer Linear Programming : Types of Integer Linear Programming Problems - Concept of Cutting Plane - Gomory's All Integer Cutting Plane Method - Gomory's mixed Integer Cutting Plane method - Branch and Bound Method. - Zero-One Integer Programming – Real life application in Integer Linear Programming.

UNIT II

Dynamic Programming: Characteristics of Dynamic Programming Problem - Developing Optimal Decision Policy - Dynamic Programming Under Certainty - DP approach to solve LPP.

UNIT III

Probabilistic Inventory Model: Real life application -Continuous review models- Probabilistic Economic order quantity (EOQ) Model. Single-period models – No setup model – setup model. Multi period model.

UNIT IV

Decision Analysis: Real life application - Decision making under certainty- Analytic hierarchy process.. Decisions under Risk- Decision Trees-based expected value criterion, variations of the expected value criterion. Decisions Under Uncertainty Real life application in Decision Analysis

UNIT V

Non-linear Programming Methods: Examples of NLPP - General NLPP - Graphical solution - Quadratic Programming - Wolfe's modified Simplex Methods - Beale's Method.

TEXT BOOK

1. Handy .A. Taha., 2007. Operations Research, Seventh edition, Prentice Hall of India Pvt Ltd, New Delhi .

REFERENCES

1. Kanti swarup., P.K.Gupta., and Manmohan., 2006. Operations Research, Twelfth edition, Sultan Chand & Sons Educational Publishers, New Delhi.
2. Panneerselvam.R ., 2007. Operations Research , Second edition, Prentice Hall of India Private Ltd, New Delhi .
3. Sharma.J.K., 2008. Operations Research Theory and Practice, Third edition ,Macmillan India Ltd.
4. Singiresu.S.Rao., 2006. Engineering Optimization Theory and Practice, Third edition New Age International Pvt.Ltd Publishers, New Delhi.
5. Sivarethina Mohan. R., 2005. Operations Research, First edition, Tata Mc Grawhill Publishing Company Ltd, New Delhi.

15MMP204	**PARTIAL DIFFERENTIAL EQUATIONS**	**Semester – II** **L T P C** **5 0 0 5**

Course Objectives

This course enables the students to learn

- The basic concepts of solution of first order partial differential equation and its applications.
- About initial and boundary value problems for PDEs of first and second order which includes Laplace Equation, Diffusion Equation and Wave Equation.
- Introduce students to how to solve linear Partial Differential with methods.
- Technique of separation of variables to solve PDEs and analyze the behavior of solutions in terms of eigen function expansions.
- Solutions of PDEs are determined by conditions at the boundary of the spatial domain and initial conditions at time zero.
- Basic questions concerning the existence and uniqueness of solutions, and continuous dependence of initial and boundary data.

Course Outcomes (COs)

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

1. Classify linear and Nonlinear first order differential equations with constant coefficients.
2. Solve the linear partial differential equations with constant coefficient equations.
3. Describe the method of separable variables and integral transforms.
4. Solve the elementary Laplace equation with symmetry.
5. Acquire the knowledge of wave equation and vibrating membranes.
6. Enrich their knowledge about diffusion equations with sources.

UNIT I

First Order Partial Differential Equations:
Non linear partial differential equation of first order – Cauchy method of characteristics – Compatible systems of first order equations – Charpit's methods – Special type of first order equations – Jacobi method.

UNIT II

Second Order Partial Differential Equations:
Partial differential equations of second order – The origin of second order equations – Linear partial differential equations with constant coefficient equations with variable coefficients.

UNIT III

Method of separation of variables –The method of integral transforms.

UNIT IV

Laplace Equation:

Elementary solutions of Laplace equations-Families of Equi-potential surfaces-Boundary Value problems-separation of variables-problems with axial symmetry.

UNIT V

Elementary solutions of one dimensional wave equation-Vibrating membranes - Applications of calculus of variations-elementary solutions of diffusion equation-Separation of variables.

TEXT BOOK

1. IAN.N.Sneedon, Elementary Partial differential equations,(1988).Tata Mcgraw Hill Ltd.

REFERENCES

1. Sharma.J.N, Kehar singh, 2001, Partial Differential Equations for Engineering and Scientists, Narosa Publishing House, New Delhi.
2. Geraold.B.Folland, 2001, Introduction to Partial Differential Equations, Prentice Hall of India Private limited, New Delhi.
3. Sankara Rao.K, 2005, Introduction to Partial Differential Equations, Prentice Hall of India Private limited, New Delhi.
4. Veerarajan.T, 2004, Partial Differential Equations and Integral Transforms, Tata Mc Graw - Hill Publishing Company limited, New Delhi.
5. John.F, 1979. Partial Differential equations, Third edition, Narosa publication co, New Delhi.

Semester – II

		L	T	P	C
15MMP205	**MECHANICS**	**4**	**0**	**0**	**4**

Course Objectives

This course enables the students to learn

- How to use Newton's laws of motion to solve advanced problems involving the dynamic motion of classical mechanical systems.
- Applications of differential equations in advanced mathematical problems.
- To solve dynamics problems such as conservation of energy and linear and angular momentum.
- Parameters defining the motion of mechanical systems and their degrees of freedom.
- The components of a force in rectangular or nonrectangular coordinates. ÿ Determine the resultant of a system of forces.
- Complete and correct free-body diagrams and write the appropriate equilibrium equations from the free-body diagram.

Course Outcomes (COs)

On successful completion of this course students will be able to

1. Understand the concept of the D'Alembert's principle.
2. Derive the Lagrange's equation for holomonic and non holomonic constraints.
3. Classify Scleronomic and Rheonomic systems.
4. Solve the problems of Hamilton equations of motion.
5. Study of the canonical transformations.
6. Know the concept of Hamilton Jacobi Theory.

UNIT I

Survey of Elementary principles: Constraints - Generalized coordinates, Holonomic and non-holonomic systems, Scleronomic and Rheonomic systems. D'Alembert's principle and Lagrange's equations – Velocity – dependent potentials and the dissipation function – some applications of the Lagrange formulation.

UNIT II

Variation principles and Lagrange's equations: Hamilton's principle – Some techniques of calculus of variations – Derivation of Lagrange's Equations from Hamilton's principle – Extension of Hamilton's principle to non-holonomic systems – Conservation theorems and symmetry properties.

UNIT III

Hamilton Equations of motion: Legendre Transformations and the Hamilton Equations of motion-canonical equations of Hamilton – Cyclic coordinates and conservation theorems – Routh's procedure - Derivation of Hamilton's equations from a variational principle – The principle of least action.

UNIT IV

Canonical transformations: The equations of canonical transformation – Examples of Canonical transformations – Poission Brackets and other Canonical invariants – integral invariants of Poincare, Lagrange brackets.

UNIT V

Hamilton Jacobi Theory: Hamilton Jacobi equations for Hamilton's principle function – Harmonic oscillator problem - Hamilton Jacobi equation for Hamilton's characteristic function – Separation of variables in the Hamilton-Jacobi equation.

TEXT BOOK

1. H. Goldstein, Classical Mechanics (2nd Edition), Narosa Publishing House, New Delhi.

REFERENCES

1. F. Gantmacher,1975. Lectures in Analytic Mechanics, MIR Publishers, Moscow.

2. I.M. Gelfand and S.V. Fomin, Calculus of Variations, Prentice Hall, New Delhi.

3. S.L. Loney, , 1979. An Elementary Treatise on Statics, Kalyani Publishers, New Delhi.

15MMP206 A	**ADVANCED DISCRETE MATHEMATICS**	**Semester – II** **L T P C** **4 0 0 4**

Course Objectives

This course enables the students to learn

- The concept of algebraic structures, lattices and its special categories which plays an important role in the field of computers.
- The fundamental concepts in graph theory, with a sense of some its modern applications.
- Some fundamental mathematical concepts and terminology.
- Learn some different types of discrete structures.
- Introduce students to the techniques, algorithms, and reasoning processes involved in the study of discrete mathematical structures.
- Introduce students to set theory, inductive reasoning, elementary and advanced counting techniques, equivalence relations, recurrence relations, graphs, and trees.

Course Outcomes (COs)

On successful completion of this course, students will be able to

1. Develop new algebraic structures.
2. Think critically and analytically by modeling problems form social and natural sciences with the help of theory of graphs.
3. Apply discrete mathematics in formal representation of various computing constructs
4. Work effectively in groups on a project that requires an understanding of graph theory.
5. Demonstrate different traversal methods for trees and graphs.
6. Recognize the importance of analytical problem-solving approach.

UNIT I

Algebraic Structures: Introduction- Algebraic Systems : Examples and General Properties : Definition and examples - Some Simple Algebraic Systems and General properties - Homomorphism and isomorphism - congruence relation - Semigroups and Monoids : Definitions and Examples - Homomorphism of Semigroups and Monoids.

UNIT II

Lattices: Lattices as Partially Ordered Sets: Definition and Examples - Principle of duality - Some Properties of Lattices - Lattices as Algebraic Systems – Sublattices - Direct product, and Homomorphism.

UNIT III

Some special Lattices - e.g. Complete, Complemented and Distributive Lattices - Boolean Algebra: Definition and Examples - Subalgebra - Direct product and Homomorphism - join irreducible - atoms and antiatoms.

UNIT IV

Graph Theory: Definition of a graph - applications, Incidence and degree - Isolated and pendant vertices - Null graph, Path and Circuits: Isomorphism - Subgraphs, Walks -Paths and circuits - Connected graphs , disconnected graphs – components - Euler graph.

UNIT V

Trees: Trees and its properties - minimally connected graph - Pendant vertices in a tree - distance and centers in a tree - rooted and binary tree. Levels in binary tree - height of a tree - Spanning trees - rank and nullity.

TEXT BOOKS

1. J .P.Tremblay & R. Manohar, 1997.Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill Book Co.(for unit I,II,III).

2. N. Deo, 2000. Graph Theory with Applications to Engineering and Computer Sciences, Prentice Hall of India. (for unit IV,V)

REFERENCES

1. C. L. Liu, 2000. Elements of Discrete Mathematics, McGraw-Hill Publishing Company Ltd, New Delhi.

2. S. Wiitala, Discrete Mathematics- A Unified Approach, McGraw-Hill Book Co, New Delhi.

3. Seymour Lepschutz, Discrete Mathematics, Schaum Series, McGraw-Hill Publishing Company Ltd, New Delhi.

15MMP206 B	**GRAPH THEORY AND ITS APPLICATIONS**	**Semester – II** **L T P C** **4 0 0 4**

Course Objectives

This course enables the students to learn

- The fundamental concepts in Graph Theory and some of its modern applications.
- The use of these methods in subsequent courses in the design and analysis of algorithms, computability theory, software engineering, and computer systems.
- Apply graph-theoretic terminology and notation.
- Analyze new networks using the main concepts of graph theory.
- Central theorems about trees, matching, connectivity, colouring and planar graphs.
- Describe and apply some basic algorithms for graphs.

Course Outcomes (COs)

On successful completion of this course, students will be able to

1. Understanding the basic concepts of graphs, directed graphs, and weighted graphs and able to present a graph by matrices.
2. Overview of properties of trees and a minimal spanning tree for a given weighted graph.
3. Identify induced subgraphs, cliques, matchings, covers in graphs.
4. Understand Eulerian and Hamiltonian graphs.
5. Know the concept of domination in graphs.
6. Determine whether graphs are Planer and/or non planer.

UNIT-I

Graphs – Introduction – Isomorphism – Sub graphs – Walks, Paths, Circuits – Connectedness – Components – Euler Graphs – Hamiltonian Paths and Circuits – Trees – Properties of trees – Distance and Centers in Tree – Rooted and Binary Trees - Spanning trees – Fundamental Circuits.

UNIT II

Spanning Trees in a Weighted Graph – Cut Sets – Properties of Cut Set – All Cut Sets – Fundamental Circuits and Cut Sets – Connectivity and Separability – Network flows – 1-Isomorphism – 2-Isomorphism – Combinational and Geometric Graphs – Planer Graphs – Different Representation of a Planer Graph.

UNIT III

Incidence matrix – Submatrices – Circuit Matrix – Path Matrix – Adjacency Matrix – Chromatic Number – Chromatic partitioning – Chromatic polynomial - Matching - Covering – Four Color Problem – Directed Graphs – Types of Directed Graphs.

UNIT IV

Graph Colourings - Vertex Colouring - Edge Colouring - Planar Graphs - Map Colouring Problem - Decompositions and Hamilton Cycles - Circuits and Cycles - Labeling Graphs

UNIT V

Domination in graphs: Introduction – Terminology and concepts – Applications – Dominating set and domination number – Independent set and independence number – History of domination in graphs.

TEXT BOOKS

1. Harary F, 1972.Graph Theory, Addison- Wesley publications.(for unit I,II,III).

2. Deo N, 1974. Graph Theory with Applications to Engineering and Computer Science, Prentice Hall Inc. (for unit IV).
3. Arumugam.S,Ramachandran.S,2003.Invitation to graph theory, scitech publications, Chennai. (for unit V).

REFERENCES

1. Jonathan L Gross, Jay Yellen, 1998. Handbook of Graph Theory ,CRC Press LLC.

2. Teresa W. Haynes, Stephen T. Hedetniemi and Peter J. Slater, Fundamentals of Domination in graphs.

3. Diestel.R Springer-Verlag, 1997. Graph Theory.

4. Jensen.TR and Toft.B Wiley-Interscience 1995. Graph Coloring Problems.

5. Fred Buckley and Frank Harary, 1990. Distance in Graphs, Addison - Wesley Publications.

6. C. R. Flouds , 1994. Graph Theory Applications, Narosa Publishing House.

15MMP206 C	THEORY OF ELASTICITY	Semester – II L T P C 4 0 0 4

Course Objectives

This course enables the students to learn

- The theoretical fundamentals of theory of elasticity.
- The ability to use the principles of theory of elasticity in engineering problems.
- To solve advanced solid mechanics problems using classical methods and to characterize materials with elastics constitutive relations.
- To make students understand the principle of strain energy function.
- Be proficient with basic concepts in continuum mechanics of solids, including of strain, internal force, stress and equilibrium in solids.
- Be able to characterize materials with elastic constitutive relations.

Course Outcomes (COs)

On successful completion of this course the student will be able to

1. Know the concept of Tensor Analysis.
2. Analyze solid mechanics problems using classical methods and energy methods.
3. Apply various failure criteria for general stress states at points.
4. Get advanced knowledge about stresses, strains.
5. Understand the theory of elasticity including strain/displacement and Hooke's law relationships.
6. Apply the concept of strain energy function.

UNIT I

Tensor Analysis:

Co-ordinate transformations-contravarient and covariant vectors and tensors-symmetric and anti-symmetric tensors- metric tensor – conjugate tensor-associated tensors –Christoffel's symbols and transformations laws – covariant derivative – permutation symbols and tensors – relative and absolute tensors.

UNIT II

Analysis of strain:

Deformation –Affine transformation – infinitesimal affine deformations – A geometrical interpretation of components of strain – strain quadric of Cauchy – Principal strains and invariants general infinitesimal deformation – examples of strain – saint-Venant's equations of compatibility – finite –deformations.

UNIT III

Analysis of Stress:

Body and surface forces – stress tensor – equations of equilibrium in Cartesian co-ordinates – transformation of co-ordinates –stress quadric of Cauchy principal stresses – invariants of stress tension – maximum normal and shear stresses- Mohr's diagram – examples of stress.

UNIT IV

Equation of elasticity
Generalized Hooke's law- homogeneous isotropic medium – elastic module for isotropic media – simple tension – pure shear – hydrostatic pressure – equilibrium equations for an isotropic elastic solid – Beltrami- Michell compatibility equations.

UNIT V

Dynamical equations of isotropic elastic solid – strain energy function – uniqueness of solution – statement of saint – Senant's principle.

TEXT BOOKS

1. Dipak Chatterjee, 2003. Vector Analysis,Prentice Hall Of India, New Delhi.(for unit-I,II,III)

2. S.P. Timoshenko, J.N. Goodier , Theory of Elasticity.(for unit-IV,V)

REFERENCES

1. P.D.S. Verma, Theory of Elasticity.
2. Murray Rspiegel, , 2010.Vector Analysis, Schaum's series.
3. I.S Sokolnikoff, Mathematical Theory of Elasticity.

15MMP206 D	**MAGNETOHYDRODYNAMICS**	**Semester – II** **L T P C** **4 0 0 4**

Course Objectives

This course enables the students to learn

- To understand fundamentals of magnetohydrodynamics which describes the dynamics of electrically conducting fluids
- To figure out the applications of magnetohydrodynamics to the various science and engineering fields
- Basics of electromagnetic theory and vector calculus.
- Able to understand the concept of flow and Stability.
- The basic properties of electrically-conducting fluids.
- The role of the Lorentz force and its relevance to plasma confinement, dynamo theory and the dynamics of magnetic waves.

Course Outcomes (COs)

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

1. Provide the details of the derivation of ideal and resistive MHD equations.
2. Demonstrate the basic properties of ideal MHD.
3. Describe electromagnetic boundary conditions.
4. Explain MHD waves.
5. Describe the derivation of fluid equations, energy equation.
6. Describe electromagnetic fields in the energy and momentum fluxes.

UNIT I

Review of equation of motions of viscous compressible fluid flow –Introduction of MHD- Electromagnetic field equations-Maxwell’s equations and their Physical significance- Maxwell’s equations in the moving frame of reference-Invariance under Galilean Transformation- Electromagnetic effects and the magnetic Reynolds number-induction equation –Alfven’s Theorem- Physical Significance-Consequence of Alfven’s Theorem-Ferraro’s Law of irritation-The magnetic Energy- the mechanical equations and the mechanical effects-Electromagnetic stresses.

UNIT II

Magneto hydrostatics and steady states-Hydro magnetic equilibrium and forces free magnetic fields- boundary conditions – Boundary conditions in the case of force free magnetic fields-free surface of an isolated fluid mass- Chandrasekhar’s theorem-General solution of force free magnetic field when is constant-some examples of force free fields.

UNIT III

Hydromagnetics of the laboratory- steady laminar motion-Hartmann flow (MHD Poiseuille’s flow)- Domination of viscous forces over magnetic forces and vice versa-physical significance- Important dimensionless of MHD and their physical significance-electromagnetic boundary conditions-tensor electrical conductivity, Hall current and ion slip – simple flow problems with tensor electrical conductivity.

UNIT IV

Magneto hydrodynamic waves- Waves in an infinite fluid of infinite electrical conductivity- Alfven waves in incompressible fluid in viscid fluid of infinite electrical conductivity-Waves of finite amplitude –propagation of velocity and current density with Alfven velocity-MHD waves in incompressible fluid- Alfven wave and two magneto acoustic waves- the limit of zero magnetic Prandtl number significance.

UNIT V

Stability of hydro magnetic systems- theory and applications-methods of investigation-small perturbations and instability-Energy principle-normal mode analysis-simple illustrative examples-the stability of Hartman layer-Squire's theorem-Orr-Summerfield equation-Instability of linear pinch-methods of stabilize- Flute Instability- A general criterion for satiability-Bernstein's method of small oscillations(normal mode analysis) for hydro magnetic stability-jeans criterion for Gravitational stability- Chandrasekhar's generalization for MHD and rotating fluids.

TEXT BOOK

1. Ferraro V.A.C and Plumpton C., 1966. An Introduction to Magneto-Fluid Mechanics., Clarendon press, oxford.

REFERENCES

1. M.R.Crammer and Shi-l pai.,1973. Magneto-Fluid Mechanics for engineers and applied physicists, Scripta publishing company, Washington D.C.
2. P.H.Roberts.,1967. An Introduction to Magneto hydrodynamics., Longmans, Green and Co Ltd., London.
3. G.W.Sutton and A.Sherman.,1965. Engineering Magneto hydrodynamics., McGraw HillBook Co.
4. S.Chandrasekhar.,1961.Hydro dynamic and Hydro dynamic stability Oxford university press.

15MMP206 E FUNDAMENTALS OF ACTUARIAL MATHEMATICS

Semester – II
L T P C
4 0 0 4

Course Objectives

This course enables the students to learn

- The fundamental theories of actuarial science as they apply in life insurance, general insurance and superannuation.
- How to assess the suitability of actuarial, financial and economic models in solving actuarial problems
- Interpretation and critically evaluating the articles in the actuarial research literature.
- About the concept of educational annuity plan.
- Understand the Premium Conversion tables for calculation of Policy values.
- The concept of Premiums for Annuity Plans.

Course Outcomes (COs)

On successful completion of this course the student will be able to

1. Explain the basic concepts of accounts and calculations of interest rates in banking / financial institution system.
2. Define Annuity and Summarize / calculate different values Annuities.
3. Leant about how to read Mortality Table and from that how to calculate the Probability of Survival and Death.
4. Describe about Premiums of Life Insurance and Endowment Assurance (Pure, Double and Marriage) and Educational Annuity plan.
5. Find the Annuity values for various Annuities.
6. Calculation of Net Premiums for Assurance Plans.

UNIT I

Accumulated Value – Present Value – Formula for present value- Annuities Certain- present Values-Amounts - Deferred Annuities –Perpetuities - Present Value of an Immediate Annuity Certain – Accumulated Value of Annuity – Relation between Sn and a_n – Present Value of Deferred Annuity Certain – Accumulated Value of a term of n years – Perpetuity – Present Value of an Immediate Perpetuity of 1p.a. – Present Value of a Perpetuity due of 1 p.a. – Deferred Perpetuity with Deferment Period of m years – Mortality Table – The Probabilities of Survival and Death.

UNIT II

Life Insurance Premiums – General considerations - Assurance Benefits – Pure Endowment Assurance – Endowment Assurance – Temporary Assurance or Term Assurance - Whole Life Assurance – Pure Endowment Assurance – Endowment Assurance – Double Endowment Assurance – Increasing Temporary Assurance – Increasing Whole Life Assurance – Commutation Functions Dx, Cx, Mx and Rx – Expressions for Present Values of Assurance Benefits in terms of Commutation Functions – Fixed Term (Marriage) Endowment – Educational Annuity Plan.

UNIT III

Life Annuities and Temporary Annuities – Commutation Functions Nx – To Find the Present Value of an Annuity Due of Re.1 p.a. for Life – Temporary Immediate Life Annuity – Expression for ax : n – Deferred Temporary Life Annuity – Variable Life Annuity – Increasing Life Annuity – Commutation Function Sx – Increasing Temporary Life Annuity – Tables of Life Annuity and Temporary Life Annuity – Variations in the Present Values of Annuities – Life Annuities Payable at Frequent Intervals.

UNIT IV

Net Premiums for Assurance Plans – Natural Premiums – Level Annual Premium – Symbols for Level Annual Premium under Various Assurance Plans – Mathematical Expressions for level Annual Premium under Level Annual Premium under Various Plans for Sum Assure of Re. 1 – Net Premiums – Consequences of charging level Premium – Consequences of withdrawals – Net Premiums for Annuity Plans – Immediate Annuities – Deferred Annuities.

UNIT V

Premium Conversion tables – Single Premium Conversion tables – Annual Premium Conversion Tables – Policy Values – Two kinds of Policy values – Policy value in symbols – Calculation of Policy Value for Unit Sum Assure – Numerical Example : Retrospective Method and Comparison with Prospective Value – Derivative of Theoretical Expressions for Policy Value, tVx by the Retrospective Method and Prospective Method – Other Expressions for Policy Value – Surrender Values – Paid up Policies – Alteration of Policy Contracts.

TEXT BOOK

1. Mathematical Basis of Life Insurance - Insurance Institute of India.

15OEP201 **COMPUTER BASED NUMERICAL METHODS** **Semester – II**

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Course Objectives

This course enables the students to learn

- Develop the working knowledge on different numerical techniques.
- Solve algebraic and transcendental equations.
- Appropriate numerical methods to solve differential equations.
- About the concept of solving ordinary differential equations.
- Understand the idea about the basics of numerical methods for the analysis of experimental results.
- Develop practical skills in the use of numerical methods, including using software.

Course Outcomes (COs)

On successful completion of this course, students will be able to

1. How to find the concept of newton's method Raphson method.
2. Provide information on methods of iteration.
3. Study in detail the concept of boundary value problems.
4. Identify the concept of numerical differentiation and integration.
5. Attain mastery in the numerical solution of ordinary differential equations.
6. Solve ordinary differential equations by using euler and modified euler method.

UNIT I

Solution of algebraic and transcendental equations: Newton Raphson method- Bairstow method – Illustrations of the methods (case studies).

UNIT II

Solution of simultaneous linear algebraic equations: Gauss elimination method – Gauss Jordan method – Factorization method – Iteration method – Gauss-Jacobi method – Gauss-seidel method. Illustrations of the methods (case studies)

UNIT III

Interpolation: Gregory Newton Forward and Newton Backward interpolation formula –Interpolation with unequal intervals — Lagrange's interpolation formula – Inverse interpolation formula. Illustrations of the methods (case studies)

UNIT IV

Numerical Differentiation and Integration: Newton's Forward and backward differences to compute derivatives – Trapezoidal rule, Simpson's 1/3 &3/8 rule. Illustrations of the methods (case studies)

UNIT-V

Numerical methods for solving ordinary differential equations – Taylor series (I order) – Euler and Modified Euler method – Runge kutta methods (II order, III order and IV order). Illustrations of the methods (case studies)

TEXT BOOK

1. Venkataraman .M.K., Fifth Edition, 2001. Numerical Methods in Science and Engineering, National publishing Company, Madras.

REFERENCES

1. Jain. M.K., Iyengar. S.R.K.,and R.K .Jain., 2004. Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, New Delhi .
2. Sastry .S.S,2009, Engineering mathematics, PHI learning Pvt. Ltd, New Delhi.
3. Balagurusamy.E.,2000, Numerical Methods, Tata McGraw-Hill Education, New Delhi.

15MMP301	**FUNCTIONAL ANALYSIS**	**Semester – III** **L T P C** **4 0 0 4**

Course Objectives

This course enables the students to learn

- The concept of Banach spaces and related theorems
- The specific techniques for bounded operators over normed and Hilbert spaces.
- The demonstrate significant applications of the theory of functional analysis.
- The ideas and some of the fundamental theorems of functional analysis.
- Understand how to use the main properties of compact operators.
- Apply the spectral analysis of compact self-adjoint operators to the resolution of integral equations.

Course Outcomes (COs)

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

1. Develop Banach spaces from vector spaces.
2. Describe the open mapping theorem.
3. Discuss Hilbert spaces and its properties.
4. Study in detail about the adjoint of an operator.
5. Handle complex problems concerning topics within the area of Functional Analysis.
6. Understand and apply fundamental theorems from the theory of normed and Banach spaces.

UNIT I

Banach Spaces- Normed linear space – Definitions and Examples-Theorems. Continuous Linear Transformations – Some theorems- Problems. The Hahn- Banach Theorem –Lemma and Theorems. The Natural imbedding of N in N**-Definitions and Theorems.

UNIT II

The Open Mapping Theorem- Theorem and Examples –Problems. The closed graph theorem. The conjugate of an operation- The uniform boundedness theorem- Problems.

UNIT III

Hilbert Spaces- The Definition and Some Simple Properties – Examples and Problems. Orthogonal Complements - Some theorems .Ortho-normal sets – Definitions and Examples- Bessel's inequality- The conjugate space H*.

UNIT IV

The Adjoint of an operator – Definitions and Some Properties-Problems. Self- adjoint operators – Some Theorems and Problems. Normal and Unitary operators –Theorems and Problems. Projections - Theorems and Problems .

UNIT V

Banach algebras: The definition and some examples of Banach algebra – Regular and singular elements – Topological divisors of zero – The spectrum – The formula for the spectral radius.

TEXT BOOK

1. Balmohan V., and Limaye., 2004. Functional Analysis, New Age International Pvt. Ltd, Chennai.

REFERENCES

1. Simmons. G.F., 1963. Introduction to Topology & Modern Analysis, Tata McGraw-Hill Publishing Company Ltd, New Delhi.

2. Chandrasekhara Rao.K., 2006. Functional Analysis, Narosa Publishing House, Chennai.

3. Choudhary .B,and Sundarsan Nanda., 2003. Functional Analysis with Applications, New Age International Pvt. Ltd, Chennai.

4. Ponnusamy.S., 2002. Foundations of functional analysis, Narosa Publishing House, Chennai.

15MMP302	**FLUID DYNAMICS**	**Semester – III** **L T P C** **4 0 0 4**

Course Objectives

This course enables the students to learn

- The concepts of fluid, its properties and behavior under various conditions of internal and external flows.
- The fundamentals of Fluid Dynamics, which is used in the applications of Aerodynamics, Hydraulics, Marine Engineering, Gas dynamics etc.
- To imbibe basic laws and equations used for analysis of static and dynamic fluids
- About the Two-Dimensional Motion of the fluid.
- Identify the fundamental kinematics of a fluid element.
- State the conservation principles of mass, linear momentum, and energy for fluid flow.

Course Outcomes (COs)

On successful completion of this course, students will be able to

1. Classify and exploit fluids based on the physical properties of a fluid.
2. Compute correctly the kinematical properties of a fluid element.
3. Apply the concept of Bernoulli's theorem in steady motion.
4. Understand both flow physics and mathematical properties of governing Navier-Stokes equations and define proper boundary conditions for solution.
5. Provide the student with the basic mathematical background and tools to model fluid motion.
6. Develop a physical understanding of the important aspects that govern incompressible flow that can be observed in a variety of situations in everyday life.

UNIT I

Introductory Notions – Velocity – Stream Lines and Path Lines – Stream Tubes and Filaments – Fluid Body – Density – Pressure. Differentiation following the Fluid – Equation of continuity – Boundary conditions – Kinematical and physical – Rate of change of linear momentum – Equation of motion of an in viscid fluid.

UNIT II

Euler's momentum Theorem – Conservative forces – Bernoulli's theorem in steady motion – energy equation for in viscid fluid – circulation – Kelvin's theorem – vortex motion – Helmholtz equation.

UNIT III

Two Dimensional Motion – Two Dimensional Functions – Complex Potential – basic singularities – source – sink – Vortex – doublet – Circle theorem. Flow past a circular cylinder with circulation – Blasius Theorem – Lift force. (Magnus effect)

UNIT IV

Viscous flows – Navier-Stokes equations – Vorticity and circulation in a viscous fluid – Steady flow through an arbitrary cylinder under pressure – Staedy Couettc flow between cylinders in relative motion – Steady flow between parallel planes.

UNIT V

Laminar Boundary Layer in incompressible flow: Boundary Layer concept – Boundary Layer equations – Displacement thickness, Momentum thickness – Kinetic energy thickness – integral equation of boundary layer – flow parallel to semi infinite flat plate – Blasius equation and its solution in series.

TEXT BOOKS

1. Milne Thomson .L.M., 1968. Theoretical Hydrodynamics , Fifth edition, Dover Publications INC, NewYork.(for unit I,II)

2. Curle.N., and H.J.Davies, Modern Fluid Dynamics Volume-I , D Van Nostrand Company Ltd., London. (for unit III,IV,V)

REFERENCES

1. Yuan.S.W, 1976. Foundations of Fluid Mechanics, Prentice- Hall ,India.

2. Shanthi swarup,2003,"Fluid dynamics" Krishna prakasan media Pvt Ltd,Meerut.

15MMP303	**INTEGRAL EQUATIONS AND TRANSFORMS**	**Semester – III** **L T P C** **4 0 0 4**

Course Objectives

This course enables the students to learn

- Range of mathematics tools with emphasis on engineering applications.
- To think quantitatively and analyse problems critically.
- How to apply integral equations to the ordinary differential equation.
- Converting the IVPs and BVPs to the corresponding integral equations and Fredholm and Volterra integro-differential equations.
- Equip with the methods of finding Laplace transform and Fourier Transforms of different functions.
- Fundamental concepts of Fourier series, Fourier transforms and Laplace transforms and their applications to differential equations.

Course Outcomes (COs)

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

1. Calculate the Laplace equation in half plane of standard functions both from the definition and by using tables.
2. Equation with seperable kernel and Fredholm alternative approximation Method.
3. Select and combine the necessary Laplace transform techniques to solve second-order ordinary differential equations.
4. Calculate both real and complex forms of the Fourier series.
5. Calculate the Fourier transform of elementary functions from the definition.
6. Calculate the variational problem in parametric form.

UNIT I

Fourier transforms: Fourier Transforms – Definition of Inversion theorem –Fourier cosine transforms - Fourier sine transforms – Fourier transforms of derivatives -Fourier transforms of some simple functions - Fourier transforms of rational function.

UNIT II

The convolution integral – convolution theorem – Parseval‟s relation for Fourier transforms – solution of PDE by Fourier transform – Laplace's Equation in Half plane – Laplace's Equation in an infinite strip - The Linear diffusion equation on a semi-infinite line - The two-dimensional diffusion equation.

UNIT III

Integral equations: Types of Integral equations–Equation with separable kernel- Fredholm Alternative Approximate method – Volterra integral equations–Classical Fredholm theory – Fredholm's First, Second, Third theorems.

UNIT- IV

Application of Integral equation to ordinary differential equation – initial value problems – Boundary value problems – singular integral equations – Abel Integral equation .

UNIT V

Calculus of variations: Variation and its properties – Euler's equation – Functionals of the integral forms - Functional dependent on higher order derivatives – functionals dependent on the functions of several independent variables – variational problems in parametric form.

TEXT BOOKS

1. Sneedon.I.N,1974. The Use of Integral Transforms, Tata Mc Graw Hill, New Delhi. (For Unit –I & II)
2. Kanwal.R.P, 1971. Linear integral Equations Theory and Technique, Academic press, New York. (For Unit –III & IV)

3.Elsgots.L., 1970. Differential Equations and Calculus of Variation, Mir Publication Moscow. (For Unit –V)

REFERENCES

1. Gelfand.I.M and S.V.Francis, 1991. Calculus of Variation, Prentice Hall, India. Tricomi.F.G, 1985. Integral Equations, Dover.

2. Larry C. Andrews and Bhimson K. Shivamoggi,1999. The Integral transforms for Engineers , Spie Press, Washington.

15MMP304	**MATHEMATICAL STATISTICS**	**Semester – III** **L T P C** **4 0 0 4**

Course Objectives

This course enables the students to learn

- To understand the basic concepts in probability generating functions, sample moments and their functions, sampling, significance tests and statistical measures
- Probability distributions, significance of testing hypothesis and its interpretation,
- Estimation, ANOVA and their applications in various disciplines.
- Understand the concept of estimation.
- The knowledge of fixed-sample and large-sample statistical properties of point and interval estimators.
- Understanding of how to design experiments and surveys for efficiency.

Course Outcomes (COs)

After successfully completed this module the students will be able to

1. Explain the concepts of probability, including conditional probability.
2. Explain the concepts of random variable, probability distribution, distribution function, expected value, variance and higher moments, and calculate expected values and probabilities associated with the distributions of random variables.
3. Summarize the main features of a data set and test statistical hypotheses.
4. Define basic discrete and continuous distributions, be able to apply them and simulate them in simple cases.
5. Explain the concepts of analysis of variance and use them to investigate factorial dependence.
6. Describe the main methods of estimation and the main properties of estimators, and apply them.

UNIT I

Probability: Random Events – Preliminary remarks – random events and operations performed on them – the system of axioms of the theory of probability – conditional probability – Bayes theorem – Independent Events –functions of random variables – Multidimensional random variables – Some probability distributions – the binomial distribution – the Poisson distribution - the uniform distribution - the normal distribution.

UNIT II

Sample moments and their functions: Notion of a sample and a statistic - Distribution functions of X, S^2 and (X , S^2) -Chi-square distribution -Student t-distribution -Fisher's Z-distribution -Snedecor's F -distribution -Distribution of sample mean from non-normal populations.

UNIT III

Significance test: Concept of a statistical test -Parametric tests for small samples and large samples Chi-square test -Kolmogorov Theorem-Smirnov Theorem-Tests of Kolmogorov and Smirnov type The Wald-Wolfovitz and Wilcoxon-Mann-Whitney tests -Independence Tests by contingency tables.

UNIT IV

Estimation: Preliminary notion -Consistency estimation -Unbiased estimates -Sufficiency -Efficiency -Asymptotically most efficient estimates -methods of finding estimates -confidence Interval.

UNIT V

Analysis of Variance: One way classification and two-way classification. Hypotheses Testing: Poser functions -OC function-Most Powerful test -Uniformly most powerful test -unbiased test.

TEXT BOOK

1. Marek Fisz, 1980. Probability Theory and Mathematical Statistics, John Wiley and Sons, New York.

REFERENCES

1. Meyer, 1969. Introduction to Probability and Statistical applications, Oxford and IBH Publishing Co.Pvt Ltd. New Delhi.

2. Sheldon M. Ross, 1995. Introduction to probability and statistics for engineers and scientists, Third edition, Academic press.

3. Heinz Bauer, 1995.Probality Theory, Narosa Publishing House, London.

4. Parimal Mukhopadhyay, 1991. Theory of Probability, New central book agency, Calcutta.

15MMP305	**MEASURE THEORY**	**Semester – III** **L T P C** **4 0 0 4**

Course Objectives

This course enables the students to learn

- Perspective on the broader impact of measure theory in ergodic theory.
- To apply the general principles of measure theory and integration.
- About the concept of Measurable spaces.
- To understand the basic concepts Riemann integral and Lebesgue integral.
- Basic knowledge of measure theory needed to understand probability theory, statistics and functional analysis.
- Develop the ideas of Lebesgue integration and its properties.

Course Outcomes (COs)

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

1. Get a clear view of the fundamentals of measure theory.
2. Acquaint with the proofs of the fundamental theorems underlying the theory of Lebesgue integration.
3. Identify the broader impact of measure theory in ergodic theory and ability to pursue further studies in this area.
4. Mastery in the measure spaces and its properties.
5. Apply the theorems of monotone and dominated convergence and Fatou's lemma.
6. Apply Lebesgue decomposition and the Radon-Nikodym theorem.

UNIT I

Lebesgue Measure: Introduction – Outer measure – Measurable sets and Lebesgue Measure – A non measurable set – Measurable set – Measurable functions – Litttlewood’s three principles.

UNIT II

The Lebesgue Integral: The Riemann integral – The Lebesgue integral of a bounded function over a set finite measure – The integral of a non negative function – The general Lebesgue integral – Convergence in measure.

UNIT III

Differentiation of monotone function, Functions of bounded variation-differentiation of an integral-Absolute continuity.

UNIT IV

Measure spaces-Measurable functions-Integration-General convergence Theorems.

UNIT V

Signed measures-The Radon-Nikodym theorem-the L^P spaces.

TEXT BOOK

1. Royden H.L,2004. Real Analysis, Third Edition, Prentice – Hall of India Pvt.Ltd, New Delhi.

REFERENCES

1. Keshwa Prasad Gupta, 2005. Measure Theory, Krishna Prakashan Ltd, Meerut.

2. Donald L. Cohn, 1994. Measure Theory, United States.

3. Paul R. Halmos, 1955. Measure Theory, Princeton University Press Dover Publications.

4. Rudin W, 1986. Real and Complex Analysis, 3 rd Edition, Mcgraw – Hill, New Delhi.

Semester – III

15MMP306 **MATHEMATICAL MODELING** **L T P C**
4 0 0 4

Course Objectives

This course enables the students to learn

- Enrich the fundamental of mathematical modeling skills.
- The construction and analysis of mathematical models inspired by real life problems
- Several modeling techniques and the means to analyze the resulting systems.
- To analyze a model and to apply an appropriate method to calculate a solution in order to predict the behavior of the system.
- Assess and articulate what type of modeling techniques are appropriate for a given physical system.
- Make predictions of the behavior of a given physical system based on the analysis of its mathematical model.

Course Outcomes (COs)

On successful completion of this course the student will be able to

1. Solve problems involving dynamic models, and probabilistic models.
2. Understand the use of modern technology in solving real-world to Epidemic models.
3. Problems through ordinary differential equations, probability theory, graphs.
4. Formulate a mathematical model given a clear statement of the underlying scientific principles.
5. Solve basic linear difference equations and solve application problems.
6. Know the concept of mathematical modeling through Graphs.

UNIT I

Mathematical Modeling through Ordinary Differential Equations of First order: Linear Growth and Decay Models – Non-Linear Growth and Decay Models – Compartment Models – Dynamics problems – Geometrical problems.

UNIT II

Mathematical Modeling through Systems of Ordinary Differential Equations of First Order: Population Dynamics – Epidemics – Compartment Models – Economics – Medicine, Arms Race, Battles and International Trade – Dynamics.

UNIT III

Mathematical Modeling through Ordinary Differential Equations of Second Order: Planetary Motions – Circular Motion and Motion of Satellites – Mathematical Modelling through Linear Differential Equations of Second Order – Miscellaneous Mathematical Models.

UNIT IV

Mathematical Modeling through Difference Equations : Simple Models – Basic Theory of Linear Difference Equations with Constant Coefficients – Economics and Finance – Population Dynamics and Genetics – Probability Theory.

UNIT V

Mathematical Modeling through Graphs: Solutions that can be Modeled through Graphs – Mathematical Modeling in Terms of Directed Graphs, Signed Graphs, Weighted Digraphs and Un oriented Graphs.

TEXT BOOK

1. J.N. Kapur, 1988. Mathematical Modeling, Wiley Eastern Limited, New Delhi,.

REFERENCES

1. J. N. Kapur, 1981. Mathematical Models in Biology and Medicine Affiliated East –West Press Pvt Limited, New Delhi.

2. Brain Albright, 2010. Mathematical Mogeling with Excel,Jones and Bartlett Publishers, New Delhi.

3.Frank.R.Giordano, Maurice. D.Weir, WilliamP. Fox, 2003, A first course in Mathematical Modelling, Vikash Publishing House, UK.

15MMP307A	**THREE DIMENSIONAL ANALYTCAL GEOMETRY**	**Semester – III** **L T P C** **4 0 0 4**

Course Objectives

This course enables the students to learn

- To enable the students to enrich the fundamental of angle between two lines.
- The construction and analysis of rectangular Cartesian co-ordinates, straight lines
- The geometrical structures such as sphere, cone etc which are all have a wide application in the field of engineering.
- The properties of four basic three-dimensional shapes.
- Identify the number of parameters necessary to express a point in the three-dimensional coordinate system.
- Understand the concept concept of three dimensional analytical geometry.

Course Outcomes (COs)

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

1. Expertise on rectangular cartesian co-ordinates in space.
2. Know about equation of plane.
3. Understand the concept of straight line in space.
4. Acquire the knowledge on basic concepts of sphere, cone, cylinder.
5. Understand the concept of transformation of rectangular axes.
6. Recognize three-dimensional shapes in the world around them.

UNIT I

Rectangular Cartesian co-ordinates in space, Concept of a geometric vector (directed lines segment). Projection of a vector on a co-ordinate axis, inclination of a vector with an axis, co-ordinates of a vector, direction cosines of a vector, distance between two points. Division of a directed line segment in a given ratio, the equation of a surface and the equation of a curve.

UNIT II

Equation of plane: General, intercept and normal form. The sides of a plane, signed distance of a point from a plane. Equation of a plane passing through the intersection of two planes. Angle between two intersecting planes, bi-sectors of angle between two intersecting planes, Parallelism and perpendicularity of two planes.

UNIT III

Straight line in space: Its equation in symmetrical (canonical) and parametric forms. Direction ratio and direction cosines, canonical equation of the line of intersection of two intersecting planes. Angle between two lines. Condition for Parallelism and perpendicularity of two straight lines, of a straight line and a plane, Equations of skew lines, Distance of a point from a straight line. Shortest distance between two skew lines.

UNIT IV

Sphere, Cone, Cylinder: Surface of revolution, Ruled surface: study of their shapes and canonical equations. Enveloping cone and enveloping cylinder. Tangents, tangent planes, normals and generating lines of quadrics.

UNIT V

Transformation of rectangular axes: Translation, rotation and their combinations. General equation of second degree in three variables: reduction to canonical (normal) forms. Classification of quadrics and their equation in canonical forms.

TEXTBOOK

1. Arup Mukherjee, Naba Kumar Bej, 2010. Analytical Geometry of Two & Three dimensions (Advanced Level), Books and allied (P) Ltd. Kolkata.

REFERENCES

1. M.C. Chaki: A Text Book of Analytic Geometry.

2. S.L. Loney: Co-ordinate Geometry.

3. J.T. Bell: Co-ordinate: Geometry of Three Dimensions.

15MMP307B **FINITE ELEMENT METHODS** **Semester – III**

L T P C

4 0 0 4

Course Objectives

This course enables the students to learn

- The fundamental concepts of the theory of the finite element method:
- To enrich the global interpolation and the solution of one dimensional heat and wave equations.
- The purpose of Galerkin method, global & local finite element models in one dimension.
- This course provides an introduction to finite elements method with a focus on one and two dimensional problems in structures, heat transfer, static and dynamics.
- Basic principles of finite element analysis procedure.
- The design and heat transfer problems with application of FEM.

Course Outcomes (COs)

On successful completion of this course the student will be able to

1. Develop the ability to generate the governing FE equations for systems governed by partial differential equations.
2. Understand the application and use of the FE method for heat transfer problem.
3. Understand the use of the basic finite elements for structural applications using truss, beam, frame, and plane elements.
4. Comprehend quantitative and analytical methods.
5. Understand the concepts Lagrangian and Hermit elements methods in FEM.
6. Recognize the need for, and engage in life long learning.

UNIT I

Finite Element Method: Variation formulation–Raayleigh- ritz minimization- weighted residuals-Galerkin method applied to boundary value problems.

UNIT II

Global and local finite element models in one dimension-derivation of finite element equation.

UNIT III

Finite element interpolation-polynomial elements in one dimension, two dimensional elements-natural coordinates-triangular elements-rectangular elements.

UNIT IV

Lagrangian and Hermit elements for rectangular elements-global interpolation functions.

UNIT V

Local and global forms of finite element equations-boundary conditions-methods of solutions for a steady state problems –Newton-Raphson continuation-one dimensional heat and wave equations.

TEXT BOOK

1. J.N.Reddy, 2009, An Introduction to the Finite element Method. McGraw Hill, NY.,

REFERENCES

1. Chung.,Finite element Analysis in Fluid Dynamics., McGraw Hill,Inc.,

2. Singiresu S. Rao , 2004. The Finite Element Method in Engineering, Fourth edition, Elsevier Inc.,

3. Chennakesava.R,Alavala,2010.Finite element Method,PHI,NewDelhi.

4.O.C.Zienkiewicz.R,R.L,Talor,2010.Finite Element Method its Basis and Fundamentals,Elesevier, New Delhi.

15MMP307C	**COMBINATORICS**	**Semester – III** **L T P C** **4 0 0 4**

Course Objectives

This course enables the students to learn

- Improve mathematical proof writing skills.
- Cater mathematical verbal communication skills.
- Afford problem-solving skills.
- Combinatorial proofs of identities and inequalities.
- Model and analyze computational processes using analytic and combinatorial methods.
- Structures to represent mathematical and applied questions, and they will become comfortable with the combinatorial tools commonly used to analyze such structures.

Course Outcomes (COs)

On successful completion of this course, students will be able to

1. Cognition in various combinatorial methods.
2. Solve recurrence relations through computational skills.
3. Apply the inclusion/exclusion principle.
4. Develop fundamental knowledge of combinatorics and Euler function.
5. Analyze combinatorial objects satisfying certain properties and answer questions related to Necklace problem.
6. Know the concept of Burnside's lemma.

UNIT I

Basic Combinatorial Numbers – Stirling numbers of the second kind – Recurrence formula for Pnm.

UNIT II

Generating functions – Recurrence relations- Bell's formula.

UNIT III

Multinomial – Multinomial theorem- Inclusion and Exclusion principle.

UNIT IV

Euler function –Permutations with forbidden positions –the Menage Problem.

UNIT V

Problem of Fibonacci –Necklace problem – Burnside's lemma.

TEXTBOOK

1. V. Krishnamurthy, 2002, Combinatorics: Theory and Applications, East West Press Pvt. Ltd.

REFERENCES

1. V.K. Balakrishnan, 1995 Theory and problems of Combinatorics, Schaums outline series, McGraw Hill Professional.

2. Alan tucker, 2002, Applied Combinatorics, Fourth edition, John wiley & Sons, New York.

Semester – III

15MMP307D FORMAL LANGUAGES AND AUTOMATA THEORY **L T P C**
4 0 0 4

Course Objectives

This course enables the students to learn

- The basic concepts in automata theory and theory of computation.
- To identify different formal language classes and their relationships.
- This course focuses on the basic theory of Computer Science and formal methods of computation like automata theory, formal languages, grammars.
- Design automata, regular expressions and context free grammars for accepting or generating a certain language.
- Design grammars and recognizers for different formal languages
- Determine the decidability and intractability of computational problems.

Course Outcomes (COs)

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

1. Understand the definition of Automata.
2. Know about the different concepts in automata theory and formal languages such as formal proofs, non-deterministic automata, regular expressions, regular languages context-free grammars, context-free languages.
3. Discuss the acceptability of a string by finite automation.
4. Applications of Pumping Lemma.
5. Design automata, regular expressions and context-free grammars accepting or generating certain languages.
6. Acquire concepts relating to the theory of computation and computational models including decidability and intractability.

UNIT I

Definition of an Automation - Description of Finite Automaton – Transition systems - Property of transition functions - Acceptability of a string by a finite Automaton - Non deterministic finite automaton - The equivalence of DFA and NDFA.

UNIT II

Formal Languages - Basic Definitions and examples - Chomsky classification of Languages - Languages and their relation - Recursive and Recursively Enumerable sets- Operations on Languages.

UNIT III

Regular expressions - Finite Automata and Regular expressions.

UNIT IV

Pumping Lemma for Regular sets - Applications of Pumping Lemma - Closure Property of Regular sets - Regular sets and Regular grammars.

UNIT V

Context free Languages and Derivation trees - Ambiguity in Context free grammars - Simplification of Context free grammars (examples only).

TEXTBOOK

1. K L P Mishra and N Chandrasekaran, 1999. Theory of Computer Science, Prentice Hall of India, New Delhi.

REFERENCES

1. John E. Hopcroft and J.D. Ullman, , 2006. Introduction to Automata theory, Languages and Computation, Third Edition, Prentice Hall.
2. A.V. Aho and J.D. Ullman, 1999. Principles of compiler design, Narosa Publishing Company, London.
3. Rakesh Duke, Adesh Pandey and RiTu Gupta, 2007. Discrete Structures and Automata theory. Narosa Publishing Company, New Delhi.

Semester – III

15MMP307E PROBABILITY AND THEORETICAL DISTRIBUTIONS **L T P C**

4 0 0 4

Course Objectives

This course enables the students to learn

- To understand the basic concepts in probability generating functions, sample moments and their functions, sampling, significance tests and statistical measures
- Probability distribution and their applications in various disciplines.
- This course introduces the key concepts in probability and distribution theory, including probability laws, random variables, expectation and variance, conditional probabilities, functions of random variables and multivariate probability distributions.
- Analyze statistical data graphically using frequency distributions and cummulative frequency distributions.
- Providing students with a formal treatment of probability theory.
- Equipping students with essential tools for statistical analyses at the graduate level.

Course Outcomes (COs)

After successfully completed this module the students will be able to

1. Explain the concepts of probability, including conditional probability.
2. Explain the concepts of random variable, probability distribution, distribution function, expected value, variance and higher moments, and calculate expected values and probabilities associated with the distributions of random variables.
3. Know the concept of conditional distributions.
4. Explain the concepts of various types of distributions.
5. Understand the concept of Bernoulli's law of large numbers.
6. Apply the concept of the gamma distribution.

UNIT I

Random Events – Preliminary remarks – random events and operations performed on them – the system of axioms of the theory of probability – conditional probability – Bayes theorem. Independent Events – Random variables – the concept of random variable – the distribution function – random variables of the discrete type and the continuous type – functions of random variables.

UNIT II

Multidimensional random variables – marginal distributions – conditional distributions – Independent random variables – Parameters of the distributions of a random variable. Expectation, moments moment generating functions and characteristic functions.

UNIT III

Conditional expectation and distribution, Chebyshev inequality – absolute moments. Modes of convergence, Weak and strong laws of large numbers, Central limit theorem.

Probability generating functions – some probability distributions - One point and two point distributions – the Bernoulli scheme.

UNIT IV

The binomial distribution – the Poisson scheme. The generalized binomial distribution – the Poisson scheme. The generalized binomial distributions and the Poisson distributions, uniform distribution - the normal distribution.

UNIT V

The gamma distribution – the Cauchy and Laplace distributions – Limit theorems – preliminary remarks – Stochastic convergence – Bernoulli's law of large numbers - the convergence of a sequence of distribution functions – the Levy-Cramer theorem – The de Moivre Laplace theorem – the Lindeberg-Levy theorem.

TEXT BOOK:

1. Kandaswamy. P.,K.Thilagavathy.,and K.Gunavathy., 2004 . Probability statistics and Queuing theory, S. Chand & Company Ltd., New Delhi.

REFERENCES:

1. Marek Fisz, 1980. Probability Theory and Mathematical Statistics, John Wiley and Sons, New York.

2. Kishor S. Trivedi., 2001. Probability and Statistics with reliability, Queuing and Computer science Applications, Prentice – Hall of India, New Delhi.

3. Hein Bauer, 1995. Probability Theory, Narosa Publishing House, London.

4. D.N.Elhance, Veena Elhance and B.M Agarwal, 1956, Fundamental of Statistics, Kitab Mahal, \ Allahabad.

5. Gupta.S.C. and V.K.Kapoor,2006.Fundamentals Of Mathematical Statistics, Sultan chand & Sons, New Delhi.

		Semester – III
15MMP308	**FUZZY LOGIC**	**L T P C**
		0 0 0 4

Course Objectives

This course enables the students to learn

- The introduction and different architectures of fuzzy sets.
- The applications of fuzzy networks.
- To cater the knowledge of fuzzy Logic Control and use these for controlling real time systems.
- Solve problems that are appropriately solved by neural networks, fuzzy logic, and genetic algorithms.
- The concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic control and other machine intelligence applications of fuzzy logic.
- The importance of tolerance of imprecision and uncertainty for design of robust & low cost intelligent machines.

Course Outcomes (COs)

On successful completion of this course, students will be able to

1. Obtain the fundamentals and types of fuzzy networks.
2. Have a broad knowledge in developing the different algorithms for fuzzy Logic.
3. Analyze constructing Fuzzy sets and operations.
4. Acquire a broad knowledge in Fuzzy relation equation.
5. The basic mathematical elements of the theory of Fuzzy systems and neural networks.
6. Explain the concepts of neural networks, fuzzy logic, and genetic algorithms.

UNIT I

Classical logic: An overview-Multivalued logics-Fuzzy Propositions-Fuzzy quantifiers-linguistic hedges-Inference from conditional fuzzy propositions-Inference from conditional and qualified propositions-Inference from qualified propositions.

UNIT II

Uncertainty based in formations-Information and uncertainty-Non specificity of crisp sets- Non specificity of Fuzzy sets-Fuzziness of fuzzy sets- Uncertainty in evidence theory-Summary of Uncertainty measures-Principles of Uncertainty.

UNIT III

Constructing Fuzzy sets and operations- General discussion-Method of construction: An overview-Direct method with one expert- Direct method with multiple experts- Indirect method with one expert- Indirect method with multiple experts-Constructions from sample data.

UNIT IV

Fuzzy expert systems: An overview-Fuzzy implications-selection of Fuzzy implications-Multi conditional approximate reasoning-The role of Fuzzy relation equation-Interval-valued approximate reasoning.

UNIT V

Fuzzy systems-General discussion-Fuzzy controllers: An overview and examples-Fuzzy systems and neural networks- Fuzzy neural networks- Fuzzy Automata-Fuzzy dynamic systems.

TEXTBOOKS

1. George J.Klir, Tina.A Folger, 2008. Fuzzy sets, uncertainty and information, Prentice Hall of India Pvt. Ltd, New Delhi, (For Unit I, II, III)

2. George J. Klir and Bo Yuan, , 1995.Fuzzy sets and fuzzy logic theory and applications, Prentice-Hall of India private limited, New Delhi. (For Unit IV, V)

REFERENCES

1. Timothy J. Ross, 2000. Fuzzy logic with Engineering Applications, McGraw Hill, Inc. New Delhi.

2. H.J. Zimmermann, 2006. Fuzzy set theory and its applications, Second Edition, Springer New Delhi,.

Semester – IV

15MMP401 ABSTRACT CONTROL THEORY **L T P C**

0 0 0 4

Course Objectives

This course enables the students to learn

- Understand the basic concepts Hille-Yosida theorem.
- Regularity of mild solutions for analytical semi groups and their applications in various disciplines.
- Able to understand the concept of semi groups.
- Understanding of classical control theory.
- Development of the bounded linear operators in semigroups.
- Use of the inhomogeneous initial value problem.

Course Outcomes (COs)

After successfully completed this module the students will be able to

1. Explain the concepts of control theory such as bounded linear operators.
2. Explain the concepts of semi groups of compact operators etc which is a powerful tool in solving the differential systems.
3. Familiar with controllability, exponential stability.
4. Understand the concept of basic concepts in control theory.
5. Analysis of linear and nonlinear systems.
6. Analyze the concept of stability for controllability.

UNIT I

Bounded Linear Operators:

Uniformly continuous semi groups of bounded linear operators – Strongly continuous semi groups of bounded linear operators – The Hille-Yosida theorem – The Lumer Phillips theorem.

UNIT II

Semi groups of Compact operators:

Semi groups of Compact operators – Differentiability – Analytic semigroups – Fractional powers of closed operators.

UNIT III

Abstract Cauchy Problem:

The Homogeneous Initial value problem – The inhomogeneous initial value problem – Regularity of mild solutions for Analytical semi groups.

UNIT IV

Basic Concepts in Control Theory:

Introduction- Fixed point methods- Observability of linear and nonlinear systems.

UNIT V
Controllability and exponential stability.

TEXT BOOKS:

1. A. Pazy, , 1983,Semigroups of Linear Operators and Applications to Partial Differential Equations, Springer-Verlag, New York.

2. R.F. Curtain and H. Zwart, 1995, Introduction to infinite dimensional linear systems theory, Spinger-Verlag, New York.

REFERENCES:

1. A.V. Balakrishnan, , 1976.Applied Functional Analysis, Springer-Verlag, New York.
2. J.A. Goldstein, 1985. Semigroups of Linear Operators and Applications, Oxford University Press, New York.

3. K. Balachandran and J.P. Dauer, 1999. Elements of Control Theory, Narosa Publishing, New Delhi.

		Semester – IV
15MMP491	**PROJECT**	**L T P C**
		0 0 0 12