**Scope:** After completing this course, the learner will be enriched with the concept of Cauchy’s theorem, Sylow’s theorem, Rings, fields, linear transformation, trace & transpose which are very useful for their research.

**Objectives:** To learn the basic ideas of Group theory, Euclidean rings, Roots of Polynomials and be thorough with canonocal forms which play a vital rule in the field of Mathematics.

**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**


**UNIT IV**


**UNIT V**


**TEXT BOOK**

REFERENCES


**Scope:** After the completion of this course, the learner will be enriched with the concept of analysis which is the motivating tool in other area such as applied mathematics.

**Objectives:** To understand the Riemann – Stieltjes Integral, Infinite series, infinite products, Sequences of functions, the Lebesgue integral, Implicit functions and extremum problems to have a sound knowledge in Measure Theory.

**UNIT I**

The Riemann – Stieltjes Integral:

**UNIT II**

Infinite series and infinite products:

**UNIT III**

Sequences of functions:

**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

REFERENCES


Scope: This course provides a deep knowledge to the learners to understand the basic concepts of Numerical Methods which utilize computers to solve Engineering Problems that are not easily solved or even impossible to solve by analytical means.

Objectives: To familiarize with numerical solution of equations, ODE & PDE and get exposed with numerical differentiation and integration.

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

TEXT BOOK
REFERENCES


1. Solution of non-linear equation-Bairstow’s method for quadratic factors.
2. Solution of simultaneous equations-Gauss Elimination.
4. Solution of simultaneous equations-Gauss Jacobi.
5. Solution of simultaneous equations-Gauss Seidal.
10. Solution for ordinary differential equation- Runge Kutta Second order.
Scope: On successful completion of this course the learner gains knowledge about Second order linear equation, Legendre equation and Bessel equations etc., which provides the essential motivation in applied mathematics.

Objectives: To be familiar with formulation and solutions of ordinary differential equations and get exposed to physical problems with applications.

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
REFERENCES


Scope: The scope of this course is to provide an introduction to the object-oriented programming paradigm in Java.

Objectives: To expose the students to the best object oriented programming paradigm, java and strengthen their OOP’s fundamental knowledge.

UNIT I


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


UNIT IV


UNIT V

TEXT BOOK


REFERENCES


WEB SITES
java.sun.com/docs/books/tutorial/
www.en.wikipedia.org/wiki/Java
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.
Scope: This course gives a clear study about the development of the functions of one complex variable and some important concepts such as Complex integration, Harmonic functions and Riemann Mapping Theorem etc...

Objectives: To be familiar with families of analytic functions, conformal mappings, exposed to complex integrations and be through with harmonic functions.

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


UNIT V


TEXT BOOK

REFERENCES


Scope: This paper gives the clear idea about closeness, continuity, shapes of metric spaces and topological spaces which place a vital role in the world of Mathematics.

Objectives: To gain basic knowledge of topological spaces, types of topologies, continuity, connectedness and compactness in normed metric spaces.

UNIT I


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


UNIT IV


UNIT V


TEXT BOOK

REFERENCES
Scope: This course has been intended to provide the knowledge in understanding the need and origin of the optimization methods which plays an essential role in present, future in the applications of Mathematics.

Objectives: To apply Mathematical techniques to model and analyze decision problems which play an essential role in the solution real life problems.

UNIT I


UNIT II


UNIT III


UNIT IV


UNIt V


TEXT BOOK

REFERENCES


Scope: On successful completion of this course the learner gains knowledge about the solution of non linear partial differential equations, solution of linear hyperbolic equations, method of integral transforms, wave equations and diffusion equations which plays an essential role in the applications of Mathematics.

Objectives: To be familiar with formulation and solutions of partial differential equations and get exposed with physical problems.

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


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

REFERENCES

Scope: This course provides a strong foundation in understanding the concepts of mechanics and to know how the friction is regulating the motion of objects, deep knowledge about the motion of particles under the influence of various forces like gravitational force, central force, impulsive force etc., which plays a vital role in Applied Mathematics.

Objectives: To be familiar with D’Alembert’s principle, Lagrange’s equations, Extension of Hamilton’s principle, Cyclic coordinates, and Canonical transformations and to be exposed with Hamilton Jacobi Theory.

UNIT I

UNIT II

UNIT III

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

REFERENCES
Scope: On successful completion of this course the learner gains good knowledge about the concept of algebraic structures, lattices and its special categories, graph theory which play an important role in the field of computers.

Objectives: To be familiar with Algebraic Structures, Lattices, Connected & Disconnected graphs and be thorough with trees, spanning trees.

UNIT I


UNIT II


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


TEXT BOOKS

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

REFERENCES


Scope: On successful completion of this course the learner gains knowledge about the concept of graphs, spanning trees, incidence matrix, graph colorings, domination in graphs which provides the basis for networks.

Objectives: To be familiar with different types of Graphs and their incidence matrices, spanning trees and to be exposed with colourings & Domination in Graphs.

UNIT-I


UNIT II


UNIT III


UNIT IV

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

UNIT V


TEXT BOOKS

2. Deo N, 1974. Graph Theory with Applications to Engineering and Computer Science, Prentice Hall Inc. (for unit IV).

REFERENCES

**Scope:** On successful completion of this course the learner gains knowledge about the behavior of tensors, strains, stress, equation of elasticity etc which have a wide application in the field of fluids.

**Objectives:** To be familiar with analysis of tensors, Cauchy – Principal strains, invariants, generalized Hooke’s law and to have knowledge with dynamical equations of isotropic elastic solid.

**UNIT I**

Tensor Analysis:

**UNIT II**

Analysis of strain:

**UNIT III**

Analysis of Stress:

**UNIT IV:**

Equation of elasticity

**UNIT V:**

TEXT BOOKS


REFERENCES

Scope: On successful completion of this course the learner gains a complete knowledge on analyzing the characteristics, polarization of MHD waves and discontinuities.

Objectives: To be familiar with MHD-Electromagnetic field equations, Hydro magnetic equilibrium, MHD Poiseuille’s flow, MHD waves in incompressible fluid and to understand the stability of hydro magnetic systems

UNIT I


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

UNIT V


TEXT BOOK


REFERENCES


**SCOPE:** On successful completion of this course the learners will be able to know that the actuarial mathematics is the discipline which applies mathematical and statistical methods to assess risks in insurance and finance industries.

**OBJECTIVES:** To be familiar with accumulated value, commutation functions, life annuities & temporary annuities, net premiums for assurance plans and be exposed with alteration of policy contracts.

**UNIT I**


**UNIT II**


**UNIT III**


**UNIT IV**

UNIT V


TEXT BOOK

1. Mathematical Basis of Life Insurance - Insurance Institute of India.
**15OEP201  COMPUTER BASED NUMERICAL METHODS**

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**Scope:** This course enables the students to gain knowledge about various aspects of numerical methods such as solution of algebraic equations, interpolation, differentiation, integration etc that are used to solve many real time problems where ever the analytic solution is complicated.

**Objectives:** To be familiar with the solution of algebraic, transcendental equations, interpolation etc and to get exposed with numerical differentiation and integration.

**UNIT I**

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

**UNIT II**


**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**


**TEXT BOOK**


**REFERENCES**


Scope: This course provides a systematic study of linear, topological or metric structures and it also deals with spaces and operators acting on them.

Objectives: To be thorough with banach spaces, related theorems, ortho-normal sets, normal and unitary operators and to be familiar with Banach algebras.

UNIT I


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


UNIT IV


UNIT V


TEXT BOOK


REFERENCES


**Scope:** This course has been intended to identify and use key concepts and fundamental principles of fluid dynamics, together with the assumptions made in their development pertaining to fluid behavior, both in static and flowing conditions.

**Objectives:** To understand the fluids, their characteristics, Bernoulli’s theorem in steady motion, Complex Potential Navier-Stokes equations and to be exposed with Laminar Boundary Layer in incompressible flow.

**UNIT I**

**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**

**UNIT IV**

**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


REFERENCES


15MMP303 INTEGRAL EQUATIONS AND TRANSFORMS

Semester – III

L T P C
4 0 0 4

Scope: This course aims to give fundamental ideas on transforms, integral Equations, and calculus of variations which play a vital role in the applications of Mathematics.

Objectives: To be familiar with the transforms, convolution integral, types of Integral equations and the solution of initial, boundary value problems.

UNIT I


UNIT II


UNIT III


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


(For Unit –I & II)
(For Unit –III & IV)

(For Unit –V)

REFERENCES


2. Larry C. Andrews and Bhimson K. Shivamoggi,1999. The Integral transforms for Engineers , Spie  
**Scope:** On successful completion of this course the learner gains knowledge about the concept of probability, moments, sampling theory, significance tests, the theory of estimation and hypothesis testing etc with exact mathematical treatment.

**Objectives:** To understand the probability generating functions, sample moments and their functions, sampling, significance tests, estimation, hypothesis testing and ANOVA.

**UNIT I**


**UNIT II**

Sample moments and their functions: Notion of a sample and a statistic - Distribution functions of X, S² and (X, S²) -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**


**UNIT V**


**TEXT BOOK**

REFERENCES


Scope: On successful completion of this course the learners gain a clear knowledge about the Integration, Outer Measure and Product Measure etc which plays an essential role in Operator Theory.

Objectives: To be familiar with the Lebesgue measure, Lebesgue Integral, differentiation of monotone function and be exposed with measure spaces & \( L^p \) spaces.

UNIT I

UNIT II

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

REFERENCES
Scope: After the completion of this course, the learner gain clear knowledge about various aspects of Mathematical modeling which is the motivating tool in the areas such as applied mathematics, engineering etc.

Objectives: To understand the mathematical model of ODE of first order & second order, Population dynamics, genetics and to be familiar with mathematical models of graphs.

UNIT I


UNIT II


UNIT III


UNIT IV


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

REFERENCES


Scope: After completing this course, the learner gain a clear knowledge about analytical geometry of three dimensions in 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.

Objectives: To be familiar with Projection of a vector on a co-ordinate axis, equation of plane, straight line in space, enveloping cone etc and to be exposed with the classification of quadrics and their equation in canonical forms.

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


REFERENCES


Scope: After completing this course, the learner gain a clear knowledge on quantitative and analytical methods, performing engineering analysis of machine systems, how to apply Mathematics in science and engineering to design and to communicate the ideas graphically.

Objectives: To understand the purpose of Galerkin method, global & local finite element models in one dimension, global interpolation and the solution of one dimensional heat and wave equations.

UNIT I

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

REFERENCES
Scope: After completing this course, the learner gain a clear knowledge on various combinatorial numbers and the applications of combinatorial techniques in real life problems.

Objectives: To be familiar with the Stirling numbers, Bell’s formula, Multinomial theorem, Euler function and be exposed with the Necklace problem.

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

REFERENCES

15MMP307D FORMAL LANGUAGES AND AUTOMATA THEORY  

**Scope:** This course makes the students to understand various aspects of automata theory and Grammar, relationship between them those have wide applications in the field of computers.

**Objectives:** To understand the formulation of DFA and NDFA, Chomsky classification of Languages, regular expression, pumping Lemma and get familiar with context free grammars.

**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**


**REFERENCES**


**Scope:** On successful completion of this course, the learner gains a clear knowledge about the basic concepts and how to use probability concepts and distributions to solve the practical problems in their respective field.

**Objectives:** To understand the functions of random variables, marginal & conditional distributions, Bernoulli scheme and to be familiar with 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**


**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**

TEXT BOOK:


REFERENCES:


**Scope:** This course makes the students to understand various aspects and the importance of fuzzy logic which is very useful in the field of science and research.

**Objectives:** To understand the fuzzy propositions & quantifiers, non specificity of crisp sets, method of construction, fuzzy implications and familiar with fuzzy systems and neural networks.

**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**


**UNIT V**


**TEXTBOOKS**


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


**Scope:** This course makes the students understand the basic concepts in control theory such as bounded linear operators, semi groups of compact operators etc which is a powerful tool in solving the differential systems.

**Objectives:** To understand the Hille-Yosida theorem, semi groups of compact operators, Regularity of mild solutions for analytical semi groups and familiar with controllability, exponential stability.

**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:

**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:**

**REFERENCES:**

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