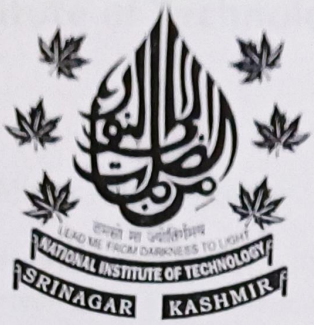


गणित विभाग

राष्ट्रीय प्रौद्योगिकी संस्थान श्रीनगर

श्रीनगर-190006, जम्मू एवं कश्मीर

**DEPARTMENT OF MATHEMATICS**
**NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR**
**SRINAGAR-190006, J&K**

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# Syllabi for B. Tech Courses offered by the Department of Mathematics for all Engineering Branches

**(w.e.f. Autumn-2024)**

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गणित विभाग
राष्ट्रीय प्रौद्योगिकी संस्थान श्रीनगर
श्रीनगर-190006, जम्मू एवं कश्मीर
**Department of Mathematics**
**National Institute of Technology Srinagar**
**Srinagar-190006, J&K**

**B. Tech. Courses in Mathematics offered by the Department of Mathematics**

| S. No. | Name of the Course | Branch | Course Code | Credits |
|---|---|---|---|---|
| 1 | Mathematics-I | All branches | MAT-101 | 3 |
| 2 | Mathematics-II | All branches | MAT-102 | 3 |
| 3 | Mathematics-III (Integral Transforms, Probability & Statistics) | Civil Engg. (3rd semester) | MAT-201 | 3 |
| 4 | Mathematics-III (Integral Transform & Probability) | Electrical Engg. (3rd semester) | MAT-202 | 3 |
| 5 | Mathematics-III (Integral Transforms) | ECE (3rd semester) | MAT-203 | 3 |
| 6 | Applied Mathematics – I (Probability & Statistics, Numerical Methods) | Mechanical Engg. (3rd semester) | MAT-204 | 3 |
| 7 | Numerical Methods | Chemical Engg. (3rd semester) | MAT-205 | 3 |
| 8 | Mathematics-III (Probability & Statistics) | MME (3rd semester) | MAT-206 | 3 |
| 9 | Discrete Mathematics | CSE (3rd semester) | MAT-207 | 3 |
| 10 | Discrete Mathematics | ITE (3rd semester) | MAT-208 | 3 |
| 11 | Mathematics-IV (Numerical Methods) | Civil Engg. (4th semester) | MAT-211 | 3 |
| 12 | Mathematics –IV (Probability & Statistics) | ECE (4th semester) | MAT-213 | 3 |
| 13 | Applied Mathematics – II (Complex Variables & Integral Transforms) | Mechanical Engg. (4th semester) | MAT-214 | 3 |
| 14 | Chemical Engineering Mathematics (Integral Transform, Probability & Statistics) | Chemical Engg. (4th semester) | MAT-215 | 3 |
| 15 | Mathematics-IV (Numerical Methods) | MME (4th semester) | MAT-216 | 3 |
| 16 | Probability & Statistics | CSE (4th semester) | MAT-217 | 3 |
| 17 | Introduction to Probability Theory and Statistics | ITE (4th semester) | MAT-218 | 3 |
| 18 | Mathematics-V (Complex Variables and Special Functions) | ECE (5th semester) | MAT-301 | 3 |
| 19 | Applied Mathematics for Chemical Engineers (Complex Variables & Functions) | Chemical Engg. (5th semester) | MAT-302 | 3 |
| 20 | Mathematics-V (Complex Variables and Numerical Methods) | Electrical Engg. (5rd semester) | MAT-303 | 3 |
| 21 | Operations Research (Elective Course) | Chemical Engg. (5th semester) | MAT-001 | 3 |
| 22 | Operations Research (Elective Course) | CSE (7th semester) | MAT-002 | 3 |
| 23 | Numerical Methods (Elective Course) | ITE (6th semester) | MAT-003 | 3 |

**DUGC, Convener**
**Dr. Rameez Raja**

**Head, Department of Mathematics**
**Dr. Zamrooda Jabeen**

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| 1st Year (1st Semester) | Mathematics-I | MAT-101 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of differential calculus and matrices.

**Course Outcomes:** At the end of the course, a student will be able to:

| CO No. | Course Outcomes | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Solve linear and nonlinear differential equations by various methods | 3 |
| CO2 | Apply ordinary differential equations for solving various engineering problems. | 3 |
| CO3 | Solve problems related to rank of matrix, Cayley-Hamilton theorem, and determine solutions of equations by matrix method. | 3 |
| CO4 | Determine eigenvalues, eigenvectors and quadratic forms. | 5 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Exact differential equations, Necessary and sufficient condition for exact differential equations, Equations reducible to exact form, Linear differential equations of second and higher order with constant and variable coefficients, Cauchy's Homogeneous Linear equation, Legendre's linear equation, Simultaneous differential equations of first and second order, Simultaneous differential equations of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$, Nonlinear differential equation. | 12 |
| Module 2 | Method of Variation of parameters, Series solution of ordinary differential equations (Frobenius method). Applications of ordinary differential equations. | 12 |
| Module 3 | Rank of a matrix, Equivalent matrices, Elementary transformations,normal form, Inverse of a matrix, Cayley- Hamilton theorem, Applications of Cayley-Hamilton theorem for finding Inverse and higher powers of a matrix, Solution of simultaneous equations by elementary operations, Similar matrices. | 10 |
| Module 4 | Special matrices viz. orthogonal matrix, Idempotent matrix, unitary matrix. Eigen values and Eigen vectors of a matrix, Properties of eigenvalues and eigenvectors. Quadratic forms, Value class of quadratic form | 8 |

**Recommended Books:**


1. R. K. Jain and S. R. K.Iyengar,*Advanced Engineering Mathematics*, 3rd Edition, Narosa Pub. House(2008).
2. E. Kreyszig, *Advanced Engineering Mathematics*, 9th Edition, John Wiley Sons, (2006).
3. H.T.H. Piaggio, *Differential Equations*, CBS publisher, (2004).

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| 1st Year (2nd Semester) | Mathematics-II | MAT-102 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of integral calculus and ordinary differential equations .

**Course Outcomes:** At the end of the course, a student will be able to:

| CO NO. | Course Outcomes | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Determine the nature of series and Fourier Series of various functions. | 5 |
| CO2 | Solve problems related to partial differential equations by various methods. | 3 |
| CO3 | Apply partial differential equations for solution of wave equation and heat equation. | 3 |
| CO4 | Solve problems related to Beta and Gamma functions, double and triple integrals. | 3 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Sequence and series, Fourier series, Dirichlet's condition for a Fourier series, Fourier series for functions having points of discontinuity, Fourier series for functions having arbitrary period, Half range series. | 10 |
| Module 2 | Formation of PDE, Lagrange's linear equation, Partial differential equations of first order, Partial differential equations of second and higher order, Homogeneous partial differential linear equations with constant coefficients, Non-homogeneous linear partial differential equations. Non-linear partial differential equations of first order, Charpit's method, Standard forms. | 12 |
| Module 3 | Classification of linear partial differential equation of second order, Vibration of a stretched flexible string, Heat flow equation, Wave equation, Solution by the methods of separation of variables. | 8 |
| Module 4 | Beta & Gamma functions (definition & related problems), Differentiation under the integral sign ( Leibnitz rule). Jacobians, Double & Triple integrals, Change of Variables in double integrals. | 12 |

**Recommended Books:**


1. R. K. Jain and S. R. K. Iyengar, *Advanced Engineering Mathematics*, 3rd Edition, Narosa Pub. House (2008).
2. E. Kreyszig, *Advanced Engineering Mathematics*, 9th Edition, John Wiley Sons,(2006).
3. H.T.H. Piaggio, *Differential Equations*, CBS publisher, (2004).

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B. Tech. Civil Engg. 2nd Year (3rd Semester) | Mathematics-III (Integral Transforms, Probability & Statistics) | MAT- 201 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of calculus.

**Course Outcomes:** At the end of the course, a student will be able to:

| CO No. | Course Outcome | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Solve Laplace transform and Fourier transform of various functions. | 3 |
| CO2 | Apply Fourier Transform to solve ordinary and partial differential equations. | 3 |
| CO3 | Evaluate various engineering problems by the concepts of statistics. | 5 |
| CO4 | Apply the concepts of probability and statistics to various engineering problems. | 3 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Basics of Laplace transform and its properties.Unit Impulse function, Dirac-delta function and its Laplace transform, Heaviside's expansion theorem. Definition of Fourier transform, Fourier Integral Theorem, Properties of Fourier transform: Linearity, Shifting property, Modulation theorem, Fourier sine and cosine. | 10 |
| Module 2 | Inverse Fourier transform, Convolution Theorem and properties of Convolution. Parseval's Identity for Fourier transform, Solution of Integral equations, Evaluation of definite integrals using Fourier transform, Applications of Fourier transforms to Ordinary and Partial differential equations. | 10 |
| Module 3 | Introduction to basic Statistics, moments, correlation, regression, methods of least square, curve fitting (polynomials, exponentials). | 8 |
| Module 4 | Basic definitions of probability, conditional probability with standard results, Bays theorem with examples. Random variable, Probability density function, Mode and median of distribution of a random variable, Probability distribution function and its properties, Mathematical expectation, Laws of expectation, Mean, Variance, Moments, Moment generating function. Binomial, Poisson and normal Distributions, Chi-square Distribution and their applications | 14 |

**Recommended Books:**


1. L. Debnath and D. Bhatta, *Integral Transforms and their Applications*,2nd Edition, CRC press, (2007).
2. Murray R. Spiegel, *Schaum's OutlineSeries,s Laplace Transforms*, Tata Mc-Graw Hill Edition, (2005).
3. R.K Jain and S.R.K Iyengar, *Advanced Engineering Mathematics*, 3rd Edition, Narosa Pub. House, (2008).
4. Sheldon M. Ross, *Introduction to Probability and Statistics for Engineers and Scientists*,4th Edition, Elsevier Academic Press (2017).

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B. Tech. Electrical Engg. 2nd Year (3rd Semester) | Mathematics-III (Integral Transform & Probability) | MAT-202 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of calculus.

**Course Outcomes:** At the end of the course, a student will be able to:

| CO No. | Course Outcome | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Evaluate Laplace transform and Inverse Laplace transforms of various functions. | 5 |
| CO2 | Solve ordinary differential equations using Laplace transform. | 3 |
| CO3 | Apply the concepts of probability and statistics to various engineering problems. | 3 |
| CO4 | Explain the concepts of probability distributions and apply to various engineering problems. | 5 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Laplace transform, Condition for the existence of Laplace transform, Laplace transform of some elementary functions, Properties of Laplace transform, Differentiation and Integration of Laplace transform. Laplace transforms of periodic functions and other special functions, Unit Impulse function, Dirac-delta function and its Laplace transform. | 10 |
| Module 2 | Inverse Laplace transform, Convolution theorem and properties of Convolution, Heaviside's expansion theorem. Use of Laplace transforms in the solution of ordinary linear differential equations with constant and variable coefficients . | 10 |
| Module 3 | Random variable, Probability density function, Mode and median of distribution of a random variable, Probability distribution function and its properties, Mathematical expectation, Laws of expectation, Mean, Variance, Moments, Moment generating function, Inequalities of Markov and Chebyshev and their applications. | 12 |
| Module 4 | Binomial, Poisson and normal Distributions, Beta and gamma Distribution, Chi-square Distribution and their applications. | 10 |

**Recommended Books:**


1. L. Debnath and D. Bhatta, *Integral Transforms and their Applications*, 2nd Edition, CRC press, (2007).
2. Murray R. Spiegel, *Schaum's OutlineSeries,s Laplace Transforms*, Tata Mc-Graw Hill Edition, (2005).
3. R.K Jain and S.R.K Iyengar, *Advanced Engineering Mathematics*, 3rd Edition, Narosa Pub. House, (2008).
4. Sheldon M. Ross, *Introduction to Probability and Statistics for Engineers and Scientists*,4th Edition, Elsevier Academic Press (2017).

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B. Tech. Electronics and Communication Engg. 2nd Year (3rd Semester) | Mathematics-III (Integral Transforms) | MAT-203 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of calculus.

**Course Outcomes:** At the end of the course, a student will be able to:

| CO No. | Course Outcomes | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Determine Laplace transform and Inverse Laplace transforms of various functions. | 5 |
| CO2 | Apply concepts of Laplace transform for solving ordinary differential equations. | 3 |
| CO3 | Evaluate Fourier transformation of various functions. | 3 |
| CO4 | Apply concepts of Z- transform for solving difference equations. | 3 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Laplace transform, Condition for the existence of Laplace transform, Laplace transform of some elementary functions, Properties of Laplace transform, Differentiation and Integration of Laplace transform. Laplace transforms of periodic functions and other special functions, Unit Impulse function, Dirac-delta function and its Laplace transform. | 10 |
| Module 2 | Inverse Laplace transform, Convolution theorem and properties of Convolution, Heaviside's expansion theorem. Use of Laplace transforms in the solution of ordinary linear differential equations with constant and variable coefficients . | 10 |
| Module 3 | Definition of Fourier transform, Fourier Integral Theorem, Properties of Fourier transform, Fourier sine and cosine, Convolution Theorem, Parseval's Identity for Fourier transform,Solution of Integral equations, Evaluation of definite integrals using Fourier transform. | 12 |
| Module 4 | Definition of Z transform, Linearty property, Z- transform of elementary functions, Shifting theorems, Initial and Final value theorems, Convolution theorem, Inversion of Z- Transforms, Use of Z- transforms in solving difference equations. | 10 |

**Recommended Books:**


1. L. Debnath and D. Bhatta, *Integral Transforms and their Applications*, 2nd Edition, CRC press, (2007).
2. Murray R. Spiegel, *Schaum's Outlines Laplace Transforms,* Tata Mc-Graw Hill Edition, (2005).
3. R.K Jain and S.R.K Iyengar, *Advanced Engineering Mathematics*, 3rd Edition, Narosa Pub. House, (2008).

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B. Tech. Mechanical Engg. 2nd Year (3rd Semester) 4TH | Applied Mathematics – I (Probability & Statistics, Numerical Methods) | MAT-204 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of Set Theory.

**Course Outcomes:** At the end of the course, a student will be able to:

| CO No. | Course outcome | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Apply the concepts of statistics to various engineering problems. | 3 |
| CO2 | Apply the concepts of probability to various engineering problems. | 3 |
| CO3 | Determine the numerical solution of algebraic and transcendental equations. | 5 |
| CO4 | Solve numerical techniques for solving differential equations. | 3 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Introduction to basic Statistics, moments, correlation, regression, methods of least square, curve fitting (polynomials, exponentials). | 10 |
| Module 2 | Basic definitions of probability, conditional probability with standard results, Bays theorem with examples. Random variables (discrete and continuous), laws of expectations theory, discrete distributions(binomial distribution, Poisson distribution, geometric distribution), continuous distributions(normal distribution, beta distribution, gamma distribution), introduction to sampling theory. | 12 |
| Module 3 | Numerical solutions of linear and non-linear algebraic equations(bisection method, Newton Raphson method); interpolation. | 10 |
| Module 4 | Integration by trapezoidal and Simpson's rules; single and multi-step methods for differential equations. | 10 |

**Recommended Books:**


1. S. Ross, *A First Course in Probability*, 6th Edition, Pearson Education India, (2002).
2. S.S. Sastry, *Introductory methods in Numerical Analysis*, 5th Edition, Prentice Hall India learning Pvt. Ltd., (2012).
3. S. C. Gupta and V. K. Kapoor, *Fundamentals of Mathematical Statistics*, 12th Edition, Sultan Chand & Sons Publications, (2020).

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B.Tech. Chemical Engg. 2nd Year (3rd Semester) | Numerical Methods | MAT-205 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of calculus.

**Course Outcomes:** At the end of the course, a student will be able to:

| CO No. | Course Outcome | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Determine the numerical solution of algebraic and transcendental equations. | 5 |
| CO2 | Solve the problems related to inverse by various numerical methods. | 3 |
| CO3 | Analyze how to approximate the functions using interpolating polynomials and finding intermediate values. | 4 |
| CO4 | Apply numerical techniques for solving ordinary differential equations. | 3 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Floating-point form of numbers, Round-off, Algorithm, Stability, Programming errors, Errors of numerical results, Error propagation, Basic error principle, Loss of significant digits. Bolzano's bisection method, iteration method, Regula-Falsi method, Newton-Raphson method, numerical solution for system of equations. Gauss elimination method, Gauss-Jordan method, Computation of Inverse by Gauss's Method, LU decomposition, Gauss-Siedel iteration method, Jacobi method, The Eigen value problem | 15 |
| Module 2 | Interpolation Forward, Backward and Shift operators, Central differences, their relations, Existence, Uniqueness of interpolating polynomial, error of interpolation - unequally spaced data; Lagrange's formula, | 7 |
| Module 3 | Newton's divided difference formula. Equally spaced data : finite difference operators and their properties, Newton's forward and backward interpolation formulae, Gauss's forward and backward. | 8 |
| Module 4 | Numerical differentiation using difference techniques, Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rule, Truncation error, Romberg's method. Picard's method, Taylor series method, Euler and modified Euler method, Runge-Kutta method of 4th order, Predictor-Corrector methods (Adam's-Moulton method & Milne's method. | 12 |

**Recommended Books:**


1. S. S. Sastry, *Introductory methods in Numerical Analysis*, 5th Edition, Prentice Hall India learning Pvt Ltd., (2012).
2. Kendall E. Atkinson, Han, *Elementary Numerical Analysis*, 3rd Edition, Wiley India Pvt Ltd., (2006).
3. J.B. Scarborough, *Mathematical Numerical Analysis*, 6th Edition, Oxford and IBH Publishers, (2020).

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B. Tech. Metallurgy and Materials Engg. 2nd Year (3rd Semester) | Mathematics-III (Probability & Statistics) | MAT-206 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of set theory.

**Course Outcomes:** At the end of the course, a student will be able to:

| CO No. | Course Outcomes | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Analyse various concepts of statistics and apply to various engineering problems | 4 |
| CO2 | Evaluate various engineering problems using concepts of probability | 3 |
| CO3 | Solve various engineering problems related to discrete and continuous distributions | 3 |
| CO4 | Analyse sampling theory and apply it to various engineering problems | 4 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Introduction to basic Statistics, moments, correlation, regression, methods of least square, curve fitting (polynomials, exponentials). | 10 |
| Module 2 | Basic definitions of probability, conditional probability with standard results, Bayes theorem with examples. Discrete and Continuous Random variables, Distribution functions, Expectation and Variance of Probability distribution, and Moment Generating function, Moments and properties. | 12 |
| Module 3 | Discrete distributions: Binomial, Poisson and Geometric distributions and their applications.Continuous distribution: Uniform, Exponential and Normal distributions, Normal approximation to Binomial distribution and their applications. | 10 |
| Module 4 | Introduction to sampling theory, types of sampling, purposive sampling, random sampling, simple sampling, stratified sampling, test of significance, null and alternate hypothesis, errors in sampling. | 10 |

**Recommended Books:**


1. S. Ross, *A First Course in Probability*, 6th Edition, Pearson Education India, (2002).
2. S. C. Gupta and V. K. Kapoor, *Fundamentals of Mathematical Statistics*, 12th Edition, Sultan Chand & Sons Publications, (2020).

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B. Tech. Computer Science and Engineering 2nd year (3rd Semester) | Discrete Mathematics | MAT-207 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of Set Theory

**Course Outcomes**: At the end of the course, a student should be able to:

| CO No. | Course Outcome | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Apply the concepts of mathematical logic and counting in engineering problems | 3 |
| CO2 | Determine ordered sets and lattices | 5 |
| CO3 | Apply concepts of graph theory in computer science and engineering | 3 |
| CO4 | Apply concepts of group theory in engineering problems | 3 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Mathematical Logic and Combinatorics: Fundamentals of Mathematical Logic, Propositions and compound propositions, Basic Logical operations, truth tables, Tautologies and contradictions, Conditional and biconditional statements. Basic counting principles, Permutations and Combinations, Pigeon hole principle with applications, Inclusion-exclusion principle, Homogenous and non-homogenous recurrence relations. | 15 |
| Module 2 | Ordered sets, Lattices: Ordered sets, Diagram of Partially ordered sets, Supremum and Infimum, well-ordered sets, Lattices, Bounded and complemented lattice, Distributive Lattice. | 10 |
| Module 3 | Graph Theory: Introduction to graphs, Basic concepts, Isomorphism, Operations in graphs, Degree sequences, Trees and their properties, Matrices associated to graphs and matrix tree theorem. | 10 |
| Module 4 | Algebra: Groups, semi group, order of a group, Abelian group, subgroup, Cosets, Lagrange's Theorem, order of an element of a group, cyclic groups. | 7 |

**Recommended Books:**


1. J. A. Gallian, *Contemporary Abstract Algebra*, 9th Edition, Cengage India Private Limited, (2019).
2. K. H. Rosen, *Discrete Mathematics and its Applications*, 8th Edition, Mc-Graw Hill Publication, (2007).

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B. Tech. Information Technology Engg. 2nd Year (3rd Semester) | Discrete Mathematics | MAT-208 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of set theory.

**Course Outcomes:** At the end of the course, a student should be able to:

| CO NO. | Course Outcomes | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Apply the concept of sets, relations and functions in various engineering problems. | 3 |
| CO2 | Solve problems by using counting techniques. | 3 |
| CO3 | Determine ordered sets and lattices. | 5 |
| CO4 | Evaluate engineering problems using concepts of groups and rings. | 3 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Sets, Review of Basic Set Operations, the cardinality of a set, countability. Relations, Types of relations, recurrence relations, operations of relations and applications. Functions, types of functions, generating functions, operations of functions and applications. | 14 |
| Module 2 | Basic counting principles, permutations and combinations, pigeon hole priniciple with applications, inclusion-exclusion principle, introduction to special numbers. | 6 |
| Module 3 | Ordered sets, Diagram of Partially ordered sets, Supremum and Infimum, well-ordered sets, Lattices, Bounded and complemented lattice, Distributive Lattice, topological ordering, Congruence arithmetic. | 8 |
| Module 4 | Groups, semigroup, infinite group, Finite group, order of a group, Abelian group, subgroup, Lagrange's Theorem, Cosets, Normal Subgroups, order of an element of a group, cyclic group, Rings, Homomorphism and Isomorphism of rings. | 14 |

**Recommended Books:**


1. S. Lipschutz, and M. L. Lipson, *Schaum's outline Series, Discrete Mathematics,* Tata Mc-Graw Hill Publication, (2007).
2. C.L. Liu,. *Elements of discrete mathematics*, Tata Mc-Graw Hill Publication, (2017).
3. I. N. Herstein, *Topics in Algebra*, John Wiley & Sons, (1996).

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B.Tech. Civil Engg. 2nd Year (4th Semester) | Mathematics-IV (Numerical Methods) | MAT-211 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of calculus.

**Course Outcomes:** At the end of the course, a student will be able to:

| CO No. | Course Outcome | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Evaluate algebraic and transcendental equations by numerical solutions | 5 |
| CO2 | Solve the problems related to inverse by various numerical methods. | 3 |
| CO3 | Apply how to approximate the functions using interpolating polynomials and finding intermediate values. | 3 |
| CO4 | Apply numerical techniques for solving ordinary differential equations. | 3 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Numerical Solution of Algebraic and Transcendental equations. Graphic Method, Regula-Falsi Method, Balzano's Bisection Method, Newton Raphson Method, Iteration method and its geometrical significance. | 10 |
| Module 2 | Gauss elimination method, Gauss-Jordan method, Computation of Inverse by Gauss's Method, LU decomposition, Gauss Siedel iteration method, Jacobi method, The Eigen value problem. | 10 |
| Module 3 | Interpolation Forward, Backward and Shift operators, Central differences, their relations, Existence, Uniqueness of interpolating polynomial, error of interpolation - unequally spaced data; Lagrange's formula, Newton's divided difference formula. Equally spaced data: finite difference operators and their properties, Newton's forward and backward interpolation formulae, Gauss's forward and backward. | 12 |
| Module 4 | Numerical solution of ordinary differential equations: Picard's method, Taylor's series methods, Euler's method, Runge-Kutta method. | 10 |

**Recommended Books:**


1. M.K. Jain, S. R. K. Iyengar and R.K. Jain, *Numerical Methods for Scientists and Engineering*, 7th Edition, Wiley Eastern Ltd New age international publishers, (2019).
2. S.S. Sastry, *Introductory methods in Numerical Analysis*, 5th Edition, Prentice Hall India learning Pvt Ltd., (2012).
3. Kendall E. Atkinson, Han, *Elementary Numerical Analysis*, 3rd Edition, Wiley India Pvt Ltd, (2006).
4. Steven C. Chapra and Raymond P. Canale, *Numerical Methods for engineering*, 7th Edition, Tata Mc-Graw Hill Education, (2015).

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B. Tech. Electronics and Communication Engg. 2nd Year (4th Semester) | Mathematics –IV (Probability & Statistics) | MAT-213 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of set theory.

**Course Outcomes:** At the end of the course, a student will be able to:

| CO No. | Course Outcomes | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Analyse various concepts of statistics and apply to various engineering problems | 4 |
| CO2 | Evaluate various engineering problems using concepts of probability | 3 |
| CO3 | Solve various engineering problems related to discrete and continuous distributions | 3 |
| CO4 | Analyse sampling theory and apply it to various engineering problems | 4 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Introduction to basic Statistics, moments, correlation, regression, methods of least square, curve fitting (polynomials, exponentials). | 10 |
| Module 2 | Basic definitions of probability, conditional probability with standard results, Bays theorem with examples. Discrete and Continuous Random variables, Distribution functions, Expectationand Variance of Probability distribution, and Moment Generating function, Moments and properties. | 12 |
| Module 3 | Discrete distributions: Binomial, Poisson and Geometric distributions and their applications. Continuous distribution: Uniform, Exponential and Normal distributions, Normal approximation to Binomial distribution and their applications. | 10 |
| Module 4 | Introduction to sampling theory, types of sampling, purposive sampling, random sampling, simple sampling, stratified sampling, test of significance, null and alternate hypothesis, errors in sampling. | 10 |

**Recommended Books:**


1. S. Ross, *A First Course in Probability*, 6th Edition, Pearson Education India, (2002).
2. S. C. Gupta and V. K. Kapoor, *Fundamentals of Mathematical Statistics*, 12th Edition, Sultan Chand & Sons Publications, (2020).

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B. Tech. Mechanical Engg. 2nd Year (4th Semester) 6TH | Applied Mathematics – II (Complex Variables & Integral Transforms) | MAT-214 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of basic calculus and improper integration .

**Course Outcomes:** At the end of the course, a student will be able to:

| CO No. | Course outcome | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Analyse the complex functions for continuity, differentiability and analyticity. | 4 |
| CO2 | Solve the problems related to complex Integration | 3 |
| CO3 | Evaluate Laplace transform and Inverse Laplace transforms of various functions. | 5 |
| CO4 | Apply Laplace transform for solving ordinary differential equations. | 3 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Function of a Complex variable, limits, continuity and differentiability; analytic functions; Cauchy-Riemann equations; Harmonic functions, construction of Analytic functions | 10 |
| Module 2 | Cauchy's integral theorem and integral formula; Taylor and Laurent series; Zeros and Poles of Analytic functions, Residue theorem. | 12 |
| Module 3 | Laplace transform, Laplace transform of some elementary functions, Properties of Laplace transform, Differentiation and Integration of Laplace transform, Dirac-delta function and its Laplace transform, | 10 |
| Module 4 | Heaviside's expansion theorem, Inverse Laplace transform, Initial and Final value theorems, Convolution theorem, Use of Laplace transforms in the solution of of heat, wave and Laplace's equations. | 10 |

**Recommended Books:**


1. J.W. Brown and R.V. Churchill, *Complex Variables and Applications*, 8th Edition, Tata Mc-Graw Hill Edition, (2009).
2. Murray R. Spiegel, *Schaum's Outlines Series, Laplace Transforms,* Tata Mc-Graw Hill Edition, (2005).
3. R.K Jain and S.R.K. Iyengar, *Advanced Engineering Mathematics*, 3rd Edition, Narosa Pub. House, (2008).

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B. Tech Chemical Engg. 2nd Year (4th Semester) | Chemical Engineering Mathematics (Integral Transform, Probability & Statistics) | MAT-215 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of calculus.

**Course Outcomes:** At the end of the course, a student will be able to:

| CO No. | Course Outcome | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Evaluate Laplace transform of various functions. | 3 |
| CO2 | Evaluate Inverse Laplace transform of various functions and solution of ODE by Laplace transform. | 3 |
| CO3 | Solve problems related to moments, correlation, regression , conditional probability. | 5 |
| CO4 | Analyse the concepts of various probability distributions and their applications. | 4 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Laplace transform, Condition for the existence of Laplace transform, Laplace transform of some elementary functions, Properties of Laplace transform, Differentiation and Integration of Laplace transform. Laplace transforms of periodic functions and other special functions, Unit Impulse function, Dirac-delta function and its Laplace transform. | 10 |
| Module 2 | Inverse Laplace transform, Convolution theorem and properties of Convolution, Heaviside's expansion theorem. Use of Laplace transforms in the solution of ordinary linear differential equations with constant and variable coefficients . | 10 |
| Module 3 | Introduction to basic statistics, moments, correlation, regression, method of least square. Introduction to basic probability, Conditional probability, Independent events, Baye's theorem and Law of Total probability and allied problems. | 10 |
| Module 4 | Random variable, Probability density function, Mode and median of distribution of a random variable, Probability distribution function and its properties, Mathematical expectation, Laws of expectation, Mean, Variance, Moments, Moment generating function, Binomial, Poisson and normal Distributions and their applications. | 12 |

**Recommended Books:**


1. L. Debnath and D. Bhatta, *Integral Transforms and their Applications*, 2nd Edition, CRC press, (2007).
2. Murray R. Spiegel, *Schaum's OutlineSeries,s Laplace Transforms*, Tata Mc-Graw Hill Edition, (2005).
3. R.K Jain and S.R.K Iyengar, *Advanced Engineering Mathematics*, 3rd Edition, Narosa Publication House, (2008).
4. Sheldon M. Ross, *Introduction to Probability and Statistics for Engineers and Scientists*,4th Edition, Elsevier Academic Press (2017).

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B. Tech. Metallurgy and Materials Engg. 2nd Year (4th Semester) | Mathematics-IV (Numerical Methods) | MAT-216 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of calculus.

**Course Outcomes:** At the end of the course, a student will be able to:

| CO No. | Course Outcome | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Determine the numerical solution of algebraic and transcendental equations. | 5 |
| CO2 | Solve the problems related to inverse by various numerical methods. | 3 |
| CO3 | Analyze how to approximate the functions using interpolating polynomials and finding intermediate values. | 4 |
| CO4 | Apply numerical techniques for solving ordinary differential equations. | 3 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Floating-point form of numbers, Round-off, Algorithm, Stability, Programming errors, Errors of numerical results, Error propagation, Basic error principle, Loss of significant digits. Bolzano's bisection method, iteration method, Regula-Falsi method, Newton-Raphson method, numerical solution for system of equations. Gauss elimination method, Gauss-Jordan method, Computation of Inverse by Gauss's Method, LU decomposition, Gauss-Siedel iteration method, Jacobi method, The Eigen value problem | 15 |
| Module 2 | Interpolation Forward, Backward and Shift operators, Central differences, their relations, Existence, Uniqueness of interpolating polynomial, error of interpolation - unequally spaced data; Lagrange's formula, Newton's divided difference formula. Equally spaced data : finite difference operators and their properties, Newton's forward and backward interpolation formulae, Gauss's forward and backward. | 15 |
| Module 3 | Numerical differentiation using difference techniques, Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rule, Truncation error, Romberg's method. Picard's method, Taylor series method, Euler and modified Euler method, Runge-Kutta method of 4th order. | 12 |

**Recommended Books:**


1. S.S. Sastry, *Introductory methods in Numerical Analysis*, 5th Edition, Prentice Hall India learning Pvt. Ltd., (2012).
2. Kendall E. Atkinson, Han, *Elementary Numerical Analysis*, 3rd Edition, Wiley India Pvt. Ltd., (2006).
3. J.B. Scarborough, *Mathematical Numerical Analysis*, 6th Edition, Oxford and IBH Publishers, (2020).

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B. Tech. Computer Science and Engineering 2nd Year (4th Semester) | Probability & Statistics | MAT-217 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of Set Theory.

**Course Outcomes:** At the end of the course, a student will be able to:

| CO No. | Course Outcome | Blooms Taxonomy Level |
|---|---|---|
| CO1 | Analyse various concepts of statistics and apply to various engineering problems | 4 |
| CO2 | Evaluate various engineering problems using concepts of probability | 3 |
| CO3 | Solve various engineering problems related to discrete and continuous distributions | 3 |
| CO4 | Analyse sampling theory and apply it to various engineering problems | 4 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Introduction to basic Statistics, moments, correlation, regression, methods of least square, curve fitting (polynomials, exponentials). | 10 |
| Module 2 | Basic definitions of probability, conditional probability with standard results, Bays theorem with examples. Discrete and Continuous Random variables, Distribution functions, Expectation and Variance of Probability distribution, and Moment Generating function, Moments and properties. | 12 |
| Module 3 | Discrete distributions: Binomial, Poisson and Geometric distributions and their applications.Continuous distribution: Uniform, Exponential and Normal distributions, Normal approximation to Binomial distribution and their applications. | 10 |
| Module 4 | Introduction to sampling theory, types of sampling, purposive sampling, random sampling, simple sampling, stratified sampling, test of significance, null and alternate hypothesis, errors in sampling. | 10 |

**Recommended Books:**


1. Spiegel, M. R., Schiller, J. and Srinivasan, R. A., *Probability and Statistics*, 3rd Edition, Tata Mc-Graw Hill, (2010).

2. S. C. Gupta and V. K. Kapoor, *Fundamentals of Mathematical Statistics*, 12th Edition, Sultan Chand & Sons Publications, (2020).

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B. Tech. Information Technology Engg. 2nd Year (4th Semester) | Introduction to Probability Theory and Statistics | MAT-218 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of set theory.

**Course Outcomes:** At the end of the course, a students should be able to:

| CO NO. | Course Outcomes | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Analyse various concepts of statistics and apply to various engineering problems | 4 |
| CO2 | Evaluate various engineering problems using concepts of probability | 3 |
| CO3 | Solve various engineering problems related to discrete and continuous distributions | 3 |
| CO4 | Analyse sampling theory and apply it to various engineering problems | 4 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Introduction to basic Statistics, moments, correlation, regression, methods of least square, curve fitting (polynomials, exponentials). | 14 |
| Module 2 | Basic definitions of probability, conditional probability with standard results, Bays theorem with examples. Discrete and Continuous Random variables, Distribution functions, Expectation and Variance of Probability distribution, and Moment Generating function, Moments and properties. | 14 |
| Module 3 | Discrete distributions: Binomial, Poisson and Geometric distributions and their applications.Continuous distribution: Uniform, Exponential and Normal distributions, Normal approximation to Binomial distribution and their applications. | 6 |
| Module 4 | Introduction to sampling theory, types of sampling, purposive sampling, random sampling, simple sampling, stratified sampling, test of significance, null and alternate hypothesis, errors in sampling. | 8 |

**Recommended Books:**


1. Johnson, Miller and Freund, *Probability and Statistics for Engineers*, Pearson Education India,8th Edition, (2015).
2. S. C. Gupta, *Fundamentals of Statistics*,8thRevised Edition, Himalaya Publication, (2023).
3. S. Ross, *A First Course in Probability*, 6th Edition, Pearson Education India, (2002).


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| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B.Tech. Electronics and Communication Engg. 3rd Year (5th Semester) | Mathematics-V (Complex Variables and Special Functions) | MAT-301 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of calculus.

**Course Outcomes:** At the end of the course, a student will be able to:

| CO No. | Course Outcome | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Analyse the complex functions for continuity, differentiability and analyticity. | 4 |
| CO2 | Solve the problems related to complex Integration, series expansion of complex functions and classification of singularities | 3 |
| CO3 | Solve problems related to series expansion of complex functions | 5 |
| CO4 | Apply concepts of special functions in various engineering problems. | 3 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Function of a Complex variable, Limit, Continuity and Differentiability of complex function. Cauchy-Riemann Equations, Polar Coordinates, Analytic function, Harmonic functions and Properties of Analytic functions, Construction of Analytic function whose real or imaginary part is given, Elementary function. | 15 |
| Module 2 | Contours and Contour Integrals, ML Theorem, Cauchy Integral Theorem, Antiderivatives and Definite Integrals, Cauchy Integral Formula, Cauchy Integral formula for Derivatives, Evaluation of Improper Definite Integrals by Contour Integration. | 10 |
| Module 3 | Taylor Series, Laurant Series, Classification of Singularities, Zeros of Analytic functions, Residues, Cauchy's Residue Theorem and its Applications. | 10 |
| Module 4 | **Special Functions:** Legendre's functions, Rodrigue's formula, generating functions for Legendre's Polynomials and recurrence formulae. Bessel's functions, Recurrence formulae and Bessel's functions of integral order. | 7 |

**Recommended Books:**


1. J.W.Brown and R.V Churchill, *Complex Variables and Applications*, 8th Edition, Mc-Graw Hill International Edition, (2009).
2. R.K. Jain and S. R. K. Iyengar, *Advanced Engineering Mathematics*, 3rd Edition, Narosa Pub. House, (2008).

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B.Tech. Chemical Engg.(Hons) 3rd Year (5th Semester) | Applied Mathematics for Chemical Engineers (Complex Variables & Functions) | MAT-302 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **InternalAssessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of calculus.

**Course Outcomes:** At the end of the course, a student will be able to:

| CO No. | Course Outcome | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Analyse the complex functions for continuity, differentiability and analyticity. | 4 |
| CO2 | Solve the problems related to complex Integration | 3 |
| CO3 | Solve problems related to series expansion of complex functions | 3 |
| CO4 | Determine the singularities and calculation of residues of complex functions. | 5 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Function of a Complex variable, Limit, Continuity and Differentiability of complex function. Cauchy-Riemann Equations, Polar Coordinates, Analytic function, Harmonic functions and Properties of Analytic functions, Elementary function. | 12 |
| Module 2 | Derivatives of functions w(t), Definite Integrals of functions w(t), Contours and Contour Integrals, ML Theorem, Cauchy Integral Theorem, Antiderivatives and Definite Integrals. | 10 |
| Module 3 | Cauchy Integral Formula, Cauchy Integral formula for Derivatives, Evaluation of Improper Definite Integrals by Contour Integration, Liouville's Theorem and its consequences. | 10 |
| Module 4 | Taylor Series, Laurant Series, Classification of Singularities, Residues, Cauchy's Residue Theorem and its Applications, Zeros of Analytic functions, Rouche's Theorem and its consequences. | 10 |

**Recommended Books:**


1. J.W.Brown and R.V Churchill, *Complex Variables and Applications*, 8th Edition, Tata Mc-Graw Hill Edition, (2009).
2. R.K. Jain and S. R. K. Iyengar,*Advanced Engineering Mathematics*, 3rd Edition, Narosa Pub. House, (2008).

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B.Tech. Electrical Engg. 3rd Year (5th Semester) | Mathematics-V (Complex Variables and Numerical Methods) | MAT-303 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of calculus.

**Course Outcomes:** At the end of the course, a student will be able to:

| CO No. | Course Outcome | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Analyse the complex functions for continuity, differentiability and analyticity. | 4 |
| CO2 | Solve the problems related to complex Integration, series expansion of complex functions and classification of singularities | 3 |
| CO3 | Determine the numerical solution of algebraic and transcendental equations | 5 |
| CO4 | Apply numerical techniques for solving ordinary differential equations. | 3 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Function of a Complex variable, Limit, Continuity and Differentiability of complex function. Cauchy-Riemann Equations, Polar Coordinates, Analytic function, Harmonic functions and Properties of Analytic functions, Construction of Analytic function whose real or imaginary part is given. | 10 |
| Module 2 | Contours and Contour Integrals, ML Theorem, Cauchy Integral Theorem, Cauchy Integral Formula, Cauchy Integral formula for Derivatives.Taylor Series, Laurant Series, Classification of Singularities, Zeros of Analytic functions, Residues, Cauchy's Residue Theorem and its Applications. | 18 |
| Module 3 | Regula-Fast method, Bolzano's Process of bisection of intervals, Newton-Raphson Method and its geometrical significance | 7 |
| Module 4 | Numerical solution of ordinary differential equations, Picard's method. Taylor's series method, Euler's method, Runge Kutta Method | 7 |

**Recommended Books:**


1. J.W. Brown and R.V. Churchill, *Complex Variables and Applications*, 8th Edition, 2009, Tata Mc-Graw Hill Edition, (1996).
2. S. R. Iyengar and R.K. Jain, *Advanced Engineering Mathematics*, 3rd Edition, Narosa Pub. House, 2008.
3. S.S. Sastry, *Introductory methods in Numerical Analysis*, 5th Edition, Prentice Hall India learning Pvt. Ltd., (2012).
4. Kendall E. Atkinson, Han, *Elementary Numerical Analysis*, 3rd Edition, Wiley India Pvt. Ltd., (2006).
5. J.B. Scarborough, *Mathematical Numerical Analysis*, 6th Edition, Oxford and IBH Publishers, (2020).

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B. Tech. Chemical Engg. 3rd Year (5th Semester) Elective Course | Operations Research | MAT-001 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **InternalAssessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of algebra.

**Course Outcomes:** At the end of the course, a student will be able to:

| CO No. | Course Outcome | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Analyse the problem and provide its solution by using graphical method. | 4 |
| CO2 | Determine the optimal solution of LPP by using simplex and dual simplex method. | 5 |
| CO3 | Determine the solution of a transportation problem by various methods. | 5 |
| CO4 | Solve the Assignment model by using Hungarian method. | 3 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Formulation of Linear Programming Problems, General Statement of LPP, Assumptions Underlying LP, Solution of Linear Programming Problems: Graphic Method. Some Special Cases of Graphic Method, Convex Set: Extreme points of Convex Set, Convex hull. | 8 |
| Module 2 | LP Model in Equation Form, Transition From Graphical To Algebraic Solution, Simplex Algorithm, Artificial starting solution: Big M-Method, Two-phase Method, Special cases in Simplex Method: Degeneracy, Alternative Optima, Unbounded solution, infeasible solution.<br>Duality in LP, Primal-Dual Relationships, General Rules for Converting any Primal into its Dual, Optimal Dual Solution, Dual Simplex Method, Comparison of solutions to the primal and its Dual. | 16 |
| Module 3 | Mathematical Model of Transportation Problem, Methods of finding Initial basic feasible solution by NWC Rule, LCM,VAM, Test for optimality by Stepping Stone and MODI method, Balanced and Unbalanced Transportation Problems, Degeneracy. | 10 |
| Module 4 | Assignment Model: Mathematical Model of Assignment Problem, The Hungarian Method, Simplex Explanation of the Hungarian Method. | 8 |

**Recommended Books:**


1. Hamdy A. Taha, *Operations Research, An Introduction,* 10th Edition, Pearson Publication India, (2017).
2. P Mariappan, *Operations Research: An Introduction,* 1st Edition, Pearson Publication India, (2013).
3. A Tamilarasi and A M Natarajan, *Operations Research,* 2nd Edition, Pearson Publication India, (2014).

| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B. Tech. Computer Science and Engineering<br>4th year (7th Semester)<br>Elective Course | Operations Research | MAT-002 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of Matrix Theory

**Course Outcomes:** At the end of the course, a student should be able to:

| CO No. | Course Outcome | Blooms Taxonomy Level |
|---|---|---|
| CO1 | Formulate LPP's and apply various optimization methods for solving these. | 6 |
| CO2 | Solve transportation problems using different optimization methods. | 3 |
| CO3 | Solve assignment problems using different optimization techniques. | 3 |
| CO4 | Solve problems related to game theory. | 3 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Introduction to Operations Research: Basics definitions, Scope, Objectives, Linear Programming Problem (LPP), Formulation of LPP, Graphical solution of LPP, Simplex Method, Artificial variables, Big-M method, Two-phase method, degeneracy and unbounded solutions. | 10 |
| Module 2 | Transportation Problem. Formulation, balanced solution and unbalanced Transportation problems. Finding basic feasible solutions – Northwest corner rule, Least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method. | 10 |
| Module 3 | Assignment problem, Formulation, Hungarian method for optimal solution. Solving unbalanced problem. Travelling salesman problem and assignment problem, Sequencing models, Solution of Sequencing Problem – Processing n Jobs through 2 Machines – Processing n Jobs through 3 Machines – Processing 2 Jobs through m machines. Replacement model | 12 |
| Module 4 | Game Theory: Introduction to Game theory, Two-person zero sum games. Dominance, Graphical method for $(2 \times n)$ and $(m \times 2)$ games, Matrix methods for $m \times n$ games. | 10 |

**Recommended Books:**


1. S. D. Sharma, *Operations Research*, 17th Edition, KNRN publishers, (2014).
2. H. A. Taha, *Operations Research-An Introduction*, 10th Edition, Pearson Education India, (2017).


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| Year (Semester) | Course Title | Course Code | L-T-P-Credits |
|---|---|---|---|
| B.Tech. Information Technology Engg. 3rd Year (6th Semester) (Elective Course) | Numerical Methods | MAT-003 | 3-0-0-3 |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** |
| | 26 Marks | 24 Marks | 50 Marks |

**Pre-requisites:** A student should have basic knowledge of calculus.

**Course Outcomes:** At the end of the course, a student will be able to:

| CO No. | Course Outcome | Bloom's Taxonomy Level |
|---|---|---|
| CO1 | Determine the numerical solution of algebraic and transcendental equations. | 5 |
| CO2 | Solve the problems related to inverse by various numerical methods. | 3 |
| CO3 | Analyze how to approximate the functions using interpolating polynomials and finding intermediate values. | 4 |
| CO4 | Apply numerical techniques for solving ordinary differential equations. | 3 |

**Detailed Syllabus:**

| Module No. | Contents | Hours |
|---|---|---|
| Module 1 | Floating-point form of numbers, Round-off, Algorithm, Stability, Programming errors, Errors of numerical results, Error propagation, Basic error principle, Loss of significant digits. Bolzano's bisection method, iteration method, Regula-Falsi method, Newton-Raphson method, numerical solution for system of equations. Gauss elimination method, Gauss-Jordan method, Computation of Inverse by Gauss's Method, LU decomposition, Gauss-Siedel iteration method, Jacobi method, The Eigen value problem | 15 |
| Module 2 | Interpolation Forward, Backward and Shift operators, Central differences, their relations, Existence, Uniqueness of interpolating polynomial, error of interpolation - unequally spaced data; Lagrange's formula, | 7 |
| Module 3 | Newton's divided difference formula. Equally spaced data : finite difference operators and their properties, Newton's forward and backward interpolation formulae, Gauss's forward and backward. | 8 |
| Module 4 | Numerical differentiation using difference techniques, Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rule, Truncation error, Rómberg's method. Picard's method, Taylor series method, Euler and modified Euler method, Runge-Kutta method of 4th order, Predictor-Corrector methods (Adam's-Moulton method & Milne's method. | 12 |

**Recommended Books:**


1. S. S. Sastry, *Introductory methods in Numerical Analysis*, 5th Edition, Prentice Hall India learning Pvt Ltd., (2012).
2. Kendall E. Atkinson, Han, *Elementary Numerical Analysis*, 3rd Edition, Wiley India Pvt Ltd., (2006).
3. J.B. Scarborough, *Mathematical Numerical Analysis*, 6th Edition, Oxford and IBH Publishers, (2020).


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