National Institute of Technology, Hamirpur (HP)
Department of Mathematics

S. No	Course No.	Course Name	(Branch & Year)
		B.Tech. 1st Semester	
1.	CES-111	Engineering Mathematics-I	CE 1st Year
2.	EES-111	Engineering Mathematics-I	EE 1st Year
3.	MES-111	Engineering Mathematics-I	ME 1st Year
4.	ECS-111	Engineering Mathematics-I	ECE 1st Year
5.	CSS-111	Engineering Mathematics-I	CSE 1st Year
6.	CHS-111	Engineering Mathematics-I	CHE 1st Year
7.	ARS-115	Architecture Mathematics-I	Arch. 1st Year
		B.Tech. 2nd Semester	
8.	CES-121	Engineering Mathematics-II	CE 1st Year
9.	EES-121	Engineering Mathematics-II	EE 1st Year
10.	MES-121	Engineering Mathematics-II	ME 1st Year
11.	ECS-121	Engineering Mathematics-II	ECE 1st Year
12.	CSS-121	Engineering Mathematics-II	CSE 1st Year
13.	CHS-121	Engineering Mathematics-II	CHE 1st Year
		B.Tech. 3rd Semester	
14.	CES-211	Engineering Mathematics-III	CE 2nd Year
15.	EES-211	Advanced Engineering Mathematics	EE 2nd Year
16.	MES-211	Engineering Mathematics-III	ME 2nd Year
17.	ECS-211	Engineering Mathematics-III	ECE 2nd Year
18.	CSS-210	Probability and Queuing Models	CSE 2nd Year
		B.Tech. 4th Semester	
19.	MES-221	Computer Programming & Numerical Methods for Mechanical Engineers	ME 2nd Year
20.	MES-226	Computer Programming & Numerical Methods Lab	ME 2nd Year
21.	CHS-224	Engineering Mathematics-III	CHE 2nd Year
		B.Tech. 5th Semester	
22.	MAO-316(a)	Operational Research	3rd Year (Open Elective)
23.	MAO-316(b)	Linear Algebra	3rd Year (Open Elective)
		B.Tech. 6th Semester	
24.	MAO-325(a)	Probability, Statistics and Queuing Models	3rd Year (Open Elective)
		Dual Degree (B.Tech.+M.Tech.) 1st Semester	
25.	ECS-111	Engineering Mathematics-I	ECE 1st Year
26.	CSS-111	Engineering Mathematics-I	CSE 1st Year
		Dual Degree (B.Tech.+M.Tech.) 2nd Semester	
27.	ECS-121	Engineering Mathematics-II	ECE 1st Year
28.	CSS-121	Engineering Mathematics-II	CSE 1st Year
		Dual Degree (B.Tech.+M.Tech.) 3rd Semester	
29.	ECS-211	Engineering Mathematics-III	ECE 2nd Year
30.	CSS-210	Probability and Queuing Models	CSE 2nd Year

		M.Tech. 2nd Semester	
31.	MA-601	Methods of Applied Mathematical Physics	ME-M.Tech.
32.	CE-634	Statistical Analysis in Transportation Systems	CE-M.Tech.
33.	EN-624	Statistical Methods & Modelling	CEEE-M.Tech.

Indian Institute of Information Technology (IIIT), Una (Saloh), Himachal Pradesh

S. No	Course No.	Course Name	(Branch & Year)
		B.Tech. 1ˢᵗ Semester	
34.	ECS-111	Engineering Mathematics-I	ECE 1ˢᵗ Year
35.	CSS-111	Engineering Mathematics-I	CSE 1ˢᵗYear
		B.Tech 2ⁿᵈ Semester	
36.	ECS-121	Engineering Mathematics-II	ECE 1ˢᵗ Year
37.	CSS-121	Engineering Mathematics-II	CSE 1ˢᵗYear
		B.Tech. 3ʳᵈ Semester	
38.	ECS-211	Engineering Mathematics-III	ECE 2ⁿᵈ Year
39.	CSS-210	Probability and Queuing Models	CSE 2ⁿᵈ Year
		B.Tech. 5ᵗʰ Semester	
40.	MAO-316(a)	Operational Research	3rd Year (Open Elective)
41.	MAO-316(b)	Linear Algebra	3rd Year (Open Elective)
		B.Tech. 6ᵗʰ Semester	
42.	MAO-325(a)	Probability, Statistics and Queuing Models	3rd Year (Open Elective)

Courses offered by the Department of Mathematics, NITH for Ph.D. Programs in various specializations

		Ph.D.	
43.	MA-851	Numerical Techniques & Computer Simulations	Ph.D.
44.	MA-798	Advanced Mathematics	Ph.D.
45.	MA-851	Fixed Point Theory and Applications	Ph.D.
46.	MA-852	Graph & Matrix Theory	Ph.D.
47.	MA-852	Mathematical Methods	Ph.D.
48.	MA-852	Hydrodynamic and Hydromagnetic Stability	Ph.D.

ENGINEERING MATHEMATICS-I [CES-111]

L T P 3 1 0

Unit I Linear Algebra

Algebra of matrices, inverse, rank, system of linear equations, symmetric, skew-symmetric, and orthogonal matrices. Hermitian, skew-Hermitian and unitary matrices. Eigen values and Eigen vectors, diagonalisation of matrices, Cayley-Hamilton Theorem.

Unit II Calculus

Functions of single variable, limit, continuity and differentiability, Mean value theorems, Indeterminate forms and L'Hospital rule, Maxima and minima, Taylor's series, Fundamental and mean value theorems of integral calculus. Evaluation of definite and improper integrals, Beta and Gamma functions, Functions of two variables, limit, continuity, partial derivatives, Euler's theorem for homogeneous functions, total derivatives, maxima and minima, Lagrange method of multipliers, double and triple integrals and their applications, sequence and series, tests for convergence, power series, Fourier series, Half range sine and cosine series.

Unit III Vector Calculus

Gradient, divergence and curl, vector identities, directional derivatives, line, surface and volume integrals, Stokes, Gauss and Green's theorems (without proofs) applications.

Unit IV Integral Calculus

Quadrature, Rectification, Surface and Volume of revolution for simple curves, Double integrals and their applications, Change of order of integration, Triple integrals and their applications, Change of variables.

Unit V Complex Variables

Analytic functions, Cauchy-Riemann equations, Application in solving potential problems, Line integral, Cauchy's integral theorem and integral formula (without proof), Taylor's and Laurent' series, Residue theorem (without proof) and its applications.

Books

1. Engineering Mathematics through Applications: by Paras Ram, CBS Publications.
2. Advanced Engineering Mathematics: by Erwin Kreyszig, John Wiley and Sons, NC, New York.
3. Advanced Engineering Mathematics: by R. K. Jain & S. R. K Iyengar, Narosa Pub. House.
4. Advanced Engineering Mathematics: by C. R. Wylie & L. C. Barrett, McGraw Hill.
5. Differential & Integral Calculus: by N. Piskunov, MIR Publications.

ENGINEERING MATHEMATICS-I [EES-111]

L T P 3 1 0

1. MATRICES

Matrices, Related matrices, Complex matrices (Hermitian and skew-Hermitian matrices, Unitary matrix), Solution of linear system of equations, Rank of a matrix, Gauss-Jordan method, Normal form of a matrix, Vectors, Linear dependence, Consistency of a linear system of equations, Rouche's theorem, System of linear homogeneous equations, Linear and orthogonal transformations, Characteristic equation, Eigen values, Eigen vectors, Properties of eigen values, Cayley-Hamilton theorem, Reduction to diagonal form, Quadratic form and their reduction to canonical form.

2. INFINITE SERIES

Convergence and divergence of infinite series, Geometric series test, Positive term series, p-series test, [Comparison test, D'Alembert's ratio test, Cauchy's root test (Radical test), Integral test, Raabe's test, Logarithmic test, Gauss's test] (without proofs), Alternating series and Leibnitz's rule, Power series, Radius and interval of convergence.

3. DIFFERENTIAL CALCULUS

Indeterminate forms, Partial Differentiation and its geometrical interpretation, Homogeneous functions, Euler's theorem and its extension, Total differentials, Composite function, Jacobian, Taylor's and Maclaurin's infinite series, Errors and increments, Introduction to limits and Indeterminate forms, Maxima and minima of functions of two variables, Method of undetermined multipliers. Curve tracing.

4. INTEGRAL CALCULUS

Quadrature, Rectification, Surface and Volume of revolution for simple curves, Double and Triple integrals and their applications.

5. VECTOR CALCULUS

Differentiation of vectors, Curves in space, Velocity and acceleration, Relative velocity and acceleration, Scalar and vector point functions, Vector operator del, gradient, divergence and curl with their physical interpretations, Formulae involving gradient, divergence and curl. Line, surface and volume integrals, Theorems of Green, Stokes and Gauss (without proofs) and their verifications and applications, Irrotational and Solenoidal fields.

TEXT & REFERENCE BOOKS

1. Engineering Mathematics through Applications: by Paras Ram, CBS Publications.
2. Advanced Engineering Mathematics: by Erwin Kreyszig, John Wiley and Sons, NC, New York.
3. Advanced Engineering Mathematics: by R. K. Jain & S. R. K Iyengar, Narosa Pub. House.
4. Advanced Engineering Mathematics: by C. R. Wylie & L. C. Barrett, McGraw Hill
5. Differential & Integral Calculus: by N. Piskunov, MIR Publications.

ENGINEERING MATHEMATICS-I [MES-111]

L T P 3 1 0

1. MATRICES

Matrices, Related matrices, Complex matrices (Hermitian and skew-Hermitian matrices, Unitary matrix), Solution of linear system of equations, Rank of a matrix, Gauss-Jordan method, Normal form of a matrix, Vectors, Linear dependence, Consistency of a linear system of equations, Rouche's theorem, System of linear homogeneous equations, Linear and orthogonal transformations, Characteristic equation, Eigen values, Eigen vectors, Properties of eigen values, Cayley-Hamilton theorem, Reduction to diagonal form, Quadratic form and their reduction to canonical form.

2. INFINITE SERIES

Convergence and divergence of infinite series, Geometric series test, Positive term series, p-series test, [Comparison test, D'Alembert's ratio test, Cauchy's root test (Radical test), Integral test, Raabe's test, Logarithmic test, Gauss's test] (without proofs), Alternating series and Leibnitz's rule, Power series, Radius and interval of convergence.

3. DIFFERENTIAL CALCULUS

Indeterminate forms, Partial Differentiation and its geometrical interpretation, Homogeneous functions, Euler's theorem and its extension, Total differentials, Composite function, Jacobian, Taylor's and Maclaurin's infinite series, Errors and increments, Introduction to limits and Indeterminate forms, Maxima and minima of functions of two variables, Method of undetermined multipliers. Curve tracing.

4. INTEGRAL CALCULUS

Quadrature, Rectification, Surface and Volume of revolution for simple curves, Double integrals and their applications, Change of order of integration, Change of variables, Triple integrals and their applications, Change of variables.

5. VECTOR CALCULUS

Differentiation of vectors, Curves in space, Velocity and acceleration, Relative velocity and acceleration, Scalar and vector point functions, Vector operator del, gradient, divergence and curl with their physical interpretations, Formulae involving gradient, divergence and curl. Line, surface and volume integrals, Theorems of Green, Stokes and Gauss (without proofs) and their verifications and applications, Irrotational and Solenoidal fields.

TEXT BOOKS
1. Engineering Mathematics through Applications: by Paras Ram, CBS Publications.
2. Advanced Engineering Mathematics: by Erwin Kreyszig, John Wiley and Sons, NC, New York.
3. Advanced Engineering Mathematics: by R. K. Jain & S. R. K Iyengar, Narosa Pub. House.

REFERENCE BOOKS
1. Advanced Engineering Mathematics: by C. R. Wylie & L. C. Barrett, McGraw Hill
2. Differential & Integral Calculus: by N. Piskunov, MIR Publications.

ENGINEERING MATHEMATICS-I [ECS-111]

L T P 3 1 0

1. MATRICES

Matrices, Related matrices, Complex matrices (Hermitian and skew-Hermitian matrices, Unitary matrix), Solution of linear system of equations, Rank of a matrix, Gauss-Jordan method, Normal form of a matrix, Vectors, Linear dependence, Consistency of a linear system of equations, Rouche's theorem, System of linear homogeneous equations, Linear and orthogonal transformations, Characteristic equation, Eigen values, Eigen vectors, Properties of eigen values, Cayley-Hamilton theorem, Reduction to diagonal form, Quadratic form and their reduction to canonical form.

2. INFINITE SERIES

Convergence and divergence of infinite series, Geometric series test, Positive term series, p-series test, [Comparison test, D'Alembert's ratio test, Cauchy's root test (Radical test), Integral test, Raabe's test, Logarithmic test, Gauss's test] (without proofs), Alternating series and Leibnitz's rule, Power series, Radius and interval of convergence.

3. DIFFERENTIAL CALCULUS

Indeterminate forms, Partial Differentiation and its geometrical interpretation, Homogeneous functions, Euler's theorem and its extension, Total differentials, Composite function, Jacobian, Taylor's and Maclaurin's infinite series, Errors and increments, Introduction to limits and Indeterminate forms, Maxima and minima of functions of two variables, Method of undetermined multipliers. Curve tracing.

4. INTEGRAL CALCULUS

Quadrature, Rectification, Surface and Volume of revolution for simple curves, Double integrals and their applications, Change of order of integration, Change of variables, Triple integrals and their applications, Change of variables.

5. VECTOR CALCULUS

Differentiation of vectors, Curves in space, Velocity and acceleration, Relative velocity and acceleration, Scalar and vector point functions, Vector operator del, gradient, divergence and curl with their physical interpretations, Formulae involving gradient, divergence and curl. Line, surface and volume integrals, Theorems of Green, Stokes and Gauss (without proofs) and their verifications and applications, Irrotational and Solenoidal fields.

TEXT BOOKS
1. Engineering Mathematics through Applications: by Paras Ram, CBS Publications.
2. Advanced Engineering Mathematics: by Erwin Kreyszig, John Wiley and Sons, NC, New York.
3. Advanced Engineering Mathematics: by R. K. Jain & S. R. K Iyengar, Narosa Pub. House.

REFERENCE BOOKS
1. Advanced Engineering Mathematics: by C. R. Wylie & L. C. Barrett, McGraw Hill
2. Differential & Integral Calculus: by N. Piskunov, MIR Publications.

ENGINEERING MATHEMATICS-I [CSS-111]

L T P 3 1 0

1. MATRICES

Matrices, Related matrices, Complex matrices (Hermitian and skew-Hermitian matrices, Unitary matrix), Solution of linear system of equations, Rank of a matrix, Gauss-Jordan method, Normal form of a matrix, Vectors, Linear dependence, Consistency of a linear system of equations, Rouche's theorem, System of linear homogeneous equations, Linear and orthogonal transformations, Characteristic equation, Eigen values, Eigen vectors, Properties of eigen values, Cayley-Hamilton theorem, Reduction to diagonal form, Quadratic form and their reduction to canonical form.

2. INFINITE SERIES

Convergence and divergence of infinite series, Geometric series test, Positive term series, p-series test, [Comparison test, D'Alembert's ratio test, Cauchy's root test (Radical test), Integral test, Raabe's test, Logarithmic test, Gauss's test] (without proofs), Alternating series and Leibnitz's rule, Power series, Radius and interval of convergence.

3. DIFFERENTIAL CALCULUS

Indeterminate forms, Partial Differentiation and its geometrical interpretation, Homogeneous functions, Euler's theorem and its extension, Total differentials, Composite function, Jacobian, Taylor's and Maclaurin's infinite series, Errors and increments, Introduction to limits and Indeterminate forms, Maxima and minima of functions of two variables, Method of undetermined multipliers. Curve tracing.

4. INTEGRAL CALCULUS

Quadrature, Rectification, Surface and Volume of revolution for simple curves, Double integrals and their applications, Change of order of integration, Change of variables, Triple integrals and their applications, Change of variables.

5. VECTOR CALCULUS

Differentiation of vectors, Curves in space, Velocity and acceleration, Relative velocity and acceleration, Scalar and vector point functions, Vector operator del, gradient, divergence and curl with their physical interpretations, Formulae involving gradient, divergence and curl. Line, surface and volume integrals, Theorems of Green, Stokes and Gauss (without proofs) and their verifications and applications, Irrotational and Solenoidal fields.

TEXT BOOKS

1. Engineering Mathematics through Applications: by Paras Ram, CBS Publications.
2. Advanced Engineering Mathematics: by Erwin Kreyszig, John Wiley and Sons, NC, New York.
3. Advanced Engineering Mathematics: by R. K. Jain & S. R. K Iyengar, Narosa Pub. House.

REFERENCE BOOKS

1. Advanced Engineering Mathematics: by C. R. Wylie & L. C. Barrett, McGraw Hill
2. Differential & Integral Calculus: by N. Piskunov, MIR Publications.

ENGINEERING MATHEMATICS-I [CHS-111]

L T P 3 1 0

1. MATRICES

Matrices, Related matrices, Complex matrices (Hermitian and skew-Hermitian matrices, Unitary matrix), Solution of linear system of equations, Rank of a matrix, Gauss-Jordan method, Normal form of a matrix, Vectors, Linear dependence, Consistency of a linear system of equations, Rouche's theorem, System of linear homogeneous equations, Linear and orthogonal transformations, Characteristic equation, Eigen values, Eigen vectors, Properties of eigen values, Cayley-Hamilton theorem, Reduction to diagonal form, Quadratic form and their reduction to canonical form.

2. INFINITE SERIES

Convergence and divergence of infinite series, Geometric series test, Positive term series, p-series test, [Comparison test, D'Alembert's ratio test, Cauchy's root test (Radical test), Integral test, Raabe's test, Logarithmic test, Gauss's test] (without proofs), Alternating series and Leibnitz's rule, Power series, Radius and interval of convergence.

3. DIFFERENTIAL CALCULUS

Indeterminate forms, Partial Differentiation and its geometrical interpretation, Homogeneous functions, Euler's theorem and its extension, Total differentials, Composite function, Jacobian, Taylor's and Maclaurin's infinite series, Errors and increments, Introduction to limits and Indeterminate forms, Maxima and minima of functions of two variables, Method of undetermined multipliers. Curve tracing.

4. INTEGRAL CALCULUS

Quadrature, Rectification, Surface and Volume of revolution for simple curves, Double integrals and their applications, Change of order of integration, Change of variables, Triple integrals and their applications, Change of variables.

5. VECTOR CALCULUS

Differentiation of vectors, Curves in space, Velocity and acceleration, Relative velocity and acceleration, Scalar and vector point functions, Vector operator del, gradient, divergence and curl with their physical interpretations, Formulae involving gradient, divergence and curl. Line, surface and volume integrals, Theorems of Green, Stokes and Gauss (without proofs) and their verifications and applications, Irrotational and Solenoidal fields.

TEXT BOOKS
1. Engineering Mathematics through Applications: by Paras Ram, CBS Publications.
2. Advanced Engineering Mathematics: by Erwin Kreyszig, John Wiley and Sons, NC, New York.
3. Advanced Engineering Mathematics: by R. K. Jain & S. R. K Iyengar, Narosa Pub. House.

REFERENCE BOOKS
1. Advanced Engineering Mathematics: by C. R. Wylie & L. C. Barrett, McGraw Hill
2. Differential & Integral Calculus: by N. Piskunov, MIR Publications.

ARCHITECTURE MATHEMATICS-I [ARS-115]

L T P 3 1 0

1. MATRICES
Matrices, Related matrices, Complex matrices (Hermitian and skew-Hermitian matrices, Unitary matrix), Solution of linear system of equations, Rank of a matrix, Gauss-Jordan method, Normal form of a matrix, Vectors, Linear dependence, Consistency of a linear system of equations, Rouche's theorem, System of linear homogeneous equations, Linear and orthogonal transformations, Characteristic equation, Eigen values, Eigen vectors, Properties of eigen values, Cayley-Hamilton theorem.

2. DIFFERENTIAL CALCULUS
Indeterminate forms, Partial Differentiation and its geometrical interpretation, Homogeneous functions, Euler's theorem and its extension, Total differentials, Composite function, Jacobian, Errors and increments, Maxima and minima of functions of two variables, Method of undetermined multipliers, Curvature, radius of curvature, Centre & Circle of curvature.

3. CURVE TRACING
Asymptotes, Curves in Cartesian and Polar form, Standard curves- Cartesian & Polar curves, Parametric curves, standard Parametric curves.

4. THREE DIMENSIONAL GEOMETRY
Review: Line, plane, sphere, vectors.
Tangent plane to sphere, cone, cylinder, Quadric surfaces-(Ellipsoids, Hyperboloid of one and two sheets, cone, elliptic paraboloid, hyperbolic paraboloid, cylinder) , surface of revolution, some standard surfaces of revolution.

5. SPHERICAL TRIGONOMETRY
Sections of spheres, great circles, spherical triangle and its properties, relations in angles and sides of spherical triangle, spherical right triangle.

6. INTEGRAL CALCULUS
Quadrature, Rectification, Surface and Volume of revolution for simple curves, Double integrals and their applications, Change of order of integration, Change of variables, Triple integrals and their applications, Change of variables. Numerical Integration-(Simpson's and Trapezoidal rule)

7. VECTOR CALCULUS
Differentiation of vectors, Curves in space, Velocity and acceleration, Relative velocity and acceleration, Scalar and vector point functions, Vector operator del, gradient, divergence and curl with their physical interpretations, Formulae involving gradient, divergence and curl. Line, surface and volume integrals, Theorems of Green, Stokes and Gauss (without proofs) and their verifications and applications,

TEXT BOOKS
1. Advanced Engineering Mathematics: by Erwin Kreyszig, John Wiley and Sons, NC, New York.
2. Engineering Mathematics through Applications: by Paras Ram, CBS Publications.
3. Advanced Engineering Mathematics: by R. K. Jain & S. R. K Iyengar, Narosa Pub. House.
4. Spherical Trigonometry: Kishana Publications, Meerut.

REFERENCE BOOKS
1. Advanced Engineering Mathematics: by C. R. Wylie & L. C. Barrett, McGraw Hill
2. Differential & Integral Calculus: by N. Piskunov, MIR Publications.

ENGINEERING MATHEMATICS-II [CES-121]

L T P 3 1 0

Ordinary and Partial Differential Equations:

First order equation (linear and nonlinear), Second order linear differential equations with variable coefficients, Variation of parameters method, higher order linear differential equations with constant coefficients, Cauchy- Euler's equations, power series solutions, Legendre polynomials and Bessel's functions of the first kind and their properties, Separation of variables method, Laplace equation and its application to engineering problem.

Integral Transform:

Laplace transforms of standard functions and their properties, Properties of Inverse Laplace transforms, Convolution Theorem and its application.

Probability and Statistics:

Definitions of probability and simple theorems, conditional probability, Bayes Theorem, random variables, discrete and continuous distributions, Binomial, Poisson, Gaussian and normal distributions, correlation and, linear regression, Probability density function, Types of error, methods of error analysis, uncertainty analysis, statistical analysis and rejection of data.

Books:

1. Elementary Differential Equations and Boundary Value Problems 9th Edition by Richard C. Diprima, William E. Boyce
2. Vector Calculus by Michael Corral
3. Probability and Statistics for Programmers by Allen B. Downey, published by O'Reilly Media

ENGINEERING MATHEMATICS-II [EES-121]

L T P 3 1 0

1. FOURIER SERIES
Euler's formula, Conditions for a Fourier expansion, Functions having points of discontinuity, Change of interval, Odd and even periodic functions, Expansion of odd and even periodic functions, Half-range series, Typical wave-forms, Parseval's formula, Practical harmonic analysis.

2. ORDINARY DIFFERENTIAL EQUATIONS
Brief review of first order ordinary differential equations, Exact equations, Equations reducible to exact equations, Equations of the first order and higher degree, Clairaut's equation, Applications of differential equations of first order (Orthogonal trajectories). Linear differential equations with constant co-efficients, Complimentary functions and particular integral, Method of variation of parameters, Equations reducible to linear equations with constant co-efficients (Cauchy's and Legendre's linear equations), Simultaneous linear equations with constant co-efficients, Applications of linear differential equations in engineering.

3. COMPLEX NUMBERS
Applications of De Moivre's theorem, Exponential, Circular, Hyperbolic and Logarithmic functions of a complex variable, Inverse Hyperbolic functions, Real and imaginary parts of Circular and Hyperbolic functions, Summation of the series-'C+iS' method.

4. FUNCTIONS OF COMPLEX VARIABLE
Limit and derivative of complex functions, Cauchy-Riemann equations, Analytic functions and its applications, Geometrical representation of complex function, Conformal mapping and standard transformations, Complex integration, Cauchy's theorem, Cauchy's integral formula, Series of complex terms, Taylor's and Laurent's series, Cauchy's residue theorem and its application for the evaluation of real definite integrals.

5. INTEGRAL TRANSFORMS
Laplace Transforms of standard functions and their properties, Inverse Laplace Transforms, General Properties of inverse Laplace transforms and Convolution Theorem, Laplace Transforms of periodic functions, Bessel functions, Error function, Dirac-delta Function, Heaviside's Unit Function, Applications to linear simultaneous differential equations.

TEXT BOOKS
1. Engineering Mathematics through Applications: by Paras Ram, CBS Publications.
2. Advanced Engineering Mathematics: by Erwin Kreyszig, John Wiley and Sons, NC, New York.
3. Advanced Engineering Mathematics: by R. K. Jain & S. R. K Iyengar, Narosa Pub. House.

REFERENCE BOOKS
1. Advanced Engineering Mathematics: by C. R. Wylie & L. C. Barrett, McGraw Hill.
2. Vector Calculus: by C. E. Weatherburn. John Wiley and Sons, NC, New York.
3. Complex variables and Applications: by R. V. Churchill, T. J. Brown & R. F. Verhey, McGraw Hill.
4. Differential Equations: by Shepley L. Ross, John Wiley & Sons, New York.

ENGINEERING MATHEMATICS-II [MES-121]

L T P 3 1 0

1. FOURIER SERIES
Euler's formula, Conditions for a Fourier expansion, Functions having points of discontinuity, Change of interval, Odd and even periodic functions, Expansion of odd and even periodic functions, Half-range series, Typical wave-forms, Parseval's formula, Practical harmonic analysis.

2. ORDINARY DIFFERENTIAL EQUATIONS
Brief review of first order ordinary differential equations, Exact equations, Equations reducible to exact equations, Equations of the first order and higher degree, Clairaut's equation, Applications of differential equations of first order (Orthogonal trajectories). Linear differential equations with constant co-efficients, Complimentary functions and particular integral, Method of variation of parameters, Equations reducible to linear equations with constant co-efficients (Cauchy's and Legendre's linear equations), Simultaneous linear equations with constant co-efficients, Applications of linear differential equations in engineering.

3. COMPLEX NUMBERS
Applications of De Moivre's theorem, Exponential, Circular, Hyperbolic and Logarithmic functions of a complex variable, Inverse Hyperbolic functions, Real and imaginary parts of Circular and Hyperbolic functions, Summation of the series-'C+iS' method.

4. FUNCTIONS OF COMPLEX VARIABLE
Limit and derivative of complex functions, Cauchy-Riemann equations, Analytic functions and its applications, Geometrical representation of complex function, Conformal mapping and standard transformations, Complex integration, Cauchy's theorem, Cauchy's integral formula, Series of complex terms, Taylor's and Laurent's series, Cauchy's residue theorem and its application for the evaluation of real definite integrals.

5. INTEGRAL TRANSFORMS
Laplace Transforms of standard functions and their properties, Inverse Laplace Transforms, General Properties of inverse Laplace transforms and Convolution Theorem, Laplace Transforms of periodic functions, Bessel functions, Error function, Dirac-delta Function, Heaviside's Unit Function, Applications to linear simultaneous differential equations.

TEXT BOOKS
1. Engineering Mathematics through Applications: by Paras Ram, CBS Publications.
2. Advanced Engineering Mathematics: by Erwin Kreyszig, John Wiley and Sons, NC, New York.
3. Advanced Engineering Mathematics: by R. K. Jain & S. R. K Iyengar, Narosa Pub. House.

REFERENCE BOOKS
1. Advanced Engineering Mathematics: by C. R. Wylie & L. C. Barrett, McGraw Hill.
2. Vector Calculus: by C. E. Weatherburn. John Wiley and Sons, NC, New York.
3. Complex variables and Applications: by R. V. Churchill, T. J. Brown & R. F. Verhey, McGraw Hill.
4. Differential Equations: by Shepley L. Ross, John Wiley & Sons, New York.

ENGINEERING MATHEMATICS-II [ECS-121]

L T P 3 1 0

1. FOURIER SERIES
Euler's formula, Conditions for a Fourier expansion, Functions having points of discontinuity, Change of interval, Odd and even periodic functions, Expansion of odd and even periodic functions, Half-range series, Typical wave-forms, Parseval's formula, Practical harmonic analysis.

2. ORDINARY DIFFERENTIAL EQUATIONS
Brief review of first order ordinary differential equations, Exact equations, Equations reducible to exact equations, Equations of the first order and higher degree, Clairaut's equation, Applications of differential equations of first order (Orthogonal trajectories). Linear differential equations with constant co-efficients, Complimentary functions and particular integral, Method of variation of parameters, Equations reducible to linear equations with constant co-efficients (Cauchy's and Legendre's linear equations), Simultaneous linear equations with constant co-efficients, Applications of linear differential equations in engineering.

3. COMPLEX NUMBERS
Applications of De Moivre's theorem, Exponential, Circular, Hyperbolic and Logarithmic functions of a complex variable, Inverse Hyperbolic functions, Real and imaginary parts of Circular and Hyperbolic functions, Summation of the series-'C+iS' method.

4. FUNCTIONS OF COMPLEX VARIABLE
Limit and derivative of complex functions, Cauchy-Riemann equations, Analytic functions and its applications, Geometrical representation of complex function, Conformal mapping and standard transformations, Complex integration, Cauchy's theorem, Cauchy's integral formula, Series of complex terms, Taylor's and Laurent's series, Cauchy's residue theorem and its application for the evaluation of real definite integrals.

5. INTEGRAL TRANSFORMS
Laplace Transforms of standard functions and their properties, Inverse Laplace Transforms, General Properties of inverse Laplace transforms and Convolution Theorem, Laplace Transforms of periodic functions, Bessel functions, Error function, Dirac-delta Function, Heaviside's Unit Function, Applications to linear simultaneous differential equations.

TEXT BOOKS
1. Advanced Engineering Mathematics: by Erwin Kreyszig, John Wiley and Sons, NC, New York.
2. Engineering Mathematics through Applications: by Paras Ram, CBS Publications.
3. Advanced Engineering Mathematics: by R. K. Jain & S. R. K Iyengar, Narosa Pub. House.

REFERENCE BOOKS
1. Advanced Engineering Mathematics: by C. R. Wylie & L. C. Barrett, McGraw Hill.
2. Vector Calculus: by C. E. Weatherburn. John Wiley and Sons, NC, New York.
3. Complex variables and Applications: by R. V. Churchill, T. J. Brown & R. F. Verhey, McGraw Hill.
4. Differential Equations: by Shepley L. Ross, John Wiley & Sons, New York.

ENGINEERING MATHEMATICS-II [CSS-121]

L T P 3 1 0

1. FOURIER SERIES
Euler's formula, Conditions for a Fourier expansion, Functions having points of discontinuity, Change of interval, Odd and even periodic functions, Expansion of odd and even periodic functions, Half-range series, Typical wave-forms, Parseval's formula, Practical harmonic analysis.

2. ORDINARY DIFFERENTIAL EQUATIONS
Brief review of first order ordinary differential equations, Exact equations, Equations reducible to exact equations, Equations of the first order and higher degree, Clairaut's equation, Applications of differential equations of first order (Orthogonal trajectories). Linear differential equations with constant co-efficients, Complimentary functions and particular integral, Method of variation of parameters, Equations reducible to linear equations with constant co-efficients (Cauchy's and Legendre's linear equations), Simultaneous linear equations with constant co-efficients, Applications of linear differential equations in engineering.

3. COMPLEX NUMBERS
Applications of De Moivre's theorem, Exponential, Circular, Hyperbolic and Logarithmic functions of a complex variable, Inverse Hyperbolic functions, Real and imaginary parts of Circular and Hyperbolic functions, Summation of the series-'C+iS' method.

4. FUNCTIONS OF COMPLEX VARIABLE
Limit and derivative of complex functions, Cauchy-Riemann equations, Analytic functions and its applications, Geometrical representation of complex function, Conformal mapping and standard transformations, Complex integration, Cauchy's theorem, Cauchy's integral formula, Series of complex terms, Taylor's and Laurent's series, Cauchy's residue theorem and its application for the evaluation of real definite integrals.

5. INTEGRAL TRANSFORMS
Laplace Transforms of standard functions and their properties, Inverse Laplace Transforms, General Properties of inverse Laplace transforms and Convolution Theorem, Laplace Transforms of periodic functions, Bessel functions, Error function, Dirac-delta Function, Heaviside's Unit Function, Applications to linear simultaneous differential equations.

TEXT BOOKS
1. Engineering Mathematics through Applications: by Paras Ram, CBS Publications.
2. Advanced Engineering Mathematics: by Erwin Kreyszig, John Wiley and Sons, NC, New York.
3. Advanced Engineering Mathematics: by R. K. Jain & S. R. K Iyengar, Narosa Pub. House.

REFERENCE BOOKS
1. Advanced Engineering Mathematics: by C. R. Wylie & L. C. Barrett, McGraw Hill.
2. Vector Calculus: by C. E. Weatherburn. John Wiley and Sons, NC, New York.
3. Complex variables and Applications: by R. V. Churchill, T. J. Brown & R. F. Verhey, McGraw Hill.
4. Differential Equations: by Shepley L. Ross, John Wiley & Sons, New York.

ENGINEERING MATHEMATICS-II [CHS-121]

L T P 3 1 0

1. FOURIER SERIES
Euler's formula, Conditions for a Fourier expansion, Functions having points of discontinuity, Change of interval, Odd and even periodic functions, Expansion of odd and even periodic functions, Half-range series, Typical wave-forms, Parseval's formula, Practical harmonic analysis.

2. ORDINARY DIFFERENTIAL EQUATIONS
Brief review of first order ordinary differential equations, Exact equations, Equations reducible to exact equations, Equations of the first order and higher degree, Clairaut's equation, Applications of differential equations of first order (Orthogonal trajectories). Linear differential equations with constant co-efficients, Complimentary functions and particular integral, Method of variation of parameters, Equations reducible to linear equations with constant co-efficients (Cauchy's and Legendre's linear equations), Simultaneous linear equations with constant co-efficients, Applications of linear differential equations in engineering.

3. COMPLEX NUMBERS
Applications of De Moivre's theorem, Exponential, Circular, Hyperbolic and Logarithmic functions of a complex variable, Inverse Hyperbolic functions, Real and imaginary parts of Circular and Hyperbolic functions, Summation of the series-'C+iS' method.

4. FUNCTIONS OF COMPLEX VARIABLE
Limit and derivative of complex functions, Cauchy-Riemann equations, Analytic functions and its applications, Geometrical representation of complex function, Conformal mapping and standard transformations, Complex integration, Cauchy's theorem, Cauchy's integral formula, Series of complex terms, Taylor's and Laurent's series, Cauchy's residue theorem and its application for the evaluation of real definite integrals.

5. INTEGRAL TRANSFORMS
Laplace Transforms of standard functions and their properties, Inverse Laplace Transforms, General Properties of inverse Laplace transforms and Convolution Theorem, Laplace Transforms of periodic functions, Bessel functions, Error function, Dirac-delta Function, Heaviside's Unit Function, Applications to linear simultaneous differential equations.

TEXT BOOKS
1. Advanced Engineering Mathematics: by Erwin Kreyszig, John Wiley and Sons, NC, New York.
2. Engineering Mathematics through Applications: by Paras Ram, CBS Publications.
3. Advanced Engineering Mathematics: by R. K. Jain & S. R. K Iyengar, Narosa Pub. House.

REFERENCE BOOKS
1. Advanced Engineering Mathematics: by C. R. Wylie & L. C. Barrett, McGraw Hill.
2. Vector Calculus: by C. E. Weatherburn. John Wiley and Sons, NC, New York.
3. Complex variables and Applications: by R. V. Churchill, T. J. Brown & R. F. Verhey, McGraw Hill.
4. Differential Equations: by Shepley L. Ross, John Wiley & Sons, New York.

ENGINEERING MATHEMATICS-III [CES-211]

L T P 3 1 0

Solution of Nonlinear and Transcendental equations

Basic concepts on polynomial equations, Roots of equations by Bisection method, iterative method, Regula-falsi method, Newton-Raphson method, Secant method.

Numerical Interpolation

Least square curve fit and trigonometric approximations, Finite differences and difference operators, Newtons interpolation formulae, Gauss forward and backward formulae, Sterling, Bessel's and Evertte's formulae, Interpolation with unevenly space d data points-Lagrange's interpolation.

Numerical differentiation and integration

Numerical differentiation, errors in numerical differentiation, Numerical integration-Trapezoidal, Simpson's 1/3 and 3/8 rules, Romberg integration-recursive formulae, Evaluation of double integrals by Trapezoidal and Simpson's rules.

Numerical Interpolation

Least square curve fit and trigonometric approximations, Finite differences and difference operators, Newtons interpolation formulae, Gauss forward and backward formulae, Sterling, Bessel's and Evertte's formulae, Interpolation with unevenly space d data points-Lagrange's interpolation.

Numerical differentiation and integration

Numerical differentiation, errors in numerical differentiation, Numerical integration-Trapezoidal, Simpson's 1/3 and 3/8 rules, Romberg integration-recursive formulae, Evaluation of double integrals by Trapezoidal and Simpson's rules.

System of simultaneous algebraic equations

Matrix inversion and solution of transcendental and system of algebraic equations-Gauss eliminattion method, Jacobi's method and Gauss-Seidal method, Eigen values and Eigen vectors, Jacobi's method

Ordinary differential equations

Picard's method, Euler's method, Modified Euler's method, Runge- Kutta methods of 2nd and 4th order.

Numerical solution of Partial Differential Equations

Classification, various types of governing conditions, Finite Difference representation of derivatives, Parabolic PDE: Solution for one Dimensional equation, explicit and implicit schemes, Elliptic PDE, Solution of Laplace/ Poisson PDE, ADI and SOR schemes.

Books:

1. Engineering Mathematics through Applications: by Paras Ram, CBS Publications.
2. Rajasekaran, S. Numerical methods in science and engineering: a practical approach, Wheeler Publishing, New Delhi.
3. Sharma, J.N., Numerical Methods for Engineers and Scientists, Narosa Publishers, New Delhi.

ADVANCED ENGINEERING MATHEMATICS [EES-211]

L T P 3 1 0

1. FOURIER AND Z-TRANSFORMS

Fourier transforms, Finite Fourier and Cosine Transforms, Properties of Fourier Transforms, Finite Fourier transform, Z-Transform and Its properties, Applications of Transforms to simple engineering problems.

2. PARTIAL DIFFERENTIAL EQUATIONS

Formation and solutions of partial differential equations, Lagrange's linear equation of the first order, Non-linear equations, Charpit's method, Homogeneous linear equations with constant co-efficients, Non-homogeneous linear equations, Nonlinear equations of the second order (Monge's method), Method of separation of variables, Solution of wave equations, Heat flow equations, Laplace's equations and transmission line equations and their applications to engineering problems.

3. NUMERICAL METHODS

Revision of some basic concepts an polynomial equations, Bisection method , iterative method , Regula-Falsi method , Newton –Raphson Method , Generalized Newton's method for multiple roots , Solution of system of linera algebraic equations- Jacobi's method and Gauss –Seidal method. Eigen Values, vectors and eign value problems Interpolation.

4. NUMERICAL DIFFERENTIATION AND INTEGRATION:

Method of Least squares, Newtons forward and Backward Interpolation. Central Interpolation: Gauss forward interpolation, Stirling formula. Lagranges interpolation. Numerical differential and integration, Numerical solution of ode-Taylor's series method , Picard's method , Euler's method, Modified Euler's method, Runge –Kutta method of 2d and 4th order.

5. PROBABILITY AND RANDOM VARIABLE:

Introduction to probability , permutations and combinations, Random veriable, Probability Distribution- Binomial , Poisson and Normal Distribution, Mean, Median , Mode and Standard Deviation. Probability density Function Expected Value,

Text & References Books
1.   Advanced Engineering Mathematics: by Erwin Kreyszig . John Wiley and Sons, NC, New York.
2.   Engineering Mathematics through Applications: by Paras Ram, CBS Publications.
3.   Partial Differential Equation for Engineers and Scientists: by J.N. Sharma and Kehar Singh
4.   Narosa Publishing House, New Delhi/ Alpha Science Int. Ltd, UK.
5.   Advanced Engineering Mathematics: by R. K. Jain & S. R. K Iyengar, Narosa Pub. House.
6.   Numerical Methods for Engineers and Scientists, I.N.sharma Narosa.
7.   Numerical Methods, S.S. Shastri.
8.   Elements of Partial Differential Equations: By Lan N. Sneddon , McGraw –Hill, Singapore.
9.   Differential Equations: by Shepley L. Ross, John Wiley & Sons, New York.
10.   Higher Engg. Mathematics, B.V. Ramana TMH

ENGINEERING MATHEMATICS-III [MES-211]

L T P 3 1 0

1. PARTIAL DIFFERENTIAL EQUATIONS

Formation and solutions of partial differential equations, Lagrange's linear equation of the first order, Non-linear equations, Charpit's method, Homogeneous linear equations with constant co-efficients, Non-homogeneous linear equations, Nonlinear equations of the second order (Monge's method), Method of separation of variables, Solution of wave equations, Heat flow equations, Laplace's equations and transmission line equations and their applications to engineering problems.

2. SPECIAL FUNCTIONS

Series solutions about ordinary and singular point, Series solutions of Bessel's and Legendre's equations, Bessel's functions and Legendre's, polynomials, Modified Bessel's functions, Recurrence relations, generating functions and orthogonal properties, Equations reducible to Bessel's equation, Ber and Bei functions.

3. INTEGRAL TRANSFORMS

Definitions and Types of Integral Transforms, Application of Laplace transform to IVP and BVP, Periodic functions, Fourier transforms, Finite Fourier Sine and Cosine Transforms, Properties of Fourier Transforms, Applications of Integral Transforms to simple engineering problems. Hankel Transforms and its applications

4. FUNDAMENTAL CONCEPT OF PROBABILITY

Mutually Exclusive , Independent events, Conditional probability, Tree diagram, Algebra of events, Multiplication rule, Baye's rule , Series and Parallel system, product law of reliability and unreliability.

5. PROBABILITY DISTRIBUTIONS

Introduction to discrete and continuous Random variables, probability functions, probability density function, cumulative distribution function and their properties, two dimensional random variables, joint distribution of several random variables ,cumulative marginal and conditional distribution functions, Expected value. Bernoulli Trials, Binomial Distribution, Poisson and Normal Distribution, Expected value and variance of continuous and discrete random variables,

TEXT BOOKS
1. Advanced Engineering Mathematics: by Erwin Kreyszig . John Wiley and Sons, NC, New York.
2. Partial Differential Equation for Engineers and Scientists: by J.N. Sharma and Kehar Singh Narosa Publishing House, New Delhi/ Alpha Science Int. Ltd, UK.
3. Engg. Mathematics: Babu Ram, Pearson.
4. Advanced Engineering Mathematics: by R. K. Jain & S. R. K Iyengar, Narosa Pub. House.

REFERENCE BOOKS
1. Elements of Partial Differential Equations: by Ian N. Sneddon, McGraw-Hill, Singapore.
2. Differential Equations: by Shepley L. Ross, John Wiley & Sons, New York.
3. Advanced Engineering Mathematics by Chandrika Prasad.
4. Higher Engg. Mathematics, B. V. Ramana TMH

ENGINEERING MATHEMATICS III [ECS-211]

L T P 3 1 0

FOURIER TRANSFORMS
Periodic functions, Fourier transforms, Finite Fourier Sine and Cosine Transforms, Properties of Fourier Transforms, Applications of Integral Transforms to simple engineering problems differential Equations in Electric Circuits.

PARTIAL DIFFERENTIAL EQUATIONS
Formation and solution of partial differential equations, Lagrange's Linear Equation of the first order, homogenous linear equations with constant coefficients, Classification of Partial Differential Equations, Method of Separation of variables, Solution of Wave equations, diffusion equations, Laplace's equations, transmission line equations, simple applications of pdes.

SPECIAL FUNCTIONS
Series solutions ordinary differential equations, Solution of Bessel and Legendre differential equation, Bessel functions, Legendre functions, recurrence relations, orthogonality properties, Ber and Bei Functions

PROBABILITY & DISTRIBUTIONS
Introduction to Random variables & probability, Conditional Probability, Probability density function, Discrete and continuous distribution, Mean, medium, mode and standard deviations of standard distributions, Central Limit theorem, Generating functions, correlation and regression analysis.
Urn model, Stochastic Independence, Independent trials, Baye's Rule, Bernoulli Trials, Binomial, Gaussian, Rayleigh, exponential, geometrical and uniform distributions and their density functions, and applications.

CONVOLUTION ERGODICITY & QUEUING MODELS
Stochastic process, Queuing systems and displines, Poisson and exponential process, classification of queues, Markov chains, definition, examples, Markovian models & finite population Markovian Models, Ergodicity, Random walk with retaining barrier, absorbing barriers, characteristics of queuing systems, queuing Notations.

BOOKS RECOMMENDED:
1. Advanced Engineering Mathematics: by Erwin Kreyszig, John Wiley and Sons.
2. Advanced Engineering Mathematics: by C.R. Wylie & L C Barrett, McGraw Hill.
3. Differential Equations: by Shepley L. Ross, John Wiley and Sons.
4. Probability, Random Variables and Stochastic Processes, McGraw Hill
5. Probability and Statistics with Reliability and Queuing and Computer Science Applications: by K S Trivedi, Prentice Hall of India.

PROBABILITY AND QUEUEING MODELS [CSS-210]

L T P 3 1 0

PROBABILITY AND RANDOM VARIABLE
Axioms of probability – Conditional probability – Total probability – Baye's theorem – Random variable- Probability mass function – probability density function – properties – Moments – Moment generating function and their properties.

STANDARD DISTRIBUTIONS
Binomial, poisson, Geometric, Negative Binomial, Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties- Function of a random variable. Probability density function and its properties

TWO DIMENSIONAL RANDOM VARIABLES
Joint distributions – Marginal and conditional distribution – Covariance – Correlation and regression – Transformation of random variables- Central limit theorem.

RANDOM PROCESSES AND MARKOV CHAINS
Classification – Stationary process – Markov process –Poisson process- Birth and death process – Markov chains- transition probabilities – Limiting distributions.

QUEUEING THEORY
Markovian models – M /M/1, M/M/C, finite and infinite capacity- M/M/8 queues – Finite source model – M/G/1 queue (steady state solution only) – Pollaczek – Khintchine formula-Special cases.

TEXT BOOKS
1. Ross, S., "A first course in probability ", Sixth Edition , Pearson Education , Delhi , 2002.
2. Medhi j., "Stochastic Processes ", New Age Publishers, New Delhi, 1994. (Chapters 2,3 & 4)
3. Taha, H.A., "Operations Research – An introduction", Seventh Edition, Pearson Education Edition Asia, Delhi, 2002.

REFERENCES
1. Veerarajan. T., "Probability, Statistics and Random. Processes", Tata McGraw – Hill, Second Edition, New Delhi, 2003.
2. Allen., A.O., " Probability , Statistics and Queuing Theory ", Academic press , New Delhi, 1981.
3. Gross, D. and Harris, C.M., "Fundamentals of Queuing theory ", John Wiley and Sons, Second Edition, New York, 1985.

COMPUTER PROGRAMMING AND NUMERICAL METHODS FOR MECHANICAL ENGINEERS [MES- 221]

	L	T	P/D	Cr
	3	1	0	3

1. Programming fundamentals & Techniques: Steps in program development, algorithm, flowchart, psuedocode, evolution and classification of programming languages, Basics of mathematical programming languages such as FORTRAN, MATLAB, C, C++ etc.

2. Numerical computations and errors analysis : Introduction, Numbers and their accuracy, Floating point arithmetic, errors in numbers, Computational methods for error estimation, General error formulae-approximation of a function, series approximations and error propagation in computation.

3. Algebraic and transcendental equations: Revision of some basic concepts on polynomial equations, Bisection method, iterative method, Regula-falsi method, Newton-Raphson method, Secant method, Generalized Newton's method for multiple roots, solution of non- linear simultaneous equations and finding complex roots by Newton-Raphson method.

4. System of simultaneous algebraic equations: Solution of system of algebraic linear equations-Gauss elimination method, Jacobi's method and Gauss-Seidal method, Eigen values and eigen vectors-Power method, Jacobi's method and Householder method.

5. Interpolation and function approximations: Least square curve fit and trigonometric approximations, Approximations by trigonometric polynomials and quality of approximations, Finite differences and difference operators, Newtons interpolation formulae, Gauss forward and backward formulae, Sterling, Bessel's and Evertte's formulae, Interpolation with unevenly spaced data points-Lagrange's interpolation.

6. Numerical differentiation and integration: Numerical differentiation, errors in numerical differentiation, Maximum and minimum values of a tabulated function, Numerical integration-Trapezoidal, Simpson's 1/3 and 3/8 rules, Boole's and Weddle's rules, Romberg integration-recursive formulae, Evaluation of double integrals by Trapezoidal and Simpson's rules.

7. Ordinary differential equations: Taylor's series method, Picard's method, Euler's method, Modified Euler's method, Runge- Kutta methods of 2nd and 4th order, Adams-Moltan and Miline methods, Solution of simultaneous and higher order equations. Finite Difference Method to solve ordinary differential equation.

8. Application of Programming and Numerical methods to solve various problems related to mechanical engineering.

Books:
1. Numerical Methods for Engineers and Scientists: J.N. Sharma
2. Engineering Mathematics through Applications: by Paras Ram, CBS Publications.
3. Numerical Analysis : F. B. Hildbrand
4. Numerical Method for Engineers and Scientists : Jain, lyngar and R. K. Jain
5. Introductory Methods of Numerical Analysis: S.S. Sastry
6. Programming with C: Byron GottFried
7. An Introduction to Programming and Numerical Methods in MATLAB: Otto & Denier

COMPUTER PROGRAMMING & NUMERICAL METHODS LAB [MES – 226]

To develop algorithm and Programs for the implementation of Following Numerical methods in C++ and FORTRAN on the Computer

1. Bisection method to Solve algebraic and transcendental equations.

2. Regula- Falsi method to solve algebraic and transcendental equations.

3. Newton –Raphson method to solve algebraic and transcendental equations.

4. Secant method to solve algebraic and transcendental equations.

5. Gauss elimination method to solve system of linear algebraic equations.

6. Jacobi method to solve system of linear algebraic equations.

7. Gauss-Seidal method to solve system of linear algebraic equations.

8. Power method to find largest eignvalues and eignvectors.

9. Newton Forward Interpolation formula.

10. Lagrange's Interpolation formula.

11. Trapezodial rule to evaluate definite intergrals.

12. Simpson's _rd rule to evaluate definite integral.

13. Runge- Kutta method (2nd & 4th order) to solve differential equations.

14. Solution of Laplace equation.

15. Bendre-Schmidt method to solve diffusion equation.

16. Solution of wave equation.

ENGINEERING MATHEMATICS-I1I [CHS-224]

L T P 3 1 0

1. PARTIAL DIFFERENTIAL EQUATIONS
Formation and solutions of partial differential equations, Lagrange's linear equation of the first order, Non-linear equations, Charpit's method, Homogeneous linear equations with constant co-efficients, Non-homogeneous linear equations, Nonlinear equations of the second order (Monge's method), Method of separation of variables, Solution of wave equations, Heat flow equations, La lace's equations and transmission line equations and their applications to engineering problems. p

2. SPECIAL FUNCTIONS
Series solutions about ordinary and singular point, Series solutions of Bessel's and Legendre's equations, Bessel's functions and Legendre's, polynomials, Modified Bessel's functions, Recurrence relations, generating functions and orthogonal properties, Equations reducible to Bessel's equation, Ber and Bei functions.

3. INTEGRAL TRANSFORMS
Definitions and Types of Integral Transforms, Application of Laplace transform to IVP and BVP, Periodic functions, Fourier transforms, Finite Fourier Sine and Cosine Transforms, Properties of Fourier Transforms, Applications of Integral Transforms to simple engineering problems. Hankel Transforms and its applications

4. PROBABILITY
Introduction to probability, Conditional Probability, Total Probability, Bay's theorem, Random variables, probability distribution: Binomial, Poisson Normal Distribution and Gamma distribution.

5. STATISTICS
Mean, Medium, Mode and standards deviation. Correlation and regression rank correlation, Regression, skewness and kurtosis, Principle of least squares, Tests based on Normal, t, Chi -Square and F distributions. Analysis of variance - one-way and two-way classifications.

TEXT BOOKS
1. Advanced Engineering Mathematics: by Erwin Kreyszig John Wiley and Sons, NC, NewYork.
2. Partial Differential Equation for Engineers and Scientists: by J.N. Sharma and Kehar Singh Narosa Publishing House, New Delhi/ Alpha Science Int. Ltd, UK.
3. Engg. Mathematics, Babu Ram, Pearson Education
4. Advanced Engineering Mathematics: by R. K. Jain & S. R. K Iyengar, Narosa Pub. House.
5. A First Course in Probability: by Ross, S, Pearson Education.
6. Engineering Mathematics through Applications: by Paras Ram, CBS Publications.
7. Miller, I. and Freund, E. F. "Probability and Statistics for Engineers", Prentice Hall, Inc.

REFERENCE BOOKS
1. Elements of Partial Differential Equations: by Ian N. Sneddon, McGraw-Hill, Singapore.
2. Differential Equations: by Shepley L. Ross, John Wiley & Sons, New York.
3. Advanced Engineering Mathematics by Chandrika Prasad.
4. Higher Engg. Mathematics, B. V. Ramana TMH
5. Probability, Statistics and Random Processes: by Verrarajan, T., Tata McGra-Hill Publication.

OPERATION RESEARCH [MAO-316(a)]

L T P 3 1 0

Introduction:
Origin, development and nature of O.R., meaning, scope and techniques of O.R., O.R. as a tool in decision making , classification of O.R. models, methods of deriving solution, limitations of O.R.

Linear Programming:
Mathematical formulation of LPP, graphical solution method , exceptional cases, general and standard LPP, matrix formulation, simplex method , two phase simplex method problems of degeneracy , duality in LPP, fundamental theorem of duality and dual simplex method.

Transportation and assignment Problems:
Mathematical formulation and solution procedure (Hungerian method) of assignment models, formulation and solution of traveling salesman problem, transportation problem, mathematical formulation and optimal solution of transportation problem, degeneracy in T.P.

Dynamic Programming
Introduction, Recursive approach, computational procedure and characteristics, solution of LPP by dynamics programming, sequencing problems with n-job and two, three, m-machines, graphical solution.

Network Analysis:
Network scheduling by PERT/CPM, basic concepts, activities, nodes, network, critical paths, constraints, CPM and PERT calculations probability of meeting the schedule time.

BOOKS RECOMMENDED:
1. 'Operation Research' by S. D. Sharma (Kedar Narh & Co.)
2. 'Operation Research' by Kanti Swarup, P.K.Gupta & Manmohan (S.Chand & Sons)

LINEAR ALGEBRA: [MAO-316(b)]

L T P 3 0 0

Introduction (Basic concepts and definitions)
Algebraic structures, Binary operation, Scalars, Vectors, Vectors in R^n and C^n, Definition of n-space, Vector Addition, Scalar Multiplication, Zero Vector, Definition of Dot or inner product in R^n and C^n, Orthogonal (Perpendicular) Vectors, Basic properties of the dot or inner product in R^n, C^n, Real and Complex Euclidean n-space, Distance and Norm in R^n and C^n, Length (or norm) of Vector, Unit Vector (Normal vector), Cauchy-Bunyakovsky-Schwartz Inequality, Minkowski's Inequality, Algebraic structure, Group, Ring, Field and subfield and their properties.

Systems of Linear Equations
Introduction, System of Linear Equations, Gaussian elimination method, Matrices and elementary row operations, Row-reduced Echelon matrices, Matrix multiplications, Elementry Matrix, Invertible matrices.

Vector Spaces or Linear Spaces
Introduction, Basic concepts, Vector Spaces and its properties, Vector subspaces, criteria for identifying subspaces, Algebra of subspaces, Linear combinations, linear span of vectors, set, subspace spanned by vectors, Row and column space of matrix, Sum and Direct sums of subspaces, Linear Dependent and Linear Independent, Bases and dimension of vector space, Properties of finite dimension vector space, Replacement theorem, Dimension of subspace and linear span, Ordered basis, Coordinates.

Linear maps or transformations
Linear maps or transformations, linear operator, linear functional and their Properties, Range, Null space, kernel, Rank and Nullity of Linear transformations, Algebra of Linear transformations, Isomorphism, Isomorphic image, Invertible linear transformation, singular and non-singular transformations, Representation of Transformations by matrices, Change of Basis, Transition matrix.

Inner Product Spaces
Introduction, Standard Norm, Inner Product in vector space, Inner Product Space, Real and complex Inner Product Space and its examples, Norm of a vector in an inner product space, Unit vector, Normed vector space, Distance in an inner product space, Cauchy-Schwartz Inequality, Triangle Inequality, Orthogonality: Orthogonal Set, Orthonormal Sets, Orthogonal Complement, Orthogonal complement of an orthogonal complement, Orthogonal Projection, Gram-Schmidt Orthogonalization Process, Linear functional on vector space and inner product space, Adjoints of linear operators, self-adjoint, Unitary, Orthogonal Operators, Normal Operators.

TEXT/ REFERENCE BOOKS:
1. K. Hoffman and R. Kunje, **Linear Algebra**, Prentice-Hall (India), (1986).
2. Gilbert Strang, **Linear Algebra and Applications**, Sunders College Publishers.
3. G. H. Golub and C. F. Van Loan, **Matrix Computations**, North Oxford Academics, (1983).
4. G. Bachman and L. Narici, **Functional Analysis**, Academic Press, (1966).
5. E. Kreyszig, **Introductory Functional Analysis with Applications**, John Wiley, (1978).
6. Thomas S. Shores, **Applied Linear Algebra**
7. B. Kanti Datta, **Matrix and Linear Algebra**, Prentice Hall of India.
8. W. Keith Nicholson, **Linear Algebra with Applications**, McGraw Hill.
9. Promode Kumar Saikia, **Linear Algebra,** Pearson.
10. Bernard Kolman and David R. Hill, **Introductory Linear Algebra,** Pearson.
11. Otto Bretscher, **Linear Algebra with Applications**, Pearson.
12. Seymour Lipschutz, **Theory and Problems of Linear Algebra,** Schaum's Outline series.

PROBABILITY, STATISTICS AND QUEUING MODELS [MAO-325(a)]

L T P 3 1 0

Fundamental of Probability

Concept of Probability, Mutually Exclusive , Independent events, Conditional probability, Tree diagram, Algebra of events, Multiplication rule, Baye's rule , Series and Parallel system, product law of reliability and unreliability.

Random variables and density functions

Introduction to discrete and continuous Random variables, probability functions, probability density function, cumulative distribution function and their properties, two dimensional random variables, joint, Several random variables, cumulative marginal and conditional distribution functions, combinatorics, Expected value.

Probability Distribution and Densities

Bernoulli Trials, Binomial Distribution, Poisson and normal Distribution, Geometric and Hypergeometric distribution, Continuous distributions Uniform, Exponential, t, F, and Chi-square distribution, Generating function. Expected value and variance of continuous and discrete random variables, Sum of Random variables, Law of large numbers and central limit theorem. Generating functions, Moment and moment generating functions.

Hypothesis testing

Critical regions and level of significance, error in testing of hypothesis , one and two tailed test, procedure for testing of hypothesis , Null hypothesis , test of significance for large and small numbers, Chi-square test of goodness of fit and independence of attributes.

Markov process & chain and Queuing Models

Real queuing systems, M /M /1 (single channel poisson arrivals with exponential service rate), M /M /k and other waiting line models. Random processes, their classification, Gaussian process and its properties, Poisson's process and its properties. Markov process, Markov chains, absorbing and ergodic Markov chains (definition and examples), continuous parameter Markov chains, Birth and death process, pure birth and death process.

Books Recommended:

1. Probability , Random Variables and Stochastic Process, McGraw Hill
2. Probability and Statistics with Reliability and Queuing and Computer Science Application: by K S Trivedi, Prentice Hall of India.
3. Introduction to probability, Charles M.Grinstead and J.Laurie Snell, American Mathematical Society.
4. Higher Engineering Mathematics, B, V. Ramana, TMH
5. Advance Engineering Mathematics: by Erwin Kreyszig, Jhon Wiley and Sons.
6. Advance Engineering Mathematics: by C.R.Wylie & LC Barrett, McGraw Hill.
7. Probability, Statistics and Random processes, T. Veerajan, Tata McGraw- Hill Publishing company limited New Delhi.
8. Operations Research for Management, G.V.Hsenoy, U.K.Srivactava, S.C. Sharma New Age International Limited Publishers.

METHODS OF APPLIED MATHEMATICAL PHYSICS [MA-601]

L T P 3 0 0

MATRICES AND LINEAR EQUATIONS

Linear equations; Gauss-Jordan Reduction; matrices & determinants; solvability of linear equations; characteristic value problems; equivalent matrices & transformations; discernments and invariants; coordinate transformation; numerical solution of characteristic value problem; sturm-Liouville problems.

CALCULUS OF VARIATIONS

Maxima & minima; natural boundary and transmition conditions; constraints and lagrangian multipliers; variable end points; Sturm-Liouville problems; Hamilton's principles; Lagrange's equation; generalized dynamical entities, constraints in dynamical system; small vibration, normal coordinates; variational problem in deformable bodies; elastic plates; Rayleigh-Ritz method.

PARTIAL DIFFERENTIAL AND INTEGRAL EQUATIONS

Introduction, Green's functions; singular integral equations, approximate methods of solutions eg. Method of collocation, weighting functions and least squares. Classification of PDE, Solutions Laplace, Diffusion and waves equation and their applications.

INTEGRAL TRANSFORMS

Fourier & Laplace transform; Inverse transforms; rectangle, triangle, exponential, Heaviside's step, sgn, filtering, sine function; impulse symbol; basic theorems similarity, addition, stiff, modulation, convolution Rayleigh, power, derivative theorems; transform of generalized functions; discrete Fourier transform; fast Fourier transform (FFT); applications of FFT.

BOOKS RECOMMENDED:

1. Methods of Applied Mathematics -F.B. Hilderbrand, Prentic-Hall of India Ltd. , 1972
2. Partial Differential Equations by J.N.Sharma & Kehar Singh Narosa Publishing House New Delhi- 2000
3. The Fourier Transform and its Applications Ronald N. Bracewell, McGraw Hill International Ed. 1986
4. Theory and Problems of Laplace Transforms Murray R. Spiegel, Schaum's series, McGraw Hill,

STATISTICAL ANALYSES IN TRANSPORTATION SYSTEMS [CE-634]

L T P 3 0 0

Elements of Probability Theory, Linear and Non-linear Regression, Experimental Data and Model Parameters, Transportation and Assignment problems. Dynamic Programming, queuing theory, Decision theory, Hypothesis Testing and Model Evaluation, Computer Simulation.

References:

- Sheffi, Y. (1984), Urban transportation networks: Equilibrium analysis with mathematical programming methods, New Jersey.
- Benjamin J. R & Comell G. A., " Probability , Statistics , & Decision for Civil engineers".
- H. S. Ang and W. H. Tang, Probability Concepts in Engineering , Planning and Design, John Wiley,1975
- Erwin Kreyszig, Introductory mathematical Statics, John Wiley, 1970.

STATISTICAL METHODS AND MODELLING [EN-624]

L T P 3 0 0

Introduction
Measures of Central tendency, dispersion, skewness and kurtosis- Principle of least squares- Correlation and regression –rank correlation.

Sampling Distribution and Estimation
Sampling distribution-Point and Interval estimates for population proportions, mean and variance- Maximum likelihood estimate method – Method of moments.

Testing of Hypothesis
Sampling distributions-Test Based on Normal , t, Chi-square and F distributions
Analysis of variance- one–way and two-way classifications.
Mathematical modelling and simulation, defining systems and its components, Types of models and their applications.

Introduction to Soft Computing Techniques
Fuzzy set Theory and logic, Fuzzy MCDM and FRBS, simple applications in environmental engineering. Neural networks and Genetic algorithms

Models for Fate and Transport of Contaminants
Modelling of Volatilization, chemical transformation, sorption/desorption, photochemical transformations, biological transformations. Brief review of mass, momentum and energy balance, advection, molecular diffusion, dispersion, their application in modelling of rivers, lakes, sediments, wetland, subsurface flow and transport, air pollution modelling

References
1. Box GEP , Hunter JS and Hunter WG Statistics for Experimenters, 2nd Edition, John Wiley and Sons, 2005
2. Berthouex P M and Brown L C. Statistics for Environmental Engineers, 2 nd Edition , CRC Press, 2002
3. Freund, J.E. and Miller, I.R., probability and Statics for Engineers, Prentice-Hall of India, 5th Edition, New Delhi,1994
4. Ramaswami, A, milford, J,B, small , M.J. integrated Environmental Modeling- Pollutant Transport, Fate, and Risk in the Environment John Wiley & Sons,2005.
5. Burrough, P.A. and McDonnell, R.A., Principles of Geographical Information Systems, Oxford University Press, 1998.
6. Snape, J.B., Dunn I.J.Ingham J and Prenosil J Dynamics of environmental Bioprocesses, Modelling and simulation Weinheim: VCH, 1995.
7. International Water association-activated sludge modelling Asm1 and Asm2
8. Chapra S C, Surface Water Quality Modeling , Mcgraw –Hill, Inc., New York, 1997.

NUMERICAL TECHNIQUES AND COMPUTER SIMULATION [MA-851]

L T P 3 0 0

1. SOLUTOIN OF ALGEBERAIC AND TRANSCENDENTAL EQUATOINS
Bisection method, Regual-Falsi method, Newton-Raphson methods, iterative method, Mulle'r' method, Quotient-Difference method, Miller method Newton~Raphson iteration method for non-linear equations. Covergence criteria of above methods.

2. SYSTEM OF ALGEBRAIC EQUATIONS
Gauss-elimination, Gauss-Jordan methods, Partitioning and Factorization methods, solutions of tridiagonal and Centro-Symmetric systems of equations, Gauss- Seidal and Jacobi's iterative methods, eigen values and eigen vectors. House Holder method, Bairstow's method, Power method Covergence criteria.

3. NUMERICAL DIFFERENTIATlON AND INTEGRATION
Numerical differentiation, maximum and minimum values, Newton-cotes integration formulae, Repeated interval halving and Romberg integration Richardson extrapolation technique, orthogonal polynominals, Gaussian quadrature, Double integration.

4. SOLUTION OF ORDINARY DlFFERENTIAL EQUATIONS
Taylor series and Picards methods of approximations, Euler's method, Runge Kutta Methods, Multistep methods, predictor corrector methods, Truncation error, stability and step size control, boundary value problems, simultaneous equations, Relaxation and Finite difference method.

5. SOLUTION OF PARTIAL DIFFERENTIAL METHODS
Classification of partial differential equations, Finite difference approximations of partial derivatives, explicit and implicit form of difference equations convergence, stability and consistency, solution of parabolic equations, Laplace and Poisson's equations; Jacobi's method, Gauss-Scidal method SoR method ,Crank-Nicolson Method, Unconditionally stable Explicit Procedures, DuFort-Franktel method, Solutions of Laplace and hyperbolic equations solution of non linear partial differential equations. Fourier series and Harmonic analysis. Finite Element Method: Rayleigh-Ritz method, Galerkin method and its applications.

6. COMPUTER PROGRAMMlNG AND SOFTWARES
Numerical programming and software MATLAB, FORTRAN and C++ for solving Boundary Value Problem / initial Value Problem.

BOOKS RECOMMENDED
1. Numerical Methods for Engineers and Scientists J.N. Sharma, Naresh Publishing House, NewDelhi
2. Engineering Mathematics through Applications: by Paras Ram, CBS Publications.
3. Introductory methods of numerical Analysis by PHI 3rd Eds. 1999
4. Numerical methods for Scientists and Engineers: by MK Jain, SRK. lyngar and R.K. Jain: Wiley Eastern
5. Numerical Analysis by FB Hildbrand 1:-Tata McGraw Hill Co.
6. Getting Started with MATLAB by Rudra Pratap, Oxford University Press

ADVANCED MATHEMATICS (MA-798)

L T P 3 0 0

Section A: Linear Algebra

Vector spaces, linear dependence, basis, dimension, algebra of linear transformations. Algebra of matrices, linear equations. Eigenvalues and eigenvectors, Cayley-Hamilton theorem. Canonical forms, diagonal forms, triangular forms, Jordan forms, Inner product spaces, orthonormal basis. Quadratic forms, reduction and classification of quadratic forms.

Section B: Real Analysis

Finite, countable and uncountable sets, supremum, infimum. Sequences and series, convergence, limsup, liminf. Bolzano Weierstrass theorem, Heine Borel theorem. Continuity, uniform continuity, differentiability, mean value theorem. Sequences and series of functions, uniform convergence. Function of bounded variation.

Section C: Complex Analysis

Power series, transcendental functions such as exponential, trigonometric and hyperbolic functions. Analytic functions, Contour integral, Cauchy's theorem, Liouville's theorem, Maximum modulus principle, Taylor series, Laurent series, calculus of residues, Rouche theorem, Morera's theorem.

Section D: Algebra

Symmetric and alternating groups; the Sylow Theorems; Special Linear Group; General Linear Group; Ring theory; Zero-divisor; Integral domain; Polynomial rings; Quatrionian
Group; Kelin's Group; Modulo Groups; Field theory; Principal ideal domains; ideals.

Section E: Elasticity

Analysis of strains and stresses, type of strains and stresses, Elastic moduli generalized
Hooke's law and its reduction to isotropic media and connection between them, Strain energy density function, Equation of equilibrium and motion, elastic waves in solids and their nomenclature, Thermo elasticity, Duhmal-Neumann relations, Thermo elastic waves and stresses, B.V.P of Elastic media.

Referred Books:

1. Hoffman, Kenneth; Kunze, Ray (April 25, 1971), Linear Algebra (2nd ed.), Prentice Hall.
2. Schaum's Outline of Linear Algebra (3rd ed.), McGraw-Hill.
3. Walter Rudin, "Real Analysis" McGraw-Hill.
4. Tom M. Apostol, "Mathematical Analysis", Narosa Publishing House.
5. H.S Kasana, "Complex variables", PHI Learning Pvt. Ltd..
6. L. V. Ahlfors, "Complex variables", McGraw-Hill.
7. John B. Fraleigh, "A First Course in Abstract Algebra" Addison-Wesley.
8. Joseph A. Gallian, "Contemporary Abstract Algebra", Narosa Publishing House.
9. I.S. Sokololuikoff, "Mathematical theory of Elasticity", McGraw-Hill.
10. Karl F. Graff, "Wave motion in Elastic Solids", Dover Publications, INC., New York.

Note: Sections A, B and C are compulsory. One section can be selected from Section D and E.

FIXED POINT THEORY IN INTEGRAL EQUATIONS AND BOUNDARY VALUE PROBLEM [MA-851]

L T P 3 0 0

UNIT - 1
Fixed Point Theory and Applications

Basic of functional analysis : Metric space – definition, examples & types. Limit, Continuity, Differentiability & Equicontinuity – definition with examples. Banach space - definition & examples, Lipschitzian map (Single & multivalued mappings) – definition, examples & types. Ascoli - Arzela theorem & Banach Fixed Point Theorem - Applications to differential and integral equations with examples.

UNIT - 2
Boundary value problems

Green's Functions : Boundary value problems, Sturm-Lioville theory, self adjoint operators, Dirac delta functions and its properties, Green's functions for one, two and three dimensional equations, eigenfunction expansion of Green's functions.

Boundary value problems : Introduction – Types of Kernels – Eigen Values and Eigen functions – Connection with differential equation – Solution of an integral equation – Initial value problems – Boundary value problems.

UNIT - 3
Integral Equations and its types – I

Classification of Linear Integral Equations : Fredholm, Volterra, Integro-Differential Equations, Singular Integral Equations, Converting Volterra Equation to ODE, Conversion of IVP to Volterra equation Conversion of BVP to Fredholm equation.

Fredholm & Volterra Intergral Equations : Decomposition method, Direct Computation method, successive approximation method, method of successive substitutions, Homogeneous Fredholm Equations, Comparison between alternative methods, Series solution method, converting Volterra/ Fredholm equation to VIP/FIP, comparison between alternative methods.

UNIT - 4
Integral Equations and its types - II

Integro-Differential Equations : Introduction, Direct Computation method, Adomian Decomposition Method. Conversion to Fredholm integral Equation. Volterra Integro-Differential equations - Series Solution, Decomposition Method, Conversion to IVP.

Singular Integral Equations : Abel problem , Generalized Abel Integral Equation, Weakly-singular Volterra Equations.

UNIT - 5
Non Linear Integral Equations

Non Linear Integral Equations : Non linear Fredholm Integral equations, Direct Computation, decomposition method, Non linear Volterra Integral Equation, Series solution, Decomposition method.

Existence and uniqueness of solutions using fixed-point theorems in cash of Linear and nonlinear Volterra and Fredholm integral equations.

Textbook

- ❖ Ravi P. Agarwal, Maria Meehan, Donal O'Regan, Fixed Point Theory and Applications, Cambridge Tracts in Mathematics, Editors: B. Bollobas, W. Fulton, A. Katok, F. Kirwan, P. Sarnak (2004), The Edinburgh Building, Cambridge CB2 2RU, UK.
- ❖ Ravi P. Agarwal, Donal O'Regan and D. R. Sahu, Fixed Point Theory of Lipschitzian--type mapping with Applications, Springer-Verlag, New York, 2009, pp. 300.
- ❖ Sudhir K. Pundir and Rimple Pundir, Integral Equators and boundary value problems, Pragati Praskashan 2005.

- Abdul-Majid, Wazwaz, Linear and Nonlinear Integral Equations, Methods and Applications, Higher Education Press, Beijing and Springer – Verlag Berlin Heidelberg, 1st Edition., 2011, XVIII, 639 p. 4 illus.
- Mohan C Joshi & Ramendra K Bose, Some topics in nonlinear functional analysis, Wiley Eastern Ltd,1985.

Reference Book

- A.M. Wazwaz, A First course in integral equations – (1997) (world Scientific)
- A.J. Jerri, Introduction to Integral Equation with Applications – (1999) Second edition Wiley Interscience.
- Allen C. Pipkin, A Course on Integral Equations, Springer, Verlag
- M. Boucher, An introduction to the study of integral equations, Cambridgev;press,1972
- F. G. Tricomi, Integral equations, interscience, new york 1957.
- R. P. Kanwal, Linear Integral Equations, Theory and Techniques, Academic Press, New York, 1971.
- S.G. Mikhlin, Linear integral equations (Translated from Russian) Hindustan Book Agency, 1960.
- B.L. Moiseiwitsch, Integral Equations, Longman, London & New York.
- M. Krasnov, A Kiselev, G.Makaregko, Problems and Exercises in integral equations (Translated from Russian) by George Yankovsky) MIR Publishers Moscow, 1971.
- A. S. Gupta, Calculus of Variations with Application, Prentice Hall of India, New Delhi, 2005.
- W. V. Lovitte Integral Equations, Dover Publications.
- Andrei D. Polyanin, Alexander V. Manzhirov, Handbook of Integral Equations, March 31, 1998 by CRC Press - 816 Pages.
- Rainer Kress, Linear Integral Equations, Series: Applied Mathematical Sciences, Vol. 82, 2nd ed., 1999, XIV, 388 p.
- G. Gripenberg, S. O. Londen, O. Staffans, Volterra Integral and Functional Equations, Cambridge University Press, 30-Mar-1990 - 724 pages.
- Peter J. Collins, Differential and Integral equations, Oxford University Press Inc., New York (2006).

Solutions of Integral Equations and Fundamental of Fractional Differential Equations [MA-852]

L T P 3 0 0

UNIT - 1
Solution of Integral equations – Second Kind

Fredholm & Volterra Integral Equations of the Second Kind - Adomian Decomposition Method, Modified Decomposition Method, Noise Terms Phenomenon, Variational Iteration Method, Successive Approximations Method, Laplace Transform Method, Series Solution Method.

UNIT - 2
Volterra – Fredholm Integro-Differential Equations

Volterra-Fredholm Integro-Differential Equation - Introduction, Methods - The Series Solution Method, The Variational Iteration Method, The Mixed Volterra-Fredholm Integro-Differential Equations, The Direct Computation Method, The Series Solution Method, The Mixed Volterra-Fredholm Integro-Differential Equations in Two Variables, The Modified Decomposition Method.

UNIT - 3
Fundamentals of Fractional Calculus

Fractional Calculus – Introduction, Motivation, The Basic Idea, Why Fractional Order? Brief Historical Overview, Examples. Riemann–Liouville Differential and Integral Operators - Riemann–Liouville Integrals, Riemann–Liouville Derivatives, Relations Between Riemann–Liouville Integrals and Derivatives. Caputo's Approach - Definition and Basic Properties. Mittag-Leffler Functions .

UNIT - 4
Existence and Uniqueness Theorems & Fractional Green's Function

Existence and Uniqueness Results for Riemann–Liouville Fractional Differential Equations – Theorem & examples. Fractional Green's Function - Definition and Some Properties, One-term Equation, Two-term Equation, Three-term Equation, Four-term Equation

UNIT - 5
Numerical Solution of Fractional Differential Equations

Initial Conditions: Which Problem to Solve ? Numerical Solution, Examples of Numerical Solutions. Survey of Applications of the Fractional Calculus.

Textbook

- ❖ Abdul-Majid, Wazwaz, Linear and Nonlinear Integral Equations, Methods and Applications, Higher Education Press, Beijing and Springer – Verlag Berlin Heidelberg, 1st Edition., 2011, XVIII, 639 p. 4 illus.
- ❖ Sudhir K. Pundir and Rimple Pundir, Integral Equators and boundary value problems, Pragati Praskashan 2005.
- ❖ Fractional Differential Equations: *Edited by Ignor Podlubny and Kenneth V. Thimann,* Volume 198, Pages xv-xxiv, 1-340 (1998).
- ❖ Lecture Notes in Mathematics - The Analysis of Fractional Differential Equations, Kai Diethelm, Edited by J.-M. Morel, Cachan, F. Takens, Groningen, B. Teissier, Paris, Springer Heidelberg Dordrecht London New York.

Reference Book

- ♣ K. S. Miller & B Ross, An introduction to the fractional calculus and fractional differential equations, John Wiley & Sons, inc (1993).
- ♣ Concepción A. Monje · YangQuan Chen, Blas M. Vinagre · Dingyü Xue · Vicente Feliu, Fractional-order Systems and Controls, Springer-Verlag London Limited 2010

GRAPH AND MATRIX THEORY [MA-852]

L T P 3 0 0

Section A
Basic definition and notation graph; Perfect graph theorem; The spectrum the graph; Line and total graph; co-spectral graph; clique of the graph; dominating number graph; coloring number the graph; Strong graph; Regular graph; connected graph; Degree sequence the graph, Bipartite graph; Line chromatic number, Total chromatic number; The Achromatic number; independence number; Sum and product the graph; Homomorphism and automorphism of the graph; Graph with given group with properties; Entire graph; Symmetry in graph; Planer graph and outer planer graph; Eularian graph; Hamiltonian graph; Girth: Diameter; Trees and cycles ; intersection graph.

Section B
Stochastic matrix and doubly stochastic matrix; Eigen values of the matrix; Nearly Reduced matrix; Decompose matrix ; graph related matrices; Adjacency Matrix; Fuzzy adjacency matrices; eigen values of the adjacency matrix ; General properties; The number of walks; Regulars graphs; Bounds for the largest, positive eigenvalues; Eigenvalue spacings; Density function of the eigenvalues; Examples of spectral density functions; Density of a sparse regular graph ; Bonds on a matrices; Algebraic Connectivit; Distance Matrix of a Tree; Resistance Distance; Laplacian Eigenvalues of Threshold Graphs; Positive Definite Completion Problem; Matrix Games Based on Graphs.

References:
1. Graph Spectra for Complex Networks : PIET VAN MIEGHEM : Published in the United States of America by Cambridge University Press, New York , ISBN 978-0-521-19458-7
2. Graph and matrices ; R.B. Bapat, ISI Delhi, Springer, Hindustan book agency, ISBN 978-1-84882-980-0
3. Algorithmic graph theory and perfect graph , Martin Charles golumbic. Academic Press New York Londan , ISBN 0-12-289260-1
4. Graph Theory, Frank Harary, Narosa Publishing House , ISBN :8185015554
5. Introduction to graph theory , Douglas B. West , Prentise- Hall, ISBN-8120314808.

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MATHEMATICAL METHODS [MA-852]

L T P 3 0 0

1. **CALCULUS OF VARIATIONS:** maxima & minima; natural boundary and transmition conditions; constraints and lagrangian multipliers; variable end points; Sturm-Liouville problems; Hamilton's principles; Lagranges equation, generalised dynamical entities, constraints in dynamical system; small vibration, normal coordinates; variational problem in deformable bodies; elastic plates; Rayleigh-Ritz method.

2. **DIFFERENTIAL AND INTEGRAL EQUATIONS:** Series solution of ODE; Bessel, Legendre, Hermite and Laguerre functions and their properties; introduction to integral equations, Fredholm and Voltera integral equations; Green's functions; singular integral equations, approximate methods of solutions eg. Method of collocation, weighting functions and least squares. Classification of PDE, Solutions Laplace, Diffusion and waves equation and their applications.

3. **INTEGRAL TRANSFORMS:** Fourier & Laplace transform; inverse transforms; rectangle, triangle, exponential, Heaviside's step, sgn, filtering, sinc function; impulse symbol; basic theorems similarity, addition, stiff, modulation, convolution Rayleigh, power, derivative theorems; transform of generalized functions; discrete Fourier transform; fast Fourier transform (FFT); applications of FFT.

4. **Classical and non-classical thermoelasticity:** Thermal strains and stresses; equation of equilibrium and their motion & their derivatives, Boundary conditions and some BVP of thermoelastic continuum such as beams, plates, dishes and shells.

BOOKS RECOMMENDED

1. Methods of Applied Mathematics -F.B. Hilderbrand , Prentic-Hall of lndia Ltd. 1972
2. Partial Differential Equations by J.N.Siiarma & Kehar Singn Narosa Pubiisliing House New Delhi-2000
3. The Fourier Transform and its Ronald N. McGraw Hill international Ed. 1986
4. Theory and Problems of Laplace Transforms' Murray R. Spiegel , Schaum's series, McGraw Hill,1986.
5. Dynamical theory of Coupled Thermoelasticity by W. Nowaoki (2nd Edition) PWN Sci Pub . Warszawa, 1975.
6. Dynamic Coupled Thermoelasticity by RS. Dhaliwal and A Singh, Hindustan Pub. House New Delhi , 1980

HYDRODYNAMIC AND HYDROMAGNETIC STABILITY (MA-852)

L T P 3 0 0

Unit 1: Basic concepts
Introduction, basic concepts, analysis in terms of normal modes, non-dimensional number.

Unit 2: The thermal instability of a layer of fluid heated from below- Bénard problem
Bénard problem, basic hydrodynamic equations, Boussinesq approximation, perturbation equations, analysis into normal modes, principal of exchange of stabilities, equations governing the marginal state, exact solution when instability sets in as stationary convection for two free boundaries.

Unit 3: The thermal instability of a layer of fluid heated from below- The effect of rotation
Thermal instability in rotating fluid, perturbation equation, analysis in terms of normal modes, variational principle for stationary convection, solution when instability sets in as stationary convection for two free boundaries, on the onset of convection as overstability; the solution for the case of two free boundaries.

Unit 4: The thermal instability of a layer of fluid heated from below- The effect of magnetic field
Thermal instability in presence of magnetic field, perturbation equations, the case when instability sets in as stationary convection; a variational principle, solution for stationary convection and for overstability for the case of two free boundaries.

Unit 5: The stability of superposed fluids: Rayleigh Taylor Instability
Rayleigh-Taylor instability, perturbation equations, inviscid case, effect of rotation, effect of vertical magnetic field.

Text books:

1. Hydrodynamic and Hydromagnetic Stability, S. Chandrasekhar, Dover Publication, New york, 1981.
2. Hydrodynamic Stability, P.G. Drazin & W. H. Reid, Cambridge Press, Cambridge, 1981.