CURRICULUM AND CREDIT FRAMEWORK
FOR
UNDERGRADUATE PROGRAMME

Department of Mathematics
Nagaland University

2023

Major Course (Core papers)

Paper Code	Course Code	Title of the paper	Total Credit
FIRST SEMESTER			
C-1	MAT/C1	Calculus	4
C-2	MAT/C2	Classical Algebra	4
SECOND SEMESTER			
C-3	MAT/C3	Ordinary Differential Equations	4
C-4	MAT/C4	Real Analysis	4
THIRD SEMESTER			
C-5	MAT/C5	Group Theory	4
C-6	MAT/C6	PDE and Systems of ODE	4
FOURTH SEMESTER			
C-7	MAT/C7	Numerical Methods	4
C-8	MAT/C8	Theory of Real Functions	4
FIFTH SEMESTER			
C- 9	MAT/C9	Riemann Integration and Series of Functions	4
C-10	MAT/C10	Ring Theory	4
C-11	MAT/C11	Mechanics-I	4
SIXTH SEMESTER			
C-12	MAT/C12	Multivariate Calculus and Metric Spaces	4
C-13	MAT/C13	Complex Analysis	4
C-14	MAT/C14	Linear Algebra	4
C-15	MAT/C15	Elementary Number Theory	4
SEVENTH SEMESTER			
C-16	MAT/C16	Probability and Statistics	4
C-17	MAT/C17	Theory of Equations	4
C-18	MAT/C18	Mechanics-II	4
C-19		1 course on Research Methodology It will be a common course for whole UG course. Each Department need not propose that.	4
EIGHTH SEMESTER			
C-20			4
C-21	Students can undertake a research project for 12 credits or undertake 3 theory courses of 4 credits each.		4
C-22			4
C-23			4

Skill Enhancement Courses

Course Title	Course Code	Semester	Total Credit
Logic and Sets	MAT/SEC1	III	3
Computer Graphics	MAT/SEC2		
Introduction to Numerical Methods	MAT/SEC3		
Graph Theory	MAT/SEC4	IV	3
Operating System: LINUX	MAT/SEC5		
Introduction to Number Theory	MAT/SEC6		

These two courses **may be** offered by Mathematics departments in respective colleges. Students having Major in Mathematics can opt for any SEC paper from the common pool offered by the college. Colleges can select the courses for SEC from the common pool made by the university**.**

Syllabus

MAT/C1: Calculus

UNIT 1
Sets and relation. Functions – Domain, Co-domain and Range. Geometrical representation. Basic functions – polynomials, trigonometric functions, exponential function, logarithmic function. Injective, surjective, bijective functions. Inverse of functions. Composition of functions. Function of functions.

UNIT 2
Limit of a function on the real line. One-sided limits - right hand and left hand limits. Basic results on limits. Continuous functions. Definition. Discontinuity. Theorems and properties on continuity of functions. Uniform continuity.

UNIT 3
Derivatives. Definition. Basic results on derivatives. Product rule. Quotient rule. Chain rule. Continuity of a derivative of a function. L'Hospital's Rule. Derivative as a rate measure. Time rate of change. Geometric interpretation. Meaning of the sign of the derivative. Determination of multiple roots.

UNIT 4
Integration. Basic methods of integration. Integration by substitution. Integrations by parts. Integration of trigonometric and hyperbolic functions. Rational function of sine and cosine. Improper integral.

Books Recommended
1. H. Anton, I. Bivens, S. Davis – Calculus, Wiley.
2. J. Hass, C. Heil, M. Weir – Thomas' Calculus, Pearson.
3. T.M. Apostol – Calculus Volume I, Wiley.
4. T.M. Apostol – Calculus Volume II, Wiley.

MAT/C2: Classical Algebra

UNIT 1
Polynomials. Division Algorithm of polynomials. Roots of polynomials. Fundamental Theorem of algebra. Complex roots. Surd roots. Relation between roots and coefficients of polynomials. Graphical interpretations.

UNIT 2
Matrix. Rows and columns. Determinant and trace. Properties of determinant. Eigen values and eigen vectors and their relation with determinant and trace of a matrix. Determinant of inverse of an invertible matrix and corresponding eigen vectors. Cayley-Hamilton Theorem.

UNIT 3
Types of matrices: Symmetric, Hermitian, skew-symmetric, skew-Hermitian, orthogonal, unitary, positive and negative definite, positive and negative semidefinite. Properties of the rows, columns, eigen values and eigen vectors of these matrices. Diagonalizability of matrix. Eigen value decomposition of matrix.

UNIT 4
Systems of linear equations, coefficient matrix and augmented matrix, row reduction and echelon forms, vector equations, the matrix equation AX = B. Solution of system of linear equations. Consistent and inconsistent system of linear equations.

Books recommended
1. M.K. Sen and S. Ghosh - Topics in Abstract Algebra, Universities Press.
2. David C. Lay -Linear Algebra and its Applications, Pearson.
3. R.A. Horn – Matrix Analysis, Cambridge University Press.
4. W.S. Burnside & A.W. Panton – The Theory of Equations, Dublin University Press.

MAT/C3: Ordinary Differential Equations

UNIT 1

Differential equations. General, particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors, separable equations and equations reducible to this form.

UNIT 2

Differential equations of the first order and first degree - Equation reducible to homogenous form. Bernoulli's equation. Exact differential equations. Differential equation of the first order but not of the first degree. Equations solvable for p,x,y. General and singular solutions. Clairaut's equation. Linear differential equations of higher order with constant coefficients. Complementary function and particular integrals.

UNIT 3

General solutions of homogenous equation of second order, principle of super position for homogenousequation, Wronskian: its properties and applications. Linear homogenous and non - homogenous equations of higher order with constant coefficients.

UNIT 4

Linear equation of second order. Standard form. Complete solution. Complementary function. Particular integral. Reduction to normal form. Transformation by changing the independent variable. Method of variation of parameters. Solution by operators.Simultaneous equations of the form $dx/P = dy/Q = dz/R$. Solution. Geometrical interpretation. Total differential equations. Solution by inspection.

Books Recommended

1. G.F. Simmons – Differential Equations with Applications and Historical Notes, CRC Press.
2. S.L. Ross -- Differential Equations, Wiley.
3. B. Barnes, G.R. Fulford -- Mathematical Modeling with Case studies: A Differential Equation Approach using Maple and Matlab, CRC Press/ Chapman and Hall.
4. C.H. Edwards, D.E. Penny, D. Calvis -- Differential Equations and Boundary Value Problems: Computing and Modeling, Pearson.

MAT/C4: Real Analysis

UNIT 1
Review of Algebraic and Order Properties of $\mathbb{R}$, ε - neighbourhood of a point in $\mathbb{R}$. Idea of countable sets and uncountable sets. Bounded above sets, Bounded below sets, Bounded sets. Maximum and minimum of sets. Supremum and Infimum. The Completeness Property of $\mathbb{R}$. The Archimedean Property. Density of Rational (and Irrational) numbers in $\mathbb{R}$.

UNIT 2
Interior points. Interior of sets. Limit points. Derived set. Closure of sets. Isolated points. Illustrations of Bolzano - Weierstrass theorem for sets. Open and closed sets. Compact sets. Heine - Borel theorem.

UNIT 3
Sequences, Bounded sequence, Convergent sequence, Limit of a sequence, Theorems on limits, Monotone Sequences, Monotone Convergence Theorem. Subsequence, Monotone Subsequence Theorem. Bolzano - Weierstrass Theorem for Sequences. Cauchy sequence, Cauchy Convergence Criterion. Incompleteness of rationals. Completeness of reals.

UNIT 4
Infinite series, convergence and divergence of infinite series, Cauchy Criterion, Tests for convergence: Comparison test, Limit Comparison test, Ratio Test, Cauchy's nth root test, Integral test, Alternating series, Leibniz test, Absolute and Conditional convergence.

Books recommended
1. R.G. Bartle and D.R. Sherbert- Introduction to Real Analysis, Wiley
2. A. Kumar and S.Kumaresan- A Basic Course in Real Analysis, CRC Press.
3. W. Rudin - Principles of Mathematical Analysis, McGraw Hill Education.
4. T.M. Apostol -- Mathematical Analysis ,Narosa.

MAT/C5: Group Theory

UNIT 1
Group. Definition. Examples. Abelian Group. Order of a group. Elementary properties of groups using definition. Integral power of an element of a group.

UNIT 2
Subgroups and examples of subgroups, Cosets, properties of cosets. Normal subgroups. Cyclic group, centralizer, normalizer, centre of a group, product of two subgroups. Properties of cyclic groups, classification of subgroups of cyclic groups.

UNIT 3
Permutations. Symmetric groups and permutation groups. Cyclic notation for permutations, properties of permutations, even and odd permutations, alternating group. Lagrange's theorem and consequences including Fermat's Little theorem. Normal subgroups, factor groups.

UNIT 4
Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms, First, Second and Third isomorphism theorems. Cauchy's theorem for finite abelian groups.

Books Recommended
1. J.B. Fraleigh-- A First Course in Abstract Algebra, Pearson.
2. M. Artin-- Abstract Algebra, Pearson.
3. I.N. Herstein -- Topics in Algebra, Wiley.
4. J.A. Gallian – Contemporary Abstract Algebra

MAT/C6: PDE and Systems of ODE

UNIT 1
Partial Differential Equations - Basic concepts and Definitions, Mathematical Problems. First - Order Equations: Classifications, Construction and Geometrical Interpretation. Method of Characteristics for obtaining General Solutions of Quasi Linear Equations.

UNIT 2
Canonical Forms of First - order Linear Equations. Method of Separation of Variables for solving first order partial differential equations. Wave equation and Laplace equation. Classification of second order Linear Equations to canonical forms.

UNIT 3
The Cauchy Problem of an infinite string. Initial Boundary Value Problems, Semi - Infinite String with a fixed end, Semi - Infinite String with a Free end, Equations with non - homogenous boundary conditions.

UNIT 4
Non - Homogenous Wave Equation. Method of separation of variables. Solving the Vibrating String Problem. Solving the Heat Conduction problem. Systems of linear differential equations, types of linear systems, differential operators, an operator method for linear systems with constant coefficients.Basic Theory of linear systems in normal form, homogenous linear systems with constant coefficients: Two Equations in two unknown functions.

Books Recommended
1. T. Myint-U, L. Debnath -- Linear Partial Differential Equations for Scientists and Engineers, Birkhäuser.
2. S.L. Ross -- Differential Equations, Wiley.
3. M.L. Abell, J.P. Braselton -- Differential equations with MATHEMATICA, Elsevier Academic Press.

MAT/C7: Numerical Methods

Use of Scientific Calculator is allowed.

UNIT 1
Finite differences. The operatorsΔ, $\nabla$and E. Properties. Central difference operators μ and δ. Gauss's central difference formula.

UNIT 2
Transcendental and Polynomial equations. Bisection method, Newton's method. Secant method. Rate of convergence of these methods.

UNIT 3
System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis.

UNIT 4
Interpolation. Lagrange and Newton's methods. Error bounds. Gregory forward and backward difference interpolation.Numerical Integration: Trapezoidal rule, Simpson's 3/8th rule, Boole's Rule. Midpoint rule, Composite Trapezoidal rule, Composite Simpson's rule.

Books Recommended
1. B.Bradie -- A Friendly Introduction to Numerical Analysis, Pearson.
2. M.K. Jain, S.R.K. Iyengar, R.K. Jain -- Numerical Methods for Scientific and Engineering Computation, New age International Publisher.
3. J.B. Scarborough – Numerical Mathematical Analysis, Oxford and IBH Publishers.
4. S.S. Sastry – Introductory Methods of Numerical Analysis, Prentice Hall India.

MAT/C8: Theory of Real Functions

UNIT 1
Limits of functions (approach), sequential criterion for limits, divergence criteria. Limit theorems, one sided limits. Infinite limits and limits at infinity. Continuous functions, sequential criterion for continuity and discontinuity. Algebra of continuous fractions.

UNIT 2
Continuous functions on an interval, intermediate value theorem, location of roots theorem, preservation of intervals theorem. Uniform continuity, non - uniform continuity criteria, uniform continuity theorem.

UNIT 3
Differentiability of a function at a point and in an interval, Caratheodory's theorem, algebra of differentiable functions. Relative extrema, interior extremum. Rolle's theorem, Mean value theorem, intermediate value property of derivatives.

UNIT 4
Darboux's theorem. Applications of mean value theorem to inequalities and approximation of polynomials, Taylor's theorem to inequalities. Cauchy's mean value theorem. Taylor's theorem with Lagrange's form of remainder.

Books Recommended
1. R. Bartle, D.R. Sherbert -- Introduction to Real Analysis, Wiley.
2. K.A. Ross -- Elementary Analysis: The Theory of Calculus, Springer.
3. A. Mattuck-- Introduction to Analysis, Prentice Hall.
4. S.R. Ghorpade, B.V. Limaye --A Course in Calculus and Real Analysis, Springer.

MAT/C9: Riemann Integration and Series of Functions

UNIT 1
Riemann integration; inequalities of upper and lower sums; Riemann conditions of integrability. Riemann sum and definition of Riemann integral through Riemann sums; equivalence of two definitions; Riemann integrability of monotone and continuous functions.

UNIT 2

Properties of the Riemann integral; definition and integrability of piecewise continuous and monotone functions. Intermediate Value theorem for Integrals; Fundamental theorems of Calculus. Integration by parts.

UNIT 3

Pointwise and uniform convergence of sequence of functions. Theorems oncontinuity , derivability and integrability of the limit function of a sequence of functions.

UNIT 4

Series of functions; Theorems on the continuity and derivability of the sum function of a series of a functions; Cauchy criterion for uniform convergence and Weierstrass M - Test.Limit superior and Limit inferior. Power series, radius of convergence, Cauchy Hadamard Theorem. Differentiation and integration of power series ; Abel's Theorem; Weierstrass Approximation Theorem.

Books Recommended

1. K.A. Ross -- Elementary Analysis: The Theory of Calculus, UTM, Springer.
2. R.G. Bartle, D.R. Sherbert -- Introduction to Real Analysis, Wiley.
3. W. Rudin – Principles of Mathematical Analysis, McGraw Hill Education.
4. A. Kumar, S. Kumaresan – A Basic Course in Real Analysis, CRC Press.

MAT/C10: Ring Theory

UNIT 1

Definition and examples of rings, properties of rings, subrings, zero divisors, integral domains – definition and examples. Fields – definitions and examples. Properties of fields, relationship between fields and integral domains. Characteristic of a ring. Characteristic of a field.

UNIT 2

Ideals – definitions and examples. Ideals generated by a subset of a ring. Operations on ideals. Prime ideal and maximal ideal. Factor rings.

UNIT 3

Ring homomorphisms, properties of ring homomorphisms, Isomorphism theorems I,II and III, field of quotients of an integral domain.

UNIT 4

Polynomial rings. Division Algorithm and its consequences. Factorization of polynomials. Euclidean Domain, Principal Ideal Domain and Unique Factorization Domain – definition, examples and properties.

Books Recommended

1. I.N. Herstein -- Topics in Algebra, Wiley.
2. J.A. Gallian -- Contemporary Abstract Algebra, Cengage Learning.
3. D.S. Dummit& R.M. Foote – Abstract Algebra, Wiley.
4. N.S. Gopalakrishnan – University Algebra, New Age International Publishers.

MAT/C11: Mechanics-I

UNIT 1

Coplanar forces. Moment of a system of coplanar forces. Equation of line of action of the resultant of a system of coplanar forces. Necessary and sufficient condition for the equilibrium of a system of coplanar forces acting on a rigid body. Astatic equilibrium. Equilibrium of a rigid body under three forces. (m,n) theorem.

UNIT 2

Work. Work done by a system of concurrent forces. Virtual work. Principle of virtual work for a system of coplanar forces acting on a particle. Omission of forces. Stability of equilibrium. Stable, unstable and neutral equilibrium. Work function test for the nature of stability of equilibrium. Energy test for equilibrium.

UNIT 3

Centre of gravity. Definition and general formulation. Centre of gravity of arc, plane area, area bounded by curve, solid of revolution, surface of revolution. Centre of gravity bounded area in polar coordinates. The theorem of Pappus, Friction, Statical, dynamical and limiting friction. Laws of friction. Limiting equilibrium. Coefficient of Friction. Angle of friction. Cone of friction. Equilibrium of a body on a rough inclined plane.

UNIT 4

Fundamental definitions and principles. Motion in a straight line. Simple harmonic motion. Motion under earth's attraction. Uniplanar motion where the accelerations parallel to fixed axes are given. Composition of simple harmonic motion.Tangential and normal accelerations. Constrained motion. Conservation of energy. The simple pendulum. Motion on a rough curve. Motion in a resisting medium. Motion where the mass moving varies.

Books Recommended

1. M.M. Rahman -- Statics,New Central Book Agency.
2. M.M. Rahman – Rigid Dynamics, New Central Book Agency.
3. I.H. Shames, G.K.M. Rao -- Engineering Mechanics: Statics and Dynamics, Pearson.
4. R.C. Hibbeler, A. Gupta -- Engineering Mechanics: Statics and Dynamics, Pearson.
5. P.N. Chatterji -- Dynamics, Educational Publishers.

MAT/C12: Multivariate Calculus and Metric Spaces

UNIT 1

Points and neighbourhoods in $\mathbb{R}^n$. Functions of several variables. Limit and continuity of functions of several variables. Partial differentiation and total differentiation. Directional derivatives and gradient. Critical points – maxima, minima and inflexion points.

UNIT 2

Double integration over rectangular region, double integration over non- rectangular region, Double integrals in polar co-ordinates, Triple integrals, Triple integral over a parallelipiped and solid regions. Volume by triple integrals. Line, surface and volume integrals.

UNIT 3

Concept of metric and metric spaces - definition and examples. Open and closed balls, neighbourhood, interior point, interior of a set, open set. Limit point, closure of a set, closed set. Basic results on union and intersection of open and closed sets. Dense sets. Bounded sets. Compact sets.

UNIT 4

Sequences in metric spaces. Convergent and Cauchy sequences. Complete Metric Spaces. Functions. Limit of function. Continuity – definitions in terms of limit, sequences,

neighbourhoods and their equivalence. Basic results on continuity. Uniform continuity. Continuous image of compact sets.

Books Recommended
1. S.R. Ghorpade, B.V. Limaye -- A Course in Multivariable Calculus and Analysis, Springer.
2. T.M. Apostol -- Calculus Volume 2, Wiley.
3. T. Tao – Analysis – II, Hindustan Book Agency
4. S. Kumaresan -- Topology of Metric Spaces, Narosa.

MAT/C13: Complex Analysis

UNIT 1
De Moivre's Theorem. Statement and proof. Euler's formula. Exponential and logarithmic functions of real variable. Laws of logarithmic functions. Trigonometric functions expressed in terms of exponential function. Inverse trigonometric functions. Hyperbolic functions.

UNIT 2
Complex numbers. Modulus and argument. Rectangular and polar representation. Regions on the complex plane. Functions of complex variable. Continuity. Derivatives. Cauchy – Riemann equations. Sufficient conditions for differentiability.Holomorphic functions. Complex exponential and logarithmic functions – their properties. Branch cut. Principal Branch. Complex trigonometric functions.

UNIT 3
Power series. Cauchy – Hadamard formula for radius of convergence. Analytic functions. Differentiability of analytic functions. Taylor series expansion of analytic functions. Common examples – complex exponential functions, trigonometric functions, logarithmic function.Point of singularity. Types of singularities.

UNIT 4
Parametrized curves and contours on the complex plane. Contour integrals and its examples. Basic properties of contour integration. ML – inequality. Cauchy-Goursat theorem, Cauchy integral formula. Cauchy's inequalities. Liouville's theorem and the fundamental theorem of algebra. Morera's Theorem. Residue Theorem.

Books Recommended
1. S. Ponnuswamy-- Foundations of Complex Analysis, Alpha Science International.

2. S. Ponnusawmy&H. Silvermann – Complex Variables with Applications, Birkhäuser.
3. R.V. Churchill & J.W. Brown -- Complex Variables and Applications, McGraw- Hill.
4. E.M. Stein & Rami Shakarchi – Complex Analysis, Princeton University Press.

MAT/C14: Linear Algebra

UNIT 1
Vector spaces – definition and examples. Subspaces, algebra of subspaces. Linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces. Theorems and examples.

UNIT 2
Linear transformations –definition and examples. Null space (kernel), range, rank and nullity of a linear transformation. Rank-nullity theorem. Algebra of linear transformations. Vector space L(V, W) of linear transformations from V to W. Dimension of L(V, W). Non-singular linear transformation. Isomorphism – definition and examples. Necessary and sufficient conditions for vector spaces to be isomorphic. Isomorphism theorems.

UNIT 3
Matrix representation of a linear transformation. Examples. Matrix representation of thesum, product and composition of linear transformations. Matrix representation of the inverse of linear transformation. Matrix representation of a linear transformation with respect to different bases.

UNIT 4
Dual space. Dual basis. Dimension of dual space. Linear functional. Annihilator. Dimension of annihilator of a subspace. Double dual. Characteristic vector and root. Characteristic polynomial. Eigen space. Algebraic and geometric multiplicities. Minimal Polynomial. Cayley-Hamilton theorem. Diagonalizability of linear operators.

Books Recommended

1. K. Hoffman & R. Kunze – Linear Algebra, Pearson.
2. S. Kumaresan -- Linear Algebra: A Geometric Approach, Prentice Hall of India.
3. S. Axler – Linear Algebra Done Right, Springer.
4. S. Friedberg & L. Spence – Linear Algebra, Pearson.

MAT/C15: Elementary Number Theory

UNIT 1
Divisibility. GCD & LCM. Euclidean Algorithm.Linear Diophantine equation. Primes. Co-primes. Prime counting function, statement of prime number theorem, Goldbach conjecture, linear congruences, complete set of residues.

UNIT 2
Chinese Remainder theorem. Fermat's Little theorem. Wilson's theorem. Number theoretic functions, sum and number of divisors, totally multiplicative functions. Greatest integer function. De Polygnac's Theorem

UNIT 3
Euler's phi-function. Euler's theorem, reduced set of residues, some properties of Euler's phi-function. . Definition and properties of the Dirichlet product. The Mobius Inversion formula.

UNIT 4
Order of an integer modulo n, primitive roots for primes, composite numbers having primitive roots, Euler's criterion, the Legendre symbol and its properties.Quadritic Residues. Quadratic reciprocity, quadratic congruences with composite moduli. The Jacobi symbol.

Books Recommended
1. D.M. Burton -- Elementary Number Theory, McGraw-Hill.
2. N. Robbins -- Beginning Number Theory, Jones & Bartlett Publishers.
3. I. Niven, H.S. Zuckerman, H.L. Montgomery – An Introduction to the Theory of Numbers, Wiley.
4. T. M. Apostol – Introduction to Number Theory, Springer.

MAT/C16: Probability and Statistics

UNIT 1

Sample space, probability axioms, real random variables (discrete and continuous), cumulative distribution function, probability mass/density functions, mathematical expectation, moments, moment generating function, characteristic function.

UNIT 2

Discrete distributions: uniform, binomial, Poisson, geometric, negative binomial, continuous distributions: uniform, normal, exponential. Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional functions.

UNIT 3

Expectation of function of two random variables, conditional expectations, independent random variables, bivariate normal distribution.

UNIT 4

Correlation coefficient, joint moment generating function (jmgf) and calculation of covariance (from jmgf), linear regression for two variables.Chebyshev's inequality, statement and interpretation of (weak) law of large numbers and strong law of large numbers, Central Limit theorem for independent and identically distributed random variables with finite variance.

Books Recommended
1. R.B. Hogg, J.W. McKean, A.T. Craig -- Introduction to Mathematical Statistics, Pearson.
2. I. Miller, M. Miller, J.E. Freund -- Mathematical Statistics with Applications, Pearson.
3. S. Ross -- Introduction to Probability Models, Academic Press.
4. A.M. Mood, F.A. Graybill, D.C. Boes -- Introduction to the Theory of Statistics,McGraw-Hill.

MAT/C17: Theory of Equations

UNIT 1

General properties of polynomials. Graphical representation of a polynomial, maximum and minimum values of a polynomial. General properties of equations, positive and negative rule. Relation between the roots and coefficients of equations.

UNIT 2

Symmetric functions. Applications of symmetric function of the roots. Transformation of equations.

UNIT 3
Solutions of reciprocal and binomial equations. Algebraic solutions of the cubic and biquadratic. Cardan's method of solution of cubic equations.

UNIT 4
Symmetric functions of the roots. Newton's theorem on the sums of powers of roots, homogenous products. Descartes' rule of signs.Separation of the roots of equations. Strums theorem, Applications of Strum's theorem. Conditions for reality of the roots of an equation and biquadratic. Solutions of numerical equations.

Books Recommended
1. W.S. Burnside, A.W. Panton -- The Theory of Equations, Dublin University Press.
2. C.C. MacDufee --Theory of Equations, Wiley.
3. R.K. Ghosh, M.K. Maity -- Higher Algebra ,New Central Book Agency.

MAT/C18: Mechanics-II

UNIT 1
Moment and product of inertia. Momental ellipsoid. Principal axes, D'Alembert's principle. The general equations of motion. Independence of the motions of translation and rotation. Impulsive forces.

UNIT 2
Motion of a fixed axis. Moment of momentum. The compound pendulum. Reactions of the axis of rotation. Motion about a fixed axis (impulsive forces). Centre of percussion.

UNIT 3
Motion in two dimensions (Finite forces). Kinetic energy in two dimensions. Moment of momentum in two dimensions. Varying mass.

UNIT 4

Laws of Coulomb friction, application to simple and complex surface contact friction problems, transmission of power through belts, screw jack, wedge, first moment of an area and the centroid, other centres, Theorems of Pappus-Guldinus.Conservative force field, conservation for mechanical energy, work energy equation, kinetic energy and work, kinetic energy expression based on centre of mass, moment of momentum equation for a single particle and a system of particles.

Books Recommended

1. M. Ray, H.S. Sharma -- A Textbook of Hydrostatics, S. Chand.
2. M.M. Rahman - - Rigid Dynamics, New Central Book Agency.
3. I.H. Shames, G. K. M. Rao -- Engineering Mechanics: Statics and Dynamics, Pearson.
4. R.C. Hibbeler, A. Gupta -- Engineering Mechanics: Statics and Dynamics, Pearson.