

COTTON COLLEGE STATE UNIVERSITY

DEPARTMENT OF MATHEMATICS

Undergraduate Syllabus in Mathematics

Credits are in the L+T+P format

Semester – I

Paper Code	Paper Name	Credits
MTH 101C	Classical Algebra and Trigonometry	3 + 1 + 0
MTH 102C	Calculus	3 + 1 + 0
MTH 103C	Coordinate Geometry	3 + 1 + 0
MTH 104E	Classical Algebra and Trigonometry	2 + 1 + 0

Semester – II

Paper Code	Paper Name	Credits
MTH 201C	Coordinate Geometry and Vector Calculus	3 + 1 + 0
MTH 202C	Differential Equations - 1	3 + 1 + 0
MTH 203C	Abstract Algebra - 1	3 + 1 + 0
MTH 204E	Calculus	2 + 1 + 0

Semester – III

Paper Code	Paper Name	Credits
MTH 301C	Real Analysis - 1	3 + 1 + 0
MTH 302C	Abstract Algebra - 2	3 + 1 + 0
MTH 303C	Differential Equation - 2	3 + 1 + 0
MTH 304E	Coordinate Geometry (2D+3D) and Vectors	2 + 1 + 0

Semester – IV

Paper Code	Paper Name	Credits
MTH 401C	Linear Algebra	3 + 1 + 0
MTH 402C	Real Analysis - 2	3 + 1 + 0
MTH 403C	Mechanics - 1	3 + 1 + 0
MTH 404E	Differential Equations	2 + 1 + 0

Semester – V

Paper Code	Paper Name	Credits
MTH 501C	Mechanics - 2	3 + 1 + 0
MTH 502C	Discrete Mathematics	3 + 1 + 0
MTH 503C	Numerical Analysis	3 + 1 + 0
MTH 504E	Abstract Algebra	2 + 1 + 0

Semester – VI

Paper Code	Paper Name	Credits
MTH 601C	Spherical Trigonometry and Astronomy	3 + 1 + 0
MTH 602C	Hydrostatics	3 + 1 + 0
MTH 603C	Computer Programming in C language	3 + 1 + 0
MTH 604E	Linear Algebra and Mechanics	2 + 1 + 0

SEMESTER- I

Paper: MTH 101C

CLASSICAL ALGEBRA AND TRIGONOMETRY

Credits: 4 (3+1+0)

Unit– I: Inequalities

Inequalities involving A. M., G. M., H. M., Cauchy Schwarz Inequality, Weirstrass' Inequalities, m th power theorem, extreme values of sum & product.

Unit– II: Relation between roots and coefficients

Descartes' rule of signs, symmetric functions of roots, Relation between roots and coefficients of a general polynomial equation in one variable, transformation of equations, solution of cubic equation by Cardon's method, Standard form of a biquadratic & Euler's method of solution of it.

Unit– III: Matrices

Symmetric, Skew-symmetric, Hermitian & skew Hermitian matrices, elementary operations on matrices, adjoint & inverse of a matrix, rank of a matrix, invariance of rank under elementary operations, normal form, solution of system of linear equations (homogeneous & non homogeneous) by matrix method.

Unit-IV: Trigonometry and complex numbers

Complex numbers as ordered pairs of real numbers, geometrical representation and polar form of complex numbers, argument & their properties, complex equations of straight line and circle.

DeMoivre's theorem, expansion of $\cos x$, $\sin x$ in positive integral powers of x , Logarithm of a complex number, exponential and trigonometric functions of a complex variable, Euler's expansion of cosine & sine, hyperbolic functions, inverse functions, Gregory's series.

Recommended readings:

1. Higher Algebra (Classical)– S. K. Mappa, Ashoke Prakasam, Calcutta
2. Matrices, F. Ayers, Schaum Series
3. Higher Algebra– B. Das & S. R. Maiti, Ashoke Prakasam, Calcutta

SEMESTER- I

Paper: MTH 102C

CALCULUS

Credits: 4 (3+1+0)

Unit– I:

Successive differentiation, standard results on nth order derivatives and Leibnitz' theorem, Partial differentiation, partial derivatives of first and higher orders for functions of two or more variables, Euler's theorem on homogeneous functions.

Unit– II:

Tangents and normals—angle of intersection of two curves, length of tangent, normal, sub-tangent and sub-normals, pedal equations, angle between radius vector and tangent, length of

perpendicular from pole to the tangent, lengths of polar sub-tangent and polar subnormal, pedal equation of a curve from its polar equation, concavity and points of inflexion and their criteria.

Curvature—definition of curvature and radius of curvature, derivation of arc length, formula for radius of curvature, circle of curvature. Asymptotes—definition and working rules for determination of a asymptotes (in case of Cartesian equations). Singular points, double points, cusp, node, conjugate point, multiple point, determination of multiple points of the curve $f(x, y) = 0$. Curve tracing—tracing of Catenary, Cissoid, asteroïd, cycloid, folium of Descartes, cardioïd, lemniscate.

Unit– III: Integrals of the form

$$\int \frac{(px + q)}{\sqrt{ax^2 + bx + c}} dx, \int (px + q)\sqrt{ax^2 + bx + c} dx, \int \frac{dx}{(px + q)\sqrt{ax^2 + bx + c}}$$

Integration of rational functions of $\sin x$ and $\cos x$. Reduction formulae for integration of the following functions:

$$x^n e^{ax}, x^m \sin nx, x^m \cos nx, \sin^p x \cos^q x \ (p > 0, q > 0), \tan^n x, \operatorname{cosec}^n x, \cos^m x \cos nx, \frac{1}{(x^2 + \lambda^2)}, x^n (\log x)^m$$

Properties of definite integrals.

Unit– IV: Rectification, Quadrature, volume and surface area of solids of revolution.

Recommended readings:

1. Differential Calculus– Das and Mukherjee, U N Dhur & sons
2. Integral Calculus– Das & Mukherjee, U N Dhur & Sons
3. Differential Calculus– Shanti Narayan. S. Chand and Co.
4. Integral Calculus– Maity and Ghose. New central book Agency.

SEMESTER- I

Paper: MTH 103C

COORDINATE GEOMETRY

Credits: 4 (3+1+0)

Unit– I:

Transformation of coordinate axes, pair of straight lines.

Unit– II:

Parabola, parametric coordinates, tangent and normal, ellipse and its conjugate diameters with properties, hyperbola and its asymptotes,

Unit-III:

General-conics: tangent, condition of tangency, pole and polar, centre of a conic, equation of pair of tangents, reduction to standard forms, central conics, equation of the axes, and length of the axes,

Unit-IV:

Polar equation of a conic, tangent and normal and properties.

Unit-V:

Plane, straight lines and shortest distance, sphere.

Recommended readings:

1. Analytical Geometry(2D) by E.H. Askwith.
2. Analytical Geometry by B. Das.
3. Analytical Geometry by Shanti Narayan– S Chand & co.
4. Analytical Geometry of two and three dimension and Vector analysis by R. M. Khan - New Central Book agency.
5. Analytical Geometry of two and three dimension– J. C. Chakraborty & Ghose, U. N. Dhur & sons.

SEMESTER- I

Paper: MTH 104E

CLASSICAL ALGEBRA AND TRIGONOMETRY

Credits: 3 (2+1+0)

Unit– I: Inequalities

Inequalities involving A. M., G. M., H. M., Cauchy Schwarz Inequality.

Unit– II: Trigonometry

- (a) Complex equations of straight line and circle.
- (b) De Moivre's theorem, expansion of $\sin x \cos x$, in positive integral powers of x , logarithm of a complex number, exponential and trigonometric functions of a complex variable, Euler's expansion of cosine & sine, hyperbolic functions, inverse functions, Gregory's series.

Unit– III: Relation between roots and coefficients

Symmetric functions of roots, Relation between roots and coefficients of a general polynomial equation in one variable, transformation of equations, solution of cubic equation by Cardon's method.

Unit– IV: Sequences and series

Sequence of real numbers, bounded, convergent and non- convergent sequences, uniqueness of the limit and boundedness of a convergent sequence. Cauchy sequence, Cauchy's General Principle of convergence, Subsequences, convergence and divergence of monotonic sequences, Algebraic operations of limit, Sandwich theorem. Infinite series and the basic properties of Infinite series. Absolute & Conditional tests for convergence, Comparison test, Ratio test, Leibnitz test, Cauchy's root test.

Recommended readings:

1. Higher Algebra (Classical) – S. K. Mappa, Ashoke Prakasam, Calcutta
2. Higher Trigonometry – Das & Mukherjee, U N Dhur & Sons
3. Higher Algebra – B. Das & S. R. Maiti, Ashoke Prakasam, Calcutta

SEMESTER- II

Paper: MTH 201C

COORDINATE GEOMETRY AND VECTOR CALCULUS

Credits: 4 (3+1+0)

Unit– I:

Cone and cylinder, central conicoids, ellipsoid, hyperboloid of one and two sheets, diametral planes, tangent lines, director sphere, polar plane, section with a given centre, enveloping cone and cylinder.

Unit-II: Vectors

Scalar triple product, vector triple product, Product of four vectors

Unit– III:

Continuity and derivability of vector-point function, partial derivatives of vector point function, gradient, curl & divergence, identities.

Unit– IV:

Vector integration, line, surface and volume integrals, Green, Stokes & Gauss' theorem.

Recommended readings:

1. Solid geometry : E.T.Bell
2. Analytical Geometry by B. Das
3. Analytical Geometry by Shanti Narayan– S Chand & co.
4. Analytical Geometry of two and three dimension and Vector analysis - R. M. Khan - New Central Book agency
5. Analytical Geometry of two and three dimension– J. C. Chakraborty&Ghose, U. N. Dhur& sons.

SEMESTER- II

Paper: MTH 202C

DIFFERENTIAL EQUATION - 1

Credits: 4 (3+1+0)

Unit– I:

First order first degree differential equations; Linear differential equations; Exact Differential equations; Bernoulli's differential equation.

Method of solving higher degree equations solvable for x , y and p . Clairaut's form and singular solutions, orthogonal trajectories. Applications of first order differential equation. .

Unit– II:

Linear ordinary differential equations of second and higher order with constant coefficients, homogeneous linear ordinary differential equations.

Unit– III:

Linear differential equations of 2nd order with variable coefficients, standard methods, transformation of the equation by changing the dependent variable, independent variable, method of variation of parameters.

Unit IV:

Simultaneous linear differential equations.

Recommended readings:

1. Differential Equations – Ross, Wiley & Sons
2. Integral Calculus – Das & Mukherjee, U N Dhur & Sons
3. Differential Equations – Piaggio
4. Theory and Problems of Differential equation—Frank Ayers. Schaum outline Series.
5. Ordinary and partial differential Equation: M.D. Raisinghania. S.Chand and Co.

SEMESTER- II

Paper: MTH 203C

ABSTRACT ALGEBRA - 1

Credits: 4 (3+1+0)

Unit– I:

Relations, Equivalence relations, Equivalence classes, Partition of a set, mappings, binary composition (brief idea).

Unit– II:

Definition of a Group, examples of Groups, Subgroups, Lagrange’s theorem on order of a subgroup of a finite group, Euler’s theorem, Fermat’s theorem, Subgroups generated by a set, cyclic groups, permutation groups, normal subgroups, quotient groups.

Unit– III:

Homomorphism of groups, Isomorphisms, Fundamental theorem of Homomorphisms, Cayley’s theorem,

Unit-IV:

Automorphisms of groups, Inner automorphisms, characteristic Subgroups, conjugacy relations, normaliser, centre of a group,

Recommended readings:

1. A Course in Abstract Algebra – Khanna & Bhambri, Vikas Pub. House
2. Modern Algebra – Singh & Zameeruddin, Vikas Pub. House
3. Topics in Algebra – I. N. Herstein, New Age Pub
4. Algebra– Bhattacharya, Nagpal & Jain - Wiley

SEMESTER- II

Paper: MTH 204E

CALCULUS

Credits: 3 (2+1+0)

Unit– I:

Successive differentiation, standard results on nth order derivatives and Leibnit'z theorem, Tangents and normals.

Unit- II:

Rolle's theorem, Lagrange's Mean Value theorem, Cauchy's Mean Value theorem, Taylor's theorem, Maclaurin's theorem. Maclaurin's infinite power series for a given function; expansion of $\exp(x)$, $\sin x$, $\cos x$, $\log(1+x)$ and allied functions. Indeterminate forms.

Unit- III:

Partial differentiation, partial derivatives of first and higher orders for functions of two or more variables, Euler's theorem on homogeneous functions, Maxima and Minima of a function of two variables and working rules (without proof) for their determination.

Unit– IV:

Curvature of plane curves, radius of curvature. Asymptotes—definition and working rules for determination of asymptotes (in case of Cartesian equations).

Unit – V:

Integrals of the form;

$$\int \frac{(px + q)}{\sqrt{ax^2 + bx + c}} dx, \int (px + q)\sqrt{ax^2 + bx + c} dx, \int \frac{dx}{(px + q)\sqrt{ax^2 + bx + c}}$$

Properties of definite integrals, Reduction formulae for integration of the following functions: $x^n e^{ax}$, $x^m \sin nx$, $x^m \cos nx$, $\tan^n x$, $\operatorname{cosec}^n x$, $\cos^m x \sin^m x$.

Unit– VI:

Rectification and Quadrature of plane curves.

Recommended readings:

1. Differential Calculus– Das and Mukherjee, U. N. Dhur & sons
2. Integral Calculus– Das & Mukherjee, U N Dhur & Sons
3. Differential Calculus– Shanti Narayan. S. Chand and Co.
4. Integral Calculus– Maity and Ghose. New central book Agency.

SEMESTER- III

Paper: MTH 301C

REAL ANALYSIS - 1

Credits: 4 (3+1+0)

Unit– I:

Characterization of the real number system R as a complete Archimedean ordered field,

neighbourhoods, open set, closed set, limit point of a set.

Unit– II: Sequences and series

Sequence of real numbers, bounded, convergent and non-convergent sequences, limit superior and limit inferior, uniqueness of the limit and boundedness of a convergent sequence.

Bolzano-Weierstrass theorem for bounded sequence;

Cauchy's sequence; Cauchy's General Principle of convergence; Nested interval theorem; Subsequences, convergence and divergence of monotonic sequences; Algebraic operations of limit; Sandwich theorem; Infinite series and the basic properties of Infinite series; Absolute & Conditional tests for convergence; Comparison test; Ratio test; Leibnitz test; Cauchy's root test, Cauchy's integral test.

Unit– III: ϵ, δ

Definition of limit and continuity of a function of single variable, properties of continuous functions in closed interval, sequential continuity, inverse function and monotonic function, uniform continuity.

Unit– IV:

Derivability of a function of single variable, algebra of derivatives, Darboux's theorem, intermediate value theorem for derivatives, Roll's theorem, mean value theorems, intermediate forms;

Taylor's theorem, Taylor's and Maclaurin's infinite series, expansion of e^x , $\sin x$, $\cos x$, $\log_e(1+x)$ and $(1+x)^m$, maxima-minima of a function of single variable and two variables (reducible to single variable).

Recommended readings:

1. Principles of Real Analysis by S.C. Malik, Newage international.
2. Real Analysis by S. K. Mappa
3. Principle of Mathematical Analysis by Walter Rudin
4. A course of Mathematical Analysis by Shanti Narayan, S. Chand and Co.
5. A Text Book of Degree Mathematics by P. Rajkhowa and N.R. Das. Asian Book Pvt. Ltd.

SEMESTER- III

Paper: MTH 302C

ABSTRACT ALGEBRA - 2

Credits: 4 (3+1+0)

Unit– I:

Definitions, examples and properties of rings, fields, Integral domains, division rings, subrings, ideals, characteristic of a ring, Ideals, sum of ideals, Product of ideals

Unit-II:

Homomorphisms of rings and imbeddings: maximal and prime ideals idempotent & nilpotent elements and ideals, nil ideals in a ring, principal, prime, maximal ideals, simple ring.

Unit-III:

Quotient rings, field of quotients of an integral domain, Euclidean rings,

Unit-IV:

Polynomial rings, its ideals and quotients etc. Ring of matrices-its ideals and quotients etc.

Recommended readings:

1. A Course in Abstract Algebra – Khanna & Bhambri, Vikas Pub. House
2. Modern Algebra – Singh & Zameeruddin, Vikas Pub. House
3. Topics in Algebra – I. N. Herstein, New Age Pub
4. Algebra– Bhattacharya, Nagpal & Jain – Wiley
5. Matrices, F. Ayers, Schaum Series

SEMESTER- III

Paper: MTH 303C

DIFFERENTIAL EQUATION - 2

Credits: 4 (3+1+0)

Unit– I:

Total differential equation and simultaneous equations of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$. Exact

differential equations including special form $\frac{d^n y}{dx^n} = f(x)$.

Unit– II:

Series solutions of differential equations. Bessel and Legendre differential equations. Bessel and Legendre functions and their properties.

Unit–III:

Partial differential equations of the first order, Partial first order differential equations of special forms.

Lagrange's method. Integral surfaces passing through a given curve. Surfaces orthogonal to a given system of surfaces.

Recommended readings:

1. Partial differential equations : S.N. Sneddon
2. Differential Equations – Ross, Wiley & Sons
3. Integral Calculus – Das & Mukherjee, U N Dhur & Sons
4. Differential Equations – Piaggio
5. Theory and Problems of Differential equation—Frank Ayers. Schaumoutline Series.
6. Ordinary and partial differential Equation: M.D. Raisinghanian. S.Chand and Co.

SEMESTER- III

Paper: MTH 304E

COORDINATE GEOMETRY (2D + 3D) AND VECTORS

Credits: 3 (2+1+0)**Unit– I:**

Transformation of coordinate axes, pair of straight lines.

Unit– II:

Parabola, parametric coordinates, tangent and normal, ellipse and its conjugate diameters with properties, hyperbola and its asymptotes, general conics: tangent, condition of tangency, pole and polar, centre of a conic, equation of pair of tangents, reduction to standard forms, central conics, and length of the axes, polar equation of a conic, tangent and properties.

Unit– III:

Sphere, cone and cylinder.

Unit– IV:

Scalar triple product, Vector triple product, Product of four vectors .

Unit– V:

Vector point function, continuity and differentiation of vector point function. Partial derivatives of vectors, curl, grad, divergence and identities (Cartesian coordinates only)

Recommended readings:

1. Analytical Geometry by B. Das
2. Analytical Geometry by Shanti Narayan – S. Chand & Co.
3. Analytical Geometry of two and three dimension and vector analysis - R. M. Khan - New Central Book agency.
4. Analytical Geometry of two and three dimension– J. C. Chakraborty & Ghose, U. N. Dhur & sons
5. Vectors by M.P. Raisinghania, S. Chand & Co.

SEMESTER- IV

Paper: MTH 401C

LINEAR ALGEBRA

Credits: 4 (3+1+0)

Unit– I:

Definition and examples of a vector space, subspaces, linear combinations. Sums and direct sum of subspaces, linear span, linear dependence and independence, and their basic properties, basis, finite dimensional vector spaces, existence theorem for bases, invariance of the number of elements of a basis, dimensions, existence of complementary subspaces of a subspace of finite dimension, dimension of sum of subspaces, quotient spaces and its dimension.

Unit– II:

Linear transformations and their representation as matrices, the algebra of linear transformations, the rank nullity theorem, change of basis, dual spaces.

Unit– III:

Eigenvalues, eigenvectors, characteristic equation of a matrix, Cayley-Hamilton theorem, minimal polynomial, characteristic & minimal polynomial of linear operators, existence & uniqueness of solution of a system of linear equations.

Recommended Readings:

1. Linear Algebra – Hoffman & Kunze
2. Linear Algebra – Lipschutz, Schaum Outline Series

SEMESTER- IV

Paper: MTH 402C

REAL ANALYSIS - 2

Credits: 4 (3+1+0)

Unit- I:

Riemann integral, integrability conditions, Riemann integral as a limit, some classes of integrable functions, the fundamental theorem of integral calculus, statement and application of M.V. theorems of integral calculus

Unit-II:

Improper integrals and their convergence, various forms of comparison tests, absolute and conditional convergence, Abel's and Dirichlet's tests,

Unit-III:

Beta and Gamma functions and their properties, applications. Frullani's integral, integral as a function of parameter (excluding improper integrals),

Unit-IV:

Continuity, derivability and integrability of an integral as a function of a parameter.

Recommended readings:

1. A course of Mathematical Analysis by Shanti Narayan, S. Chand and Co.
2. Mathematical analysis by S. C. Malik and S. Arora, New Age international.
3. Advanced Calculus by Spiegel, Schaum Outline Series.
4. A text Book for Degree Mathematics Part-I by P. Rajkhowa and N. R. Das, Asian Books Pvt. Ltd

SEMESTER- IV

Paper: MTH 403C

MECHANICS - 1

Credits: 4 (3+1+0)

Unit- I:

(Only brief idea of Resultant of two concurrent forces, λ - μ theorem, Rectangular resolution of a force Parallel forces) Couples, moments, reduction of coplanar forces, analytical condition of equilibrium of coplanar forces, friction.

Unit– II:

Centre of gravity of a plane area, arc and a sector of a curve, C.G of solids and surface of revolution, C.G of areas bounded by a given curve.

Unit– III:

Principle of virtual work-in two dimensions, forces in three dimensions. Poinso't's central axis, wrenches, null lines and planes.

Unit– IV:

Stable and unstable equilibrium. Simple examples of Common Catenary.

Unit– V:

Velocity & Acceleration, Resultant Velocity, Uniform velocity & acceleration (a brief idea). Velocities and accelerations along radial & transverse directions & along tangential & normal directions, motion in a straight line under variable acceleration, simple harmonic motion.

Unit– VI:

Motion in resisting medium, motion of particles of varying mass.

Unit– VII:

Central orbit and Kepler's Laws of planetary motion.

Recommended readings:

1. Statics by S.L.Loney, Cambridge University Press.
2. Dynamics by S.L.Loney, Cambridge University Press.
3. Dynamics by Ramsey.
4. Dynamics by M. Ray, S. Chand.
5. Statics by Das and Mukherjee, UN Dhar and Sons.
6. Dynamics by Das and Mukherjee, UN Dhar and Son.
7. Theoretical Mechanics by Spiegel, Schaum Outline Series.

SEMESTER- IV

Paper: MTH 404E

DIFFERENTIAL EQUATIONS

Credits: 3 (2+1+0)

Unit– I:

Differential Equations of 1st order and 1st degree, First order linear differential equations, Bernoulli's equations, Exact differential equations, 1st order and higher degree differential equations, method of solving higher degree equations solvable for x, y and p. Clairaut's form and singular solutions, orthogonal trajectories. Applications of d.e.s.

Unit– II:

Second order linear differential equations with constant coefficients, homogeneous linear differential equations.

Unit– III:

Simultaneous linear differential equations.

Unit– IV:

Partial differential equation; Origin of Partial differential equations; Lagrange's solutions.

Recommended readings:

1. Differential Equations – Ross, Wiley & Sons
2. Integral Calculus – Das & Mukherjee, U N Dhur & Sons
3. Differential Equations – Piaggio
4. Theory and Problems of Differential equation—Frank Ayers. Schaum outline Series.
5. Ordinary and partial differential Equation: M.D. Raisinghania. S.Chand and Co.

SEMESTER- V

Paper: MTH 501C

MECHANICS - II

Credits: 4 (3+1+0)

Unit-I:

Central orbit, Kepler's Laws and its applications

Unit– II:

Moments and products of inertia, parallel axes theorem, theorem of six constants, the momental ellipsoid, equimomental systems, principle axes.

Unit– III:

D'Alembert's principle, the general equation of motion of a rigid body, motion of the centre of inertia and motion relative to the centre of inertia.

Unit– IV:

Motion about a fixed axis, the compound pendulum, centre of percussion.

Unit– V:

Motion of a body in two dimensions under finite and impulsive forces.

Recommended readings:

1. An elementary treatise on the Dynamics of a particle and of Rigid bodies by S. L. Loney.
2. Dynamics part- I by A. S. Ramsey
3. Theoretical Mechanics by Spiegel, Schaum Series.
4. Analytical Dynamics by F. Chorlton.

SEMESTER- V

Paper: MTH 502C

DISCRETE MATHEMATICS

Credits: 4 (3+1+0)

Unit– I: Divisibility theory

Peano's axiom, well ordered principle, mathematical induction, division algorithm, the basis representation theorem, prime numbers, unique factorization theorem.

Unit– II: Congruence's

Basic properties of congruence's, residual systems, linear congruence's and their solutions, special divisibility tests, the Chinese remainder theorem and its applications, Fermat's Little theorem and Wilson's theorem. Polynomial congruence's.

Unit– III: Diophantine equation

Linear Diophantine equation, the equation $x^2+y^2=z^2$ and $x^4+y^4=z^4$. Fermat's last theorem, representation of a number by two or four squares.

Unit– IV: Number theoretic function

Euler's phi function, Euler's theorem, combinatorial study of the Euler's phi function, the function τ and σ , basic theorems on $\tau(n)$ and $\sigma(n)$, the Mobious function, multiplicative arithmetic function, inversion formula, greatest integer function.

Unit– V: Propositional Calculus

Operation on statements, truth function, laws of propositional logic, Boolean algebra of statement bundles, adequate system of connectives, binary connectives 'Nor' and 'Nand'.

Unit– VI: Boolean Algebra

Disjunctive normal form (DNF), Complement of Boolean expression in DNF, construction of a Boolean function corresponding to a Boolean expression, conjunctive normal form (CNF), Complement of Boolean expression in CNF, transformation of normal form to the other form, applications.

Recommended readings:

1. Elementary Number Theory-David M. Burton, University Bookstall, New Delhi.
2. Introduction to Discrete Mathematics- M.K. Sen, Allied publisher.
3. Elements of Discrete Mathematics: C.L. Liu; McGraw Hill, Comp.c. Series.
4. A First Course in Theory Of Numbers: K.C. Chowdhury; Asian Books Private Ltd.

SEMESTER- V

Paper: MTH 503C

NUMERICAL ANALYSIS

Credits: 4 (3+1+0)

Unit– I:

Normalized floating point representation of real numbers and operations using it, normalization and its consequence, errors in arithmetic operations, absolute and relative error, truncation and round off errors, approximation and significant figures.

Unit– II:

Calculus of finite difference: different interpolation formulae with remainder terms, finite difference operators and their operations on function of a single variable, interpolation with equal and unequal intervals, Newton's formulae, Lagrange's formula, Gauss, Bessel and sterling's formula, Hermite interpolation.

Unit– III:

Numerical differentiation and integration: Numerical differentiation with the help of different interpolation formulae, general quadrature formula, trapezoidal rule, Simpson's one third and three eighth rule, Weddel's rule, Newton-Cote's formula, Gauss quadrature formula, Chebycheve's formula.

Unit– IV:

Solution of polynomial and transcendental equations: Bisection method, secant method, Regula Falsi method, Newton-Raphson method, rate of convergence and comparison of methods.

Recommended readings:

1. Numerical methods by S.Balachandra Rao and C.K.Santha, Univ. Press.
2. Numerical Analysis by Sanyal & Das
3. Numerical Analysis by Kunz
4. Numerical Analysis, Schaum Outline Series.

SEMESTER- V

Paper: MTH 504E

ABSTRACT ALGEBRA

Credits: 3 (2+1+0)

Unit– I: Matrices

Hermitian & skew Hermitian matrices, elementary operations on matrices, adjoint & inverse of a matrix, rank of a matrix, solution of system of linear equations (homogeneous & non-homogenous) by matrix method.

Unit- II:

Relations, Equivalence relations, Equivalence classes, Partition of a set, mappings, binary composition.

Unit– III:

Definition of a Group, examples of Groups, Subgroups, Cosets, Lagrange's theorem on order of a subgroup of a finite group, cyclic groups, permutation groups, normal subgroups, quotient groups. Homomorphism and Isomorphism of groups.

Unit– IV:

Definitions, examples and properties of rings, fields, Integral domains, division rings, subrings.

Recommended readings:

1. A Course in Abstract Algebra – Khanna & Bhambri, Vikas Pub. House
2. Modern Algebra – Singh & Zameeruddin, Vikas Pub. House
3. Topics in Algebra – I. N. Herstein, New Age Pub
4. Algebra– Bhattacharya, Nagpal & Jain – Wiley
5. Matrices, F. Ayers, Schaum Series.

SEMESTER- VI

Paper: MTH 601C

SPHERICAL TRIGONOMETRY AND ASTRONOMY

Credits: 4 (3+1+0)

Unit– I:

Section of a sphere by a plane, spherical triangles, properties of spherical and polar triangles, fundamental formulae of spherical triangles, sine formula, cosine formula, sine- cosine formula, cot formula, Napier’s rule of circular parts.

Unit– II:

The standard(or geometric)celestial sphere, system of coordinates, conversion of one coordinate system to the another system, diurnal motion of heavenly bodies, sidereal time, solar time(mean), rising and setting of stars, circumpolar star, dip of the horizon, rate of change of zenith distance and azimuth, examples

Unit -III:

Two body problem and Kepler’s Laws

Unit-IV:

Eclipses: Solar and Lunar eclipses. Maximum number of eclipses in a year. Mathematical conditions for occurrence of solar and lunar eclipses.

Unit-V:

Parallax: Parallaxes of various kinds, effects of parallaxes.

Recommended readings:

1. Spherical Astronomy by W.M. Smart.
2. Spherical Astronomy by B. Sarma.
3. Spherical Astronomy by S. Malik.

SEMESTER- VI

Paper: MTH 602C

HYDROSTATICS

Credits: 4 (3+1+0)

Unit– I:

Pressure equation, condition of equilibrium, lines of force, homogeneous and heterogeneous fluids, elastic fluids, surface of equal pressure, fluid at rest under action of gravity, rotating fluids.

Unit– II:

Fluid pressure on plane surfaces, centre of pressure, resultant pressure on curved surfaces.

Unit– III:

Equilibrium of a floating body, curves of buoyancy, surface of buoyancy, stability of equilibrium of floating bodies, meta centre, work done in producing a displacement, vessel containing a liquid.

Unit– IV:

Gas law, mixture of gases, internal energy, adiabatic expansion, work done in compressing a gas, isothermal atmosphere, convective equilibrium.

Recommended readings:

1. A Treatise on Hydromechanics part-I Hydrostatics by W.H. Besant and A.S.Ramsey.
2. Hydrostatics by J.M.Kar, K.P.Basu Pub. Co. Calcutta.
3. Hydrostatics by M.Ray

SEMESTER- VI

Paper: MTH 603C

COMPUTER PROGRAMMING IN C LANGUAGE

Credits: 4 (3+1+0)

Unit-I:

Brief introduction of central processing, main memory, secondary memory, input/output devices, operating system and its need, representation of numbers and characters in computer, machine level language and high level language, compiler, interpreter, assembler, linker, loader, editor, debugger, algorithm, flowchart and computer programmes, decision table and trees, efficiency and analysis of algorithm. Introduction to C-requirement of programming language to solve problems.

Unit- II:

Elementary data types: variables, constants and identifiers, integer, character, floating point and string constants, variable declaration, initialization of variables during declaration, constant data types), Syntax and semantics, reserved words, expression in C operator precedence and associatively, unary, binary and ternary operators, C arithmetic operators, assignment operators, relational operators, logical and bitwise operators, L-value and R-value, expression statement, cast and size of operator, automatic type conversion.

Unit- III:

Conditional Statement: if, if-else, switch. Iterative statement, block statement.

Unit- IV:

Function: function declaration, calling a function by value, call by reference and its absence in C, storage class (automatic register, static, external); recursion and how it works (use of machine stack for storing return address, parameters and local variables), conversion of recursive programmes to non-recursive version.

Programmes for practical (Internal)

To evaluate an arithmetic expression, to find gcd, factorial, Fibonacci number, prime number generation, reversing digits of an integer, finding square root of a number, roots of a quadratic equation, sum of different algebraic and trigonometric series, base conversion, towers of Hanoi, test for Palindrome, addition subtraction and multiplication of matrices, to find the greatest and smallest of a finite number of numbers, interpolation and solution of transcendental equation.

Recommended readings:

1. E. Balaguru swamy – Programming in ANSI C, Tata McGraw Hill.
2. E. Balaguru swamy – Programming with C, Schaum Series.
3. Let us C – Y. Kanetkar, B.P. Publication.

SEMESTER- VI

Paper: MTH 604E

LINEAR ALGEBRA AND MECHANICS**Credits: 3 (2+1+0)****Unit– I:**

Definition and examples of a vector space, subspaces, linear combinations, linear transformations and simple examples.

Unit– II:

Parallel forces, Moments, Couples, System of coplanar forces and conditions of equilibrium. Friction.

Unit – III:

Components of velocity and acceleration along radial and transverse direction and along tangential and normal directions, Simple harmonic motion, Central orbits Kepler's laws of planetary motion.

Recommended readings:

1. Linear Algebra – Hoffman & Kunze
2. Linear Algebra – Lipschutz, Schaum Outline Series
3. Theoretical mechanics – Schaum Outline Series
4. Dynamics by M. Ray, S. Chand and Co.
5. Dynamics by Das and Mukharjee, U.N Dhur publication.
6. Statics by Das and Mukherjee, U.N.Dhur publications