B.A./ B.Sc. DEGREE

COURSE STRUCTURE FOR MATHEMATICS SUBJECT

[Duration 6 Semesters (3 Years)]

SEMESTER-I

Paper No.	Paper Title	Contents Topics
BSM 1.1	Algebra-I	Mathematical Logic Elements of Set Theory Matrices
BSM 1.2	Calculus-I	Limits & Continuity Successive Differentiation Polar Coordinates Theory of Plane Curves

SEMESTER-II

Paper No.	Paper Title	Contents Topics
BSM 2.1	Algebra-II	Theory of Equations Sequences Infinite Series
BSM 2.2	Calculus-II	Integral Calculus Application of Integral Calculus Functions of Two & Three Variables

SEMESTER-III

Paper No.	Paper Title	Contents Topics
BSM 3.1	Vectors & Solid Geometry	Vectors and Solid Geometry
BSM 3.2	Real Analysis	Differentiability Reimann Integration Line & Multiple Integration

SEMESTER-IV

Paper No.	Paper Title	Contents Topics
BSM 4.1	Algebra-III	Abstract Algebra & Linear Algebra
BSM 4.2	Differential Equations-I	Ordinary Differential Equations

SEMESTER-V

Paper No.	Paper Title	Contents Topics
BSM 5.1	Vector Analysis & Laplace Transform	Vector Analysis, Fourier Series and Laplace Transforms
BSM 5.2	Differential Equations-II	Series Solution Partial Differential Equations
BSM 5.3	Optional-I	

SEMESTER-VI

Paper No.	Paper Title	Contents Topics
BSM 6.1	Numerical Analysis	Numerical Analysis
BSM 6.2	Complex Analysis	Complex Analysis and Improper Integrals
BSM 6.3	Optional-II	

Students have to select **ONE** of the optional papers listed below during V Semester and corresponding paper during VI Semester (depending upon the teaching staff available and infrastructure available in the college).

Optionals for Fifth Semester:

- BSM-5.3(a) Discrete Mathematics-I
- BSM-5.3(b) Mechanics-I
- BSM-5.3(c) Operations Research-I
- BSM-5.3(e) Graph Theory-I
- BSM-5.3(f) Mathematical Modelling-I.

Optionals for Sixth Semester:

- BSM-6.3(a) Discrete Mathematics-II
- BSM-6.3(b) Mechanics-II
- BSM-6.3(c) Operations Research-II
- BSM-6.3(e) Graph Theory-II
- BSM-6.3(f) Mathematical Modelling-II

BSM-1.1: ALGEBRA-I

Mathematical Logic:

Revision of symbolic logic of simple and compound propositions, tautology, contradiction, valid arguments, the structure of mathematical systems. Direct and indirect proofs. Disproof by a counter example. Quantifiers, universal quantifiers, existential quantifiers and negation containing quantifiers. 10 Hrs

Elements of Set Theory:

Equivalence relations, partition of a set, functions, set theoretic properties of functions. Existence of inverse of a function and properties of inverse functions. Composition of functions. Associativity of inverse of composition. Countable and uncountable sets. 10 Hrs

Matrices:

Recapitulation of matrix algebra, rank of matrix, elementary operations, equivalent matrices, invariance of rank under elementary operation, inverse of a non-singular matrix by elementary operations.

System of m-linear equations in n unknowns, matrices associated with linear equation, criterion for existence of non-trivial solution of homogeneous and non-homogeneous system, criterion for uniqueness of solutions. 25 Hrs

References:

1. F.J. Noronha, et al: Introduction to Mathematical Logic, (Bangalore University Publication).
2. F.Ayres: Matrices (Schaum Publishing Co.)
3. Y.F. Line and S.Y. Lio: Set Theory, Intuitive Approach (Houghton Mifflin Co.)
4. S.Lipschutz: Set Theory & Related Topics (Schaum Publishing Co.)
5. Rudraiah et al: College Mathematics, Vol. I, (Sapna, Bangalore).

BSM-1.2: CALCULUS-I

Limits & Continuity:

Recapitulations, algebra of continuous functions. Properties of continuous functions, differentiability, Rules of differentiation. 10 Hrs

Successive Differentiation:

n^{th} derivative of the functions $(ax+b)^m$, log (ax+b), e^{ax}, sin (ax+b), cos (ax+b), e^{ax} sin (bx+c), e^{ax} cos (bx+c), Leibnitz theorem and applications. 10 Hrs

Polar Coordinates:

Angle between the radius vector and the tangent. Angle of intersection of curves (polar form). Perpendicular from pole on to the tangent. Pedal equations. Derivative of an arc in Cartesian, parametric and polar form. 10 Hrs

Theory of Plane Curves:

Points of inflection, concavity and convexity of curves. Curvature of plane curves. Formula for radius of curvature in Cartesian, parametric, polar and pedal form. Centre of curvature, evolutes and involutes. Envelopes, asymptotes, singular points, cusp, node and conjugate points. Tracing of standard curves in Cartesian and polar forms. 25 Hrs

References:

1. Shanthi Narayan: Differential Calculus (S.Chand & Co.).
2. Murray R. Spiegel: Advanced Calculus (Schaum Series).
3. L.Bers: Calculus, Vol. I & II (IBM).
4. Rudraiah et al, College Mathematics, Vol. I, (Sapna, Bangalore)
5. F.Ayres Jr: Calculus, Schaum Series.

BSM-2.1: ALGEBRA-II

Theory of Equations:

Relation between the roots and coefficients of general polynomial equation in one variable. Transformations of equations. Descartes' rule of signs. Solution of cubic equations (Cardon method and trigonometric method). Biquadratic equations. 15 hrs

Sequences:

Sequences, sub-sequences, bounded and unbounded sequences. Convergence and divergence of sequences and subsequences, monotonic sequences, algebra of convergent sequences, limit superior and limit inferior of sequences, limit points as limit of convergent, subsequences. Cauchy sequences, Cauchy's criterion for convergence. 15 hrs

Infinite Series:

Partial sums of a series, convergence and divergence of series, series of non-negative terms, geometric and harmonic series, comparison test and integral test for series of non negative terms, absolute and conditional convergence. Ratio test and root test for absolute convergence, alternating series, uniform convergence. 15 hrs

References:

1. Uspenskey: Theory of Equations.
2. C.C.Macduffee: Theory of Equations (John Wiley).
3. Ray & Sharma: Higher Algebra (S.Chand & Co.)
4. Burnside and Porton: Theory of Equations (S.Chand & Co.)
5. S.C.Malik: Mathematical Analysis (Wiley-Eastern).
6. Earl D.Rainville: Infinite Series, McMillan Co.
7. OE Stanaitis: An Introduction to Sequences, Series and Improper Integrals, Holdan-Dey Inc.

BSM-2.2: CALCULUS-II

Integral Calculus:

Recapitulation of definition of integration. Integrals of algebraic, trigonometric, rational and irrational functions. Definite integrals. Definite integral as limit of sum with examples. Standard reduction formulae with examples.

15 hrs

Applications of Integral Calculus:

Computation of areas, surface areas and volumes of solids of revolution. Lengths of arcs for standard curves in Cartesian and polar forms.

30 hrs

Functions of Two and Three Variables:

Continuity, partial derivatives, Euler's theorem for homogeneous functions (2-variables). Maxima and minima of functions of two variables. Total derivative. Total differential, differentiation of implicit functions. Change of variables. Dependent and independent functions. Jacobian's properties and functional relations.

15 hrs

References:

1. Shanthi Narayan: Integral Calculus (S.Chand & Co.).
2. Murray R. Spiegel: Advanced Calculus (Schaum Series).
3. L.Bers: Calculus, Vol. I & II (IBM).
4. Shanti Narayan: Differential Calculus (S.Chand & Co.).
5. Rudraiah et al: College Mathematics, (Sapna, Bangalore).

BSM-3.1: VECTORS AND SOLID GEOMETRY

Vectors:

Recapitulation of vector algebra. Vector triple product. Product of four vectors. Reciprocal vectors. 10 hrs

Solid Geometry:

Cartesian coordinates in three-dimensional space. Relation between Cartesian coordinates and position vectors. Distance and division formulae (in vector and Cartesian form). Direction cosines of a line (as components of a unit vector). Direction ratios of the join of two points. Projection on a straight line (vector and Cartesian form), angle between two lines (dot product and Cartesian forms). Area of a triangle and volume of a tetrahedron with given vertices (vector and Cartesian forms).

Equation of a plane in the form: (i) $(\vec{r}-\vec{a})\hat{n}=0$ (ii) $\vec{r}=\vec{c}+l\vec{a}+m\vec{b}$

(iii) $\left[\vec{r}-\vec{a}\ \vec{b}-\vec{a}\ \vec{c}-\vec{a}\right]=0$ and their Cartesian equivalence. Plane through three points. Angle between planes. Equation of plane in the form (i) $\vec{r}=\vec{a}+\vec{b}$; (ii) $\vec{r}=[1-t]\vec{a}+t\vec{b}$ and their equivalent Cartesian forms. Angle between line and plane (vector and Cartesian forms). Condition for a line to lie in a plane (vector and Cartesian forms). Planes coaxial with given planes. Equation of the line of intersection of two planes. Perpendicular distance of a point from a line and plane. Planes bisecting the angle between two given planes co-planarity of two lines. Shortest distance between two lines (all these results are to be obtained in both vector and Cartesian forms). 35 hrs

References:

1. S.L.Loney: Coordinate Geometry, Part-I (MacMillan)
2. Shanti Narayan: Elements of Analytical Solid Geometry (S.Chand & Co.)
3. Khanna M.L.: Analytical Solid Geometry.
4. Bill R.J.T.: Coordinate Geometry of 3-Dimensions, McMillan India.
5. Spiegel M.R.: Vector Analysis (Schaum Series).
6. Shanti Narayan: Vector Algebra and Linear Algebra (S.Chand & Co.)

BSM-3.2: REAL ANALYSIS

Differentiability:

Rolle's theorem, Lagrange's and Cauchy's mean value theorem. Taylor's theorem with Lagrange's form of the remainder. Taylor's and Maclaurin's series. Problems on transcendental functions. Indeterminate forms, L'Hospital rules. 15 Hrs

Reimann Integration:

Recapitulation of real number system, postulates and their consequences, inequalities and absolute values, lower and upper bounds.

The upper and lower sums, necessary and sufficient conditions for integrability. Algebra of integrable functions. Intergrability of continuous and monotonic functions. Fundamental theorem of calculus, change of variables. Integration by parts. The first and second mean value theorems of integral calculus. 15 Hrs

Line and Multiple Integrals:

Definitions of a line integral, basic properties. Examples on evaluation of line integrals. Examples on differentiation under integral sign and integration under differential sign.

Definitions of double integral: its conversion to iterated integrals. Evaluation of double integrals (i) under given limits (ii) in regions bounded by given curve – change of variables. Surface areas as double integrals.

Definition of a triple integral and evaluation. Change of variables. Volume as a triple integrals. 15 Hrs

References:

1. Shanti Narayan: Differential Calculus (S.Chand & Co.)
2. Murray R. Spiegel: Advanced Calculus (Schaum's Series).
3. Sokoilnikoff I.S.: Advanced Calculus (McGraw Hill).
4. S.C.Malik: Mathematical Analysis (Wiley-Eastern)
5. Sharma and Vasistha: Real Analysis (Krishna Prakashan Mandir, Meerut).

BSM-4.1: ALGEBRA-III

Abstract Algebra:

Groups, sub-groups, cyclic groups, Lagrange's theorem and its consequences. Farmat's and Euler's theorems. Homomorphism and isomorphism. Normal sub-groups, quotient groups. The fundamental theorem of homomorphism. Permutation groups. Rings, sub-rings, integral domains and fields and their simple properties. 25 hrs

Linear Algebra:

Vector space examples Including R^n and C^n. Properties of vector space: Sub-spaces. Criteria for a subset to be a subspace. Linear combination concepts of linearly independent and dependent subsets. Basis and dimension of a vector space and standard results related to a basis. Examples illustrating concept and results (with emphasis on R^3). Linear transformations: Properties of linear transformations, matrix of a linear transformation, change of basis, range and Kernel of a linear transformation, rank nullity theorem. 20 hrs

References:

1. Herstein I.N.: Topics in Algebra (Vikas)
2. Fraleigh J.B.: A first course in Abstract Algebra (Addison – Wesley).
3. Lipschitz S.: Linear Algebra (Schaum Series).
4. Shepherd G.C.: Vector space of Finite Dimension (Oliver and Boyed).
5. N.Jacobson: Basic Algebra, Vol. I & II, Hindustan Pub. Co.

BSM-4.2: DIFFERENTIAL EQUATIONS-I

Formation, equations of first order and first degree. Homogeneous, exact, linear and Bernoulli's equation. Simple equations of first order and higher degree equations solvable for p, x, y. Clairaut's equations. Singular solutions. Linear equation with n^{th} order and constant coefficients. Particular integral when RHS is of the form e^{ax}, x^n sin ax, cos ax, e^{ax} V, xV where V is a function of x. Cauchy Euler differential equations of order two. Simultaneous differential equations (two variables) with constant coefficients. Solution of ordinary second order linear differential equations by the following methods:

1. When a part of complementary function is given
2. Changing the independent variable
3. Changing the dependent variable.
4. When a first integral is given (exact equation).
5. Variation of parameters

45 hrs

References:

1. Daniel Murray: Introductory Course in Differential Equations (Orient Longman).
2. Chorlton F: Ordinary Differential & Difference Equations (Van Norstrand).
3. Ayres F: Differential Equations (Schaum's Series).
4. Simmons G.F.: Differential Equations (T.M.H.)
5. Pisggio H.T.H.: Differential Equations (Orient Longmans)
6. Willim E. Boyce and Richard C.Diprima: Elementary Differential Equations and BVP (John Wiley & Sons).
7. Rudraiah et al: College Mathematics, Vol. I & II, (Sapna, Bangalore).

BSM-5.1: VECTOR ANALYSIS AND LAPLACE TRANSFORMS

Vector Analysis:

Scalar field, gradient of a scalar field, geometrical meaning, directional derivatives. Vector field, divergence and curl of a vector field. Solenoidal and irrotational fields. Laplacian of a scalar field. Vector identities. Expressions for $\nabla\phi$, div $\bar{f}$ and curl $\bar{f}$ in orthogonal, curvilinear coordinates and specialization to Cartesian, cylindrical and spherical coordinates. Greens, Gauss and Stokes theorems (Statements only) simple examples. 15 hrs

Fourier Series:

Periodic functions. Fourier series of functions with period 2π and period 2L. Half range cosine and sine series. 10 hrs

Laplace Transform:

Definition and basic properties. Laplace transform of some common functions. Laplace transforms of the derivatives and the integral of a function. Laplace transform of the Heaviside and Dirac delta function – Convolution theorem. Inverse Laplace transforms: Application to ordinary linear differential equation of first and second order with constant coefficients. 20 hrs

References:

1. Murray R, Spiegel L: Vector Analysis (Schaum Series).
2. Spain B: Vector Analysis (ELBS)
3. Murray R, Spiegel L: Laplace Transforms (Schaum Series).
4. Spain B and Smith M.G.: Functions of Mathematical Physics (Van-Norstrand).
5. Churchill RV and Brown JW: Fourier Series & Boundary Value Problems (McGraw Hill).

BSM-5.2: DIFFERENTIAL EQUATIONS-II

Series Solution:

Legendre differential equation. Legendre polynomails $P_n(x)$ as a solution, Rodrigue's formula, generating polynomials theorem, orthogonal property and basic recurrence relations. Bessel differential equation. Bessel function $J_n(x)$ as a solution – generation formula – integral formula for $J_n(x)$: orthogonal property. Basic recurrence relations – problems there on.

15 hrs

Total Differential Equation:

Necessary condition for the equation $Pdx+Qdy+Rdz=0$ to integral – problems there on. Solution of equation of the form $\frac{dx}{P}=\frac{dy}{Q}=\frac{dz}{R}$.

10 hrs

Partial Differential Equations:

Formation of partial differential equations, Lagrange's linear equations $Pp+Qq=R$. Standard types of first order linear partial differential equations and equations reducible to standard form. Charpit's method.

20 hrs

45 hrs

References:

1. Boyce and Diprima Elementary Differential Equations and BVP (John Wiley & Sons).
2. Simmons G.F.: Differential Equations (TMH).
3. Cholton F.: Ordinary Differential Equations (Von-Norstand).
4. Ayres F.: Differential Equations (Schaum Series)
5. Ian N.Sneddan: Elements of Partial Differential Equations, McGraw Hill.
6. Stephenson G: An introduction to Partial Differential Equations (ELBS).

OPTIONALS

BSM-5.3(a): DISCRETE MATHEMATICS-I

Sets and propositions-Cardinality. Mathematical induction. Principle of inclusion and exclusion.

Computability and formal languages – Ordered sets.

Languages, Phrase structure grammars. Types of grammars and languages. 12 Hrs

Permutation, combinations and discrete probability. Relations and Functions: Binary relations. Equivalence relations and partitions. Partial order relations and lattices. Chains and Antichains. Functions and the Pigeon Hole Principle. 13 Hrs

Graphs and Planar Graphs: Basic terminology, Multigraphs. Weighted graphs. Paths and Circuits. Hamiltonian Paths and Circuits. Traveling Salesman problem. Planar graphs.

Trees: Trees, Routed Trees, Binary Search Trees. Spanning trees and cut sets.

Transport Networks

Finite State Machines: Equivalent machines. Finite State Machines as Language Recognizers. 20 Hrs

References:

1. Liu C.L.: Elements of Discrete Mathematics (McGraw Hill).
2. Trambley J.P. and Manohar P., Discrete Mathematical Structures with Application to Computer Science (TMH).
3. Narsingh Deo: Graph Theory with Application to Engineering and Computer Science (PHI).
4. Kolamn B. and Busy R.C.: Discrete Mathematical Structures for Computer Science (PHI).

BSM-5.3(b): MECHANICS-I

Dynamics of a Particle and System of Particles:

Conservation principle. Mechanics of particle-conservation of linear momentum, angular momentum and energy. Mechanics and system of particles – conservation of linear momentum, angular momentum and energy.

Tangential and normal components of velocity and acceleration. Constrained motion of a particle under gravity along, inside and outside of a circle and a cycloid. Radial and transverse compounds of velocity and acceleration. Motion of a particle in a central force field, determination of orbit from central forces and vice versa, Kepler's law of planetary motion. 23 hrs

Dynamics of Rigid Bodies:

Centre of mass of a rigid body, static equilibrium of rigid body, rotation of rigid body about a fixed axes. Moment of inertia. Laminar motion of a rigid body, body rolling down an inclined plane. Angular momentum of a rigid body. Product of intertia, moment of intertia of a rigid body, about an arbitrary axes, momental ellipsoid. D'Alembert's principle, General equation of motion of a rigid body, motion of centre of inertia, motion relative to centre of inertia. 22 hrs

References:

1. S.L.Gupta, V.Kumar and H.V.Sharma: Classical Mechanics, Pragati Prakashan, Meerut.
2. F.Chorlton: Textbook of Dynamics, CBS Publishers, New Delhi.
3. Murray R Spiegel: Theoretical Mechanics, Schaum Series.
4. S.L.Loney: An Elementary treatise on the dynamics of a particle and of rigid bodies, Cambridge University Press, 1958.
5. Grant R.Fowles: Analytical Mechanics, Holt, Rinehart and Winston Inc.

Probability Theory:

Notion of probability – Random experiment, sample space, axiom of probability, elementary properties of probability, equally likely outcome problems.

Random variables – Concept, cumulative distribution function discrete and continuous random vriables, expectations, mean variance, moment generating functions.

Discrete Random Variables – Bernoulli random variable, binomial random variable, geometric random variable, Poisson random variable.

Continuous Random Variables – Uniform random variable, exponential random variable, gamma random variable, Normal random variable.

Conditional probability and Conditional expectations – Bayes theorem, Independence, Computing expectation by conditioning; some applications – a list model, a random graph, Polya's urn model.

Bivariate Random Variables – Joint distribution, joint and conditional distributions, the correlation coefficient.

Functions of Random Variables – sum of random variables, the law of large numbers and central limit theorem, the approximation of distribution. 45 hrs

References:

1. Ross S.M.: Introduction to probability models (Academic Press).
2. Gupta S.C. and Kapoor V.K.: Fundamentals of mathematical statistics (S.Chand & Sons).
3. Pitman J.: Probability (Narosa).
4. Blake I.: An Introduction to Applied Probability (John Wiley & Sons).

BSM-5.3(d): THEORY OF GRAPHS-I

Introduction, graphs, finite and null graphs. Connectedness and component, degree of vertex, minimum and maximum degree, $\Sigma \deg v_i = 2v$. The number of vertices of odd degree is even. Isomorphism, complete graph, line graph, total graph. 20 hrs

Sub-graph, spanning and induced sub-graphs, walk, trail, path, cycle, the shortest path problems, bipartite graph. Characterization of bipartite graph in terms of its cycles. 10 hrs

Matrix representation: Incidence, adjacency, rank of a matrix, cyclic matrices, some applications. 15 hrs

References:

1. Robin J. Wilson: Introduction to Graph Theory, Longman (London), UK.
2. Narsing Deo: Graph Theory & Applications (PHI), India.
3. Frank Harrary: Graph Theory Narosa Publications, India.

BSM-5.3(e): MATHEMATICAL MODELLING-I

The Technique of mathematical modelling, characteristics of mathematical models, limitations of mathematical modelling.

Mathematical Modelling through Ordinary Differential Equations:

Linear growth and decay models: Single species population models, population growth, effects of immigration and emigration on population size, spread of scientific and technological innovation, radioactive decay, diffusion, diffusion of medicine in the blood stream.

Higher Order Linear Models:

A model for the detection of diabetes, modelling in dynamics, vibration of a mass on a spring free and undamped, damped forced motion, electric circuit problem.

Modelling of Epidemics:

A simple epidemic model, a susceptible – infected – susceptible (SIS) model, simple epidence model with carriers and removal model for arm race, combat model, traffic model. 45 hrs

BSM-6.1: NUMERICAL ANALYSIS

Errors: Classification of errors (absolute, rounding, relative and percentage errors). Relations connecting the errors with illustrations.

Solution of non-linear equations: method of successive bisection, method of false position, Newton-Raphson's iterative method, the secant method.

Solution of system of equations: Gauss elimination method, Jacobi method, Gauss-Seidel method.

Finite Differences: Definition and properties of Δ, ∇ and E and relations between them. The n^{th} differences of a polynomial.

Interpolation: Newton-Gregory forward and backward interpolation formulae, Lagrange's and Newton's interpolation formula for unequal intervals, inverse interpolation.

Numerical differentiation using forward and backward difference formulae. Computation of first and second derivatives.

Numerical integration: General Quadrature formula. Trapezoidal rule, Simpsons $1/3^{rd}$ and $3/8^{th}$ rules, Weddles rule, Problems thereon. Solution of initial value problem for ordinary linear first order differential equations by Picard's, Taylor's, Euler's and Euler's modified method and Fourth Order Runge – Kutta Methods. 45 Hrs

References:

1. Scheild P: Numerical Analysis (Schaum Series)
2. Sastry S.S.: Numerical Analysis (Prentice Hall of India).
3. Rajaram V.: Computer Oriented Numerical Method (Prentice Hall of India).
4. Balaguruswamy E.: Numerical Methods (Tata McGraw Hill).
5. M.K.Jain, S.R.K. Iyangar and R.K. Jain: Numerical Methods (New Age Int.)

BSM-6.2: COMPLEX ANALYSIS AND IMPROPER INTEGRALS

Trigonometry:

Expression of sine and cosines using De-Moiver's theorem. Series of sines and cosines. Hyperbolic functions. Logarithm of a complex number (Simple examples) Summation of trigonometric series (simple problems).

Complex Analysis:

Recapitulation of Complex numbers, the complex plane, conjugate and modulus of a complex number. The polar form, geometrical representation, Euler's formula $e^{i\theta} = \cos\theta + i \sin\theta$. Functions of complex variables: Limit, continuity and differentiability. 10 hrs

Analytic functions, Cauchy-Reimann equations in Cartesian and polar forms. Sufficient conditions for analyticity (in Cartesian form). Real and imaginary parts of analytic function which are harmonic. Construction of analytic function, given real and imaginary parts.

The complex line integral: Examples and properties (definitions of the concepts like neighborhood of a point, closed contour, etc. at appropriate places should be mentioned).

Cauchy integral theorem (statement) and its consequences. The Cauchy's integral formulae for the function and derivatives. Applications to the evaluation of simple line integrals. Cauchy's inequality. Liouille's theorem-Fundamental theorem of algebra. 20 hrs

Improper Integrals:

Improper integrals of the first and second kinds. Convergence-Gamma and Beta functions, normal probability integral and error functions, results following the definitions – connection between two functions, applications to evaluation of integrals. Duplication formulae, Sterling formulae (Statements). 15 hrs

References:

1. Churchill R.V.: Introduction to Complex Variables and Applications (McGraw Hill).
2. Murray R. Spiegel: Complex Variables (Schaum Series).
3. Choudhary B.: The Elements of Complex Analysis (Wiley Eastern).
4. L.V. Ahifors: Complex Analysis (McGraw Hill).
5. Murray R.Spiegel: Advanced Calculus (Schaum Series).
6. Sokolnikoff I.S.: Advanced Calculus (McGraw Hill).

References: For Mathematical Modelling - I

1. Differential Equation Models, Eds. Martin Braun, C.S.Colman, D.A.Drew, Springer Verlag, 1982.
2. Discrete & System Models, W.R. Lucas, F.S. Roberts, R.M. Thrall, Springer Verlag, 1982.
3. Life Science Models, H.M. Roberts and M. Thompson, Springer Verlag, 1982.
4. Models in Applied Mathematics, Springer Verlag, 1982.
5. Mathematical Modeling, J.N. Kapur, Wiley Eastern, 1988.

BSM-6.3(a): DISCRETE MATHEMATICS-II

Analysis of Algorithms:

Time complexity of algorithms, shortest path algorithm, complexity of problems. Trackable and intrackable problems. Discrete numeric functions and generating functions. Recurrence relations and recursive algorithms: Linear recurrence relations with constant coefficients. Homogenous solutions. Particular solutions. Total solutions. Solution by the method of generating functions. 22 Hrs

Coding Theory:

Semigroups, monoids and groups, codes and group codes, codes, coding of binary information and error detection, decoding and error correction.

Boolean Algebra:

Lattices and Algebraic Structures. Principle of duality. Distributive and complemented lattices. Boolean lattices and Boolean Algebras. Boolean functions and expressions. Propositional calculus. Design and implementation of digital networks. Switching circuits. 23 hrs

References:

1. Liu C.L., Elements of Discrete Mathematics (McGraw Hill).
2. Trambley J.P. and Manohar R., Discrete Mathematical Structures with Application to Computer Science (TMH).
3. Narsingh Deo, Graph Theory with Application to Engineering and Computer Science (PHI).
4. Kolamn B. and Busy R.C., Discrete Mathematical Structures for Computer Science (PHI).

BSM-6.3(b): MECHANICS-II

Analytical Statics:

Resolution of forces in two and three-dimensions, parallelogram law, triangular law of forces, Lamis theorem. Resultant of parallel forces, couples, moment of a couple, Varignan's theorem and theorem of couples.

A system of forces acting in one plane at different points of a body be reduced to a single force through a given point and couple. A static equilibrium, General conditions of equilibrium, common catenary. 20 hrs

Hydrostatics:

Pressure equation, condition of equilibrium, lines of force, surface of equal pressure, pressure in fluids, centre of pressure, resultant pressure on plane and curved surfaces.

Equilibrium of floating bodies, curves and surfaces of buoyancy, stability of hydrostatic equilibrium of floating bodies, meta centre, work done in producing a displacement, vessel containing liquid. 25 hrs

References:

1. S.L. Loney:Statics, McMillan & Co. London.
2. R.S. Verma: A Textbook on Statics, Pothishala Publ. Allahabad.
3. M.Ray and P.T. Chandi: Statics.
4. W.H. Besant & A.S. Ramsey: A Treatise on Hydromechanics: Part-I Hydrostatics, ELBS & G Bell & Sons Ltd., London.

BSM-6.3(c): OPERATIONS RESEARCH-II

Linear Programming:

Formulation, linear programming in matrix notation, Graphical solution, some basic properties of convex sets, convex functions and concave functions, simplex methods, artificial variables, M-technique, two-phase method. Principle of duality in linear programming problem. Fundamental duality theorem. Simple problems, dual simplex method, sensitivity analysis, transportation and assignment problems. Network analysis – CPM and PERT. 35 hrs

Integer Programming:

Gomory's constraints, cutting plane algorithm, branch and bound algorithms. 10 hrs

References:

1. Taha H.: Operations Research (McMillan).
2. Kanti Swarup, Gupta P.K. and Manmohan: Operations Research (S.Chand & Co.).
3. Kalavathy S.: Operations Research (Vikas).
4. Sharma S.D.: Operations Research.

BSM-6.3(d): THEORY OF GRAPH-II

Cut vertex, bridge, block, tree, spanning tree, rooted and binary trees, forest. Some properties of trees, characterizations and some examples. 15 hrs

Connectivity:

Vertex and edge connectivity. Separability, Whitney's inequality $K(G) \leq \lambda(G) \leq \delta(G)$. Menger's theorem statement. 10 hrs

Eulerian and Hamiltonian Graphs:

Introduction. The Konigsberg Bridge (new name as Kaliningrad) problem and travelling salesmen problem.

Characterization of Eulerian graphs and properties of Hamiltonian graphs. Some applications of graphs in electronic network. 20 hrs

References:

1. Robin J. Wilson: Introduction to Graph Theory, Longman (London), UK.
2. Narsing Deo: Graph Theory & Applications (PHI), India.
3. Frank Harrary: Graph Theory, Narosa Publications, India.

BSM-6.3(e): MATHEMATICAL MODELLING-II

Modelling through differential equations. Non-linear model: Non-linear population growth model, multi-species models, age structured population model, prey-predator model, competition model, epidemic growth model, spread of technological innovations and infections diseases, chemical reactions.

Modelling in dynamics -- simple pendulum, falling body.

Mathematical modelling through difference equations: the need for modelling through difference equations, simple models population growth model, logistic model, prey-predator model, competition model, epidemic model, non-linear population growth model, an age structued model, Hardy-Weinberg law in Genetics.

References:

1. Differential Equations Models, Eds. Martin Braun, C.S. Colman, D.A. Drew, Springer Verlag, 1982.
2. Discrete & System Models, W.R. Lucas, F.S. Roberts, R.M. Thrall, Springer Verlag, 1982.
3. Life Science Models, H.M. Roberts & M.Thompson, Springer-Verlag, 1982.
4. Models in Applied Mathematics, Springer-Verlag, 1982.
5. Mathematical Modeling, J.N. Kapur, Wiley Eastern, 1988.