

BHUPAL NOBLES' UNIVERSITY, UDAIPUR

DEPARTMENT OF MATHEMATICS

SYLLABUS

M.Sc. MATHEMATICS (CBCS)

Preamble

Education plays enormously significant role in building of a nation. There are quite a large number of educational institutions, engaged in imparting education in our country. Majority of them have entered recently into semester system to match with international educational pattern. However, our present education system is churning out youth who have to compete locally, regionally, nationally as well as globally. The present alarming situation necessitates transformation and/or redesigning of system, not only by introducing innovations but developing "learner-centric approach.

Majority of Indian higher education institutions have been following the system which obstructs the flexibility for the students to study the subjects/courses of their choice and their mobility to different institutions. There is need to allow the flexibility in education system, so that students depending upon their interests can choose inter-disciplinary, intra-disciplinary and skill-based courses. This can only be possible when choice based credit system (CBCS), an internationally acknowledged system, is adopted. The choice based credit system not only offers opportunities and avenues to learn core subjects but also explore additional avenues of learning beyond the core subjects for holistic development of an individual. The CBCS will undoubtedly facilitate benchmarking of our courses with best international academic practices.

Advantages of the choice based credit system:

- Shift in focus from the teacher-centric to student-centric education.
- Student may undertake as many credits as they can cope with (without repeating all courses in a given semester if they fail in one/more courses).
- CBCS allows students to choose inter-disciplinary, intra-disciplinary courses, skill oriented papers (even from other disciplines according to their learning needs, interests and aptitude) and more flexibility for students.
- CBCS makes education broad-based and at par with global standards. One can take credits by combining unique combinations. For example, Physics with Economics, Microbiology with Chemistry or Environment Science etc.
- CBCS offers flexibility for students to study at different times and at different institutions to complete one course (ease mobility of students). Credits earned at one institution can be transferred to another institution.

BHUPAL NOBLES' UNIVERSITY, UDAIPUR

DEPARTMENT OF MATHEMATICS

SYLLABUS

M.Sc. MATHEMATICS (CBCS)

List of Core Courses

Course Code	Title of the Course
MAT-611	Algebra-I
MAT-612	Real Analysis
MAT-613	Differential Equations & Calculus of Variation
MAT-614	Mechanics-I
MAT-615	Differential Geometry-I
MAT-621	Algebra-II
MAT-622	Complex Analysis
MAT-623	Special Functions
MAT-624	Mechanics-II
MAT-625	Differential Geometry-II
MAT-631	Topology
MAT-632	Tensor Analysis
MAT-641	Functional Analysis
MAT-642	Relativity and Cosmology

Discipline Specific Elective Course (DSE) for Semester III & IV

Note: Students are to opt any three DSE courses among the following with the permission of the Head of the Department.

Course Code	Title of the Course
MAT-633	Optimization Techniques-I
MAT-634	Discrete Mathematics-I
MAT-635	Numerical Analysis-I
MAT-636 A	Mathematical Theory of Statistics-I
MAT-636 B	Viscous Fluid Dynamics-I
MAT-637	Integral Equations
MAT-638 A	Astronomy-I
MAT-638 B	Number Theory-I
MAT-638 C	*Computer Programming in-C
MAT-643	Optimization Techniques-II
MAT-644	Discrete Mathematics-II
MAT-645	Numerical Analysis-II
MAT-646 A	Mathematical Theory of Statistics-II
MAT-646 B	Viscous Fluid Dynamics-II
MAT-647	Integral Transform
MAT-648 A	Astronomy-II
MAT-648 B	Number Theory-II
MAT-648 C	**Computer Programming of Numerical Method

* (i) This paper cannot be opted by the students having computer science as an optional paper in their U.G. Course.

(ii) This paper can be opted by maximum of 25 students on the basis of merit of previous semesters.

** This paper can be opted by maximum of 25 students on the basis of merit of previous semesters.

List of Skill Enhancement Courses (SEC)

course No.	Course Code	Title of the Course
I	MAT-626	Official Statistics-I
II	MAT-627	Mathematical and Analytical Skill
III	MAT- 628	Information and Communication Skills (ICT)
III	MAT-649 A	Basic Statistical Techniques
IV	MAT-649 B	Official Statistics-II

M.Sc. MATHEMATICS (CBCS)

Semester- I

Course No.	Course Code	Title of the Course	L-T-P	No. of Credits	Max. Marks		Total
					External	Internal	
I	MAT-611	Algebra-I (CC)	4-1-0	5	70	30	100
II	MAT-612	Real Analysis (CC)	4-1-0	5	70	30	100
III	MAT-613	Differential Equations & Calculus of Variation (CC)	4-1-0	5	70	30	100
IV	MAT-614	Mechanics-I (CC)	4-1-0	5	70	30	100
V	MAT-615	Differential Geometry-I (CC)	3-1-0	4	70	30	100

Semester- II

Course No.	Course Code	Title of the Course	L-T-P	No. of Credits	Max. Marks		Total
					External	Internal	
I	MAT-621	Algebra-II (CC)	4-1-0	5	70	30	100
II	MAT-622	Complex Analysis (CC)	4-1-0	5	70	30	100
III	MAT-623	Special Functions (CC)	4-1-0	5	70	30	100
IV	MAT-624	Mechanics-II (CC)	4-1-0	5	70	30	100
V	MAT-625	Differential Geometry-II (CC)	3-1-0	4	70	30	100
VI		SEC	0-0-2	2	70	30	100

Skill Enhancement Course (SEC) for Semester II

Note: Students can opt one SEC courses with the permission of the Head of the Department.

Course No.	Course Code	Title of the Course	L-T-P	No. of Credits	Max. Marks		Total
					External	Internal	
I	MAT-626	Official Statistics-I	0-0-2	2	70	30	100
II	MAT-627	Mathematical and Analytical Skill	0-0-2	2	70	30	100
III	MAT-628	Information and Communication Technology Skills	0-0-2	2	70	30	100

Semester- III

Course No.	Course Code	Title of the Course	L-T-P	No. of Credits	Max. Marks		Total
					External	Internal	
I	MAT-631	Topology (CC)	3-1-0	4	70	30	100
II	MAT-632	Tensor Analysis (CC)	4-1-0	5	70	30	100
III		DSE	4-1-0	5	70	30	100
IV		DSE	4-1-0	5	70	30	100
V		DSE	4-1-0	5	70	30	100

Discipline Specific Elective Course (DSE) for Semester III

Note: Students are to opt any three DSE courses among the following with the permission of the Head of the Department.

Course No.	Course Code	Title of the Course	L-T-P	No. of Credits	Max. Marks		Total
					External	Internal	
I	MAT-633	Optimization Techniques-I	4-1-0	5	70	30	100
II	MAT-634	Discrete Mathematics-I	4-1-0	5	70	30	100
III	MAT-635	Numerical Analysis-I	4-1-0	5	70	30	100
IV	MAT-636 A	Mathematical Theory of Statistics-I	4-1-0	5	70	30	100
V	MAT-636 B	Viscous Fluid Dynamics-I	4-1-0	5	70	30	100
VI	MAT-637	Integral Equations	4-1-0	5	70	30	100
VII	MAT-638 A	Astronomy-I	4-1-0	5	70	30	100
VIII	MAT-638 B	Number Theory-I	4-1-0	5	70	30	100
IX	MAT-638 C	*Computer Programming in-C	2-0-3	5	70	30	100

* (i) This paper cannot be opted by the students having computer science as an optional paper in their U.G. Course.

(ii) This paper can be opted by maximum of 25 students on the basis of merit of previous.

Semester- IV

Course No.	Course Code	Title of the Course	L-T-P	No. of Credits	Max. Marks		Total
					External	Internal	
I	MAT-641	Functional Analysis (CC)	3-1-0	4	70	30	100
II	MAT-642	Relativity and Cosmology-II (CC)	4-1-0	5	70	30	100
III		DSE	4-1-0	5	70	30	100
IV		DSE	4-1-0	5	70	30	100
V		DSE	4-1-0	5	70	30	100
VI		SEC	0-0-2	2	70	30	100

Discipline Specific Elective Course (DSE) for Semester IV

Note: Students are to opt any three DSE courses among the following with the permission of the Head of the Department.

Course No.	Course Code	Title of the Course	L-T-P	No. of Credits	Max. Marks		Total
					External	Internal	
I	MAT-643	Optimization Techniques-II	4-1-0	5	70	30	100
II	MAT-644	Discrete Mathematics-II	4-1-0	5	70	30	100
III	MAT-645	Numerical Analysis-II	4-1-0	5	70	30	100
IV	MAT-646 A	Mathematical Theory of Statistics-II	4-1-0	5	70	30	100
V	MAT-646 B	Viscous Fluid Dynamics-II	4-1-0	5	70	30	100
VI	MAT-647	Integral Transform	4-1-0	5	70	30	100
VII	MAT-648 A	Astronomy-II	4-1-0	5	70	30	100
VIII	MAT-648 B	Number Theory-II	4-1-0	5	70	30	100
IX	MAT-648 C	**Computer Programming of Numerical Method	2-0-3	5	70	30	100

** This paper can be opted by maximum of 25 students on the basis of merit of previous semesters.

Skill Enhancement Course (SEC) for Semester IV

Note: Students can opt one SC courses with the permission of the Head of the Department.

Course No.	Course Code	Title of the Course	L-T-P	No. of Credits	Max. Marks		Total
					External	Internal	
I	MAT-649 A	Basic Statistical Techniques	0-0-2	2	70	30	100
II	MAT-649 B	Official Statistics-II	0-0-2	2	70	30	100

M. Sc. MATHEMATICS (Semester I)

MAT-611

ALGEBRA-I (CC)

UNIT I

External and Internal direct product of two and finite number of subgroups; Commutator subgroup; Cauchy's theorem for finite abelian and non abelian groups.

UNIT II

Sylow's three theorem and their easy applications, Subnormal and Composition series, Zassenhaus lemma and Jordan Holder theorem.

UNIT III

Solvable groups and their properties, Nilpotent groups, Fundamental theorem for finite abelian groups.

UNIT IV

Annihilators of subspace and its dimension in finite dimensional vector space, Invariant, Projection, adjoints.

UNIT V

Singular and nonsingular linear transformation, quadratic forms and Diagonalization.

Books recommended:

1. Modern Algebra, Surjeet Singh and Quazi Zameeruddin
2. Topics in algebra, Herstein, I.N.
3. Algebra, Agrawal, R.S.

M. Sc. MATHEMATICS (Semester I)

MAT-612

REAL ANALYSIS (CC)

UNIT I

Measure Theory: Length of an interval, outer measure of a subset of \mathbb{R} , Lebesgue outer measure of a subset of \mathbb{R} , Existence, non-negativity and monotonicity of Lebesgue outer measure, Translation Invariance of outer measure, Countable sub-additivity of Lebesgue outer measure.

UNIT II

Lebesgue outer Measure: σ - algebra, Definition of measures with equations, signed measure, measurable space, measurable sets (Lebesgue), Complement, Lebesgue measure, union intersection and difference of measurable sets, Denumerable union and intersection of measurable sets, countable additivity of measure, Borel measure, Measures of infinite union of measure sets (intersection).

UNIT III

Measurable functions; Different equivalent definition of a measurable function; almost every where Scalar multiple constant function, modules f/g , inverse image of a mean function, sum, difference and product of measurable functions of measurable function, Supremum, infimum, limit superior, limit inferior and limit of a sequence of measurable functions.

UNIT IV

Convergence of sequence of Measurable function: Convergence pointwise, uniform Convergence, Convergence almost every where (a.e.), Convergence in measure of a sequence of measurable functions, characteristic function of a set, simple function, step function, pointwise Convergence, theorem of measure functions.

UNIT V

Lebesgue Integral; Characteristic function of a set; Simple functions, Lebesgue integral of a simple function; Lebesgue integral of a bounded measurable function; Lebesgue integral and Riemann integral of a bounded function defined on a closed interval; Lebesgue integral of a non-negative function; Lebesgue integral of a measurable function; Properties of Lebesgue integral. Convergence Theorems and Lebesgue integral.

Books recommended:

1. Measure Theory, (D.Van Nostrand Company, INC), 6th Edition, Univ. of Chikago, Pal R. Halmos
2. Theory and Problems of Real Variables (Schaum's Outline series, McGraw-Hill Book), Murray R. Spiegel
3. Measure and Integration (New age International Publishers), P.K. Jain & V.P. Gupta

M. Sc. MATHEMATICS (Semester I)

MAT-613

DIFFERENTIAL EQUATIONS & CALCULUS OF VARIATION (CC)

UNIT I

Partial differential equation: Lipschitz condition and question based on it. Existence and Uniqueness theorem and Existence and uniqueness solutions of I.V.P. $\frac{dy}{dx} = f(x, y), y(x_0) = y_0$ Solution of second order partial differential equations through Mange's method.

UNIT II

Canonical forms and reduction of second order Semi-linear partial differential equations to canonical forms. Classification of second order partial differential equations having more than two independent variables. Cauchy's problem.

UNIT III

Boundary value problems of second order ordinary differential equations. Orthogonality, Strum-Liouville B.V.P. Lagrange's Identity. Relevent theorems and properties based on eigen values and eigen functions. Expansion of function in terms of eigen functions. Periodic Strum problem.

UNIT IV

Solution of second order P.D. equations by the method of separation of variables. Green's function and its construction and solution of second order Homogonous B.V.P's through Green's function. Dirac delta function and its important properties.

UNIT V

Calculus of variations: Functionals, Euler- Lagrauge differential equation for externals and it's alternative forms. Variational problems involving several dependent variables, several in dependent variables and higher order derivatives. Isoperimetric Problems. Solution of variational problems using Ritz method.

Books recommended:

1. Element of Practical differential equation, Sneddon, I.N.
2. A Treatise of Differential equations, Forsyth, A.R.
3. Calculus of variations with Applications, Gupta, A.S.

M. Sc. MATHEMATICS (Semester I)

MAT-614

MECHANICS-I (CC)

UNIT I

Hydrodynamics: Lagrange's and Euler's, Methods; Acceleration, Equation of Continuity, Boundary surface, Stream lines, velocity potential.

UNIT II

Euler's dynamical Equations, Bernoulli's Theorem, Lagrange's Equations under conservative forces, the motion once irrotational is always irrotational.

UNIT III

Central Orbit, Kapler's Law of Planetary motion.

UNIT IV

Michelson-Morley experiment, Lorentz-Fitzgerald contraction, postulates of special theory of Relativity, Lorentz transformations.

UNIT V

Mass-Energy formula, transformation formulas for momentum and energy. Minkowski's 4-dimensional continuum space, Space like and time like intervals, Relativistic Hamiltonian and Lagrangian.

Books recommended:

1. A Text book of Hydrodynamics, Ramsay, A.S.
2. Hydrodynamics, Ray, M.
3. Hydrodynamics, Gaur, Mathur & Goyal
4. Theory of Relativity, Roy & Bali

M. Sc. MATHEMATICS (Semester I)

MAT-615

DIFFERENTIAL GEOMETRY-I (CC)

UNIT I

The Axes of Plane Sections: Circular sections, Axes of central sections of a central conicoid, Axes of non central section of a central conicoid.

UNIT II

Axes of any section of a central conicoid, Circular sections. Generating Lines: Introduction, properties of generating line, intersection of generators of hyperboloid of one sheet, generators through any point of hyperboloid, direction cosines of generating line, The section of a surface by a tangent plane.

UNIT III

Systems of generators of a central hyperboloid, Locus of the points of intersection of perpendicular, generators, The projection of generators, Generators' of the hyperbolic paraboloid.

UNIT IV

Confocal Conicoids: The three confocals through a point,- Elliptic coordinates, confocal touching a given plane, confocal touching a given line, The parameter of the confocals through a point on a central conicoid, The normals. The self polar tetrahedron, The axes of an enveloping cone.

UNIT V

Conoids; Equation to a conoid, surface in general, The degree of a surface, tangents and tangent planes, The inflexional tangents; the equations $\xi = f(\xi, \eta)$ The indicatrix and representation by parameters.

Books recommended:

1. Coordinate Geometry of the three dimensions, Robert, L., Bell, J.T.
2. Differential Geometry, Bansal & Sharma
3. Analytical Geometry of Three Dimension, N. Saran & R. S. Gupta

M. Sc. MATHEMATICS (Semester II)

MAT-621

ALGEBRA-II (CC)

UNIT I

Prime fields of characteristic zero and of prime number, Polynomial rings, Factorization theory in Integral domain, Prime and irreducible elements, Greatest common divisor and least common multiple, Euclidean domain, Principle ideal domain and Unique Factorization domain and their related theorems, Product of ideals and nilpotent ideals.

UNIT II

Definition and examples of Modules, sub module, Sub module generated by a set, Sum and direct sum of two sub modules, Quotient Modules, R-Homomorphism, Kernel, Fundamental, Theorems of Homomorphism and isomorphism. Three isomorphism theorems in modules.

UNIT III

Simple, free, cyclic and Finitely generated modules, Fundamental theorem on finitely generated modules over Euclidean rings, Noetherian and Artinian modules, maximal element and theorems based on it's.

UNIT IV

Field extension: finite and infinite, examples, Algebraic and transcendental extensions, Splitting field Separable and inseparable extensions, Normal Extensions, Perfect fields, Finite fields, primitive elements.

UNIT V

Automorphisms, Galois Theory of field extensions and its fundamental theorem, Solution of polynomial equations by radicals, Abel's theorem.

Books recommended:

1. Modern Algebra, Surjeet Singh and Quazi Zameeruddin
2. Topics in algebra, I.N.Herstein
3. Basic Abstract Algebra (IInd Edition), P.B. Bhattacharya S.K. Jain and Etc.

M. Sc. MATHEMATICS (Semester II)

MAT-622

COMPLEX ANALYSIS (CC)

UNIT I

Complex numbers, Algebra of complex functions, differentiability of complex function, Analytic functions, Cauchy-Riemann equations, Harmonic functions, Power series, radius of convergence, circle of convergence.

UNIT II

Conformal transformation, Linear & Bilinear transformations, fixed points, cross ratio, inverse points, critical points Exponential, Trigonometric transformations.

UNIT III

Complex integration : Riemann definition of integration, complex integral as the sum of line integrals, Cauchy's fundamental theorem, extension of Cauchy's theorem to multi-connected region, Cauchy's integral formula, Cauchy's integral formula for multi-connected region, Cauchy's integral formula for higher order derivatives.

UNIT IV

Morera's theorem, Liouville's theorem , Maximum Modulus theorem, Poisson's integral formula, Development of Analytic function as power series : Taylor's Series, Laurent's Series.

UNIT V

Singularities and Zeroes of an Analytic function, residues, Cauchy's theorem of residues and Evaluation of definite integrals.

Books recommended:

1. Functions of a complex variable, E.G.Phillips
2. An introduction to the Theory of functions of a Complex variable, E.T.Copson
3. A First Course in Complex Analysis with Application, Zill Shanahan

M. Sc. MATHEMATICS (Semester II)

MAT-623

SPECIAL FUNCTIONS (CC)

UNIT I

Series solutions and Hypergeometric equations: Singularities in second order ordinary differential equations with constant coefficients and variable coefficients, radius of convergence. Series solutions of second order homogeneous ordinary differential equations. Frobenius method. Hypergeometric Series. Hypergeometric functions. Confluent Hypergeometric function and solution of confluent Hypergeometric equation.

UNIT II

Legendre's polynomial Functions: Legendre's differential equation and associated Legendre's differential equations.

UNIT III

Simple properties of Legendre's functions of first and second kind and the associated Legendre's function of integral order.

UNIT IV

Bessel functions, Generating function, Integral formula, Recurrence relations; addition formula and other properties of Bessel functions.

UNIT V

Classical Orthogonal Polynomials, Generating functions and other properties, associated with the Laguerre, Legendre and Hermite Polynomials.

Books recommended:

1. Special Functions, Rainville, E.D.
2. Special Functions, Sneddon, I.N.
3. Differential Equations Vol. II, Bansal, J.L.

M. Sc. MATHEMATICS (Semester II)

MAT-624

MECHANICS-II (CC)

UNIT I

Rigid Dynamics: Moments and products of inertia, Principal axes theorem, Parallel axes, Momental ellipsoid.

UNIT II

D'Alembert's principle and the equation of motion. Motion about fixed axes.

UNIT III

Motion in two dimensions under finite forces including sliding and rolling friction, Impulsive motion in two dimensions.

UNIT IV

Principles conservation of momentum and energy.

UNIT V

Lagrange's equations in generalized coordinates under finite and impulsive forces.

Books recommended:

1. Dynamics, S.L.Loney
2. Dynamics of a Rigid Body, Bansal, Sharma & Goyal
3. A Text Book of dynamics of a Rigid Body, Ray & Sharma

M. Sc. MATHEMATICS (Semester II)

MAT-625

DIFFERENTIAL GEOMETRY-II (CC)

UNIT I

Curves in space, Equation to a curve, The tangent and its direction cosines, The normal plane-, contact of a curve and surface, Osculating plane, Principal normal and binormal curvature, torsion, spherical indicatrices, frenet's formulae, signs of the curvature and torsion.

UNIT II

Formula for direction cosines of the principal normal and binormal, radius of torsion the relation $\sigma = +\eta \tan \alpha$ Circle of curvature, The osculating sphere and coordinates in terms of the arc.

Envelopes: Envelopes of a system of surfaces with one parameter and its relation with characteristic, The edge of regression and its relation with characteristic, Envelope of a system of surfaces with two parameters and its relation with characteristic.

UNIT III

Skew and developable surface, Tangent plane to a ruled surface, Generators of developable surface, envelope of a plane with one parameter: criterion for $\xi = f(\xi, \eta)$ to represent a developable surface and properties of a generator of a skew surface, Curvature of surfaces, Curvature of normal sections through elliptic and hyperbolic points, Umblics.

UNIT IV

Curvature of an oblique section, radius of curvature of a given section through any point of a surface, Principal radii at a point of an ellipsoid, Lines of curvature of an ellipsoid, Lines of curvature on a developable surface, Normals to a surface at points of a line of a curvature, Lines of curvature on a surface of revolution.

UNIT V

Principal radii and lines of curvature through a point of the surface, determination of umblics, Curvature at points of a generator of a skew surface, The measure of curvature at a point and expressions for the measure of curvature, Curvilinear coordinates, Linear element principal radii and lines of curvature.

Books recommended:

1. Coordinate Geometry of the three dimensions, L. Robert, J-T.Bell
2. Differential Geometry, Bansal & Sharma
3. Advanced Tensor Analysis, Raj Bali
4. Advance Differential Geometry, Raj Bali

M. Sc. MATHEMATICS (Semester III)

MAT-631

TOPOLOGY (CC)

UNIT I

Metric Space: Definition, Examples and properties of a metric space. Open and closed sphere (ball or neighbourhood), open sets, closed sets and the related results, limit point, continuous mappings, Convergence of a sequence, Cauchy Sequence, Uniform and Pointwise convergence, Complete metric space, compact spaces and compact sets, Baire's category theorem.

UNIT II

Topological Spaces: Definition of Topology, T-open sets, weaker and stronger topology, open sets and closed sets, closure of a set, limit point of a set, derived set, Interior of a set, Boundary of set, Intersection of topological spaces, Kuratowski-space, Kuratowski theorem. Base, sub base, open bases, open sub bases, first countable space, second countable space, separable space, continuous functions in topological spaces, sequentially topological spaces.

UNIT III

Separation Axioms: T_0 , T_1 , T_2 - space, separation axioms, normal spaces, Regular spaces, completely regular space, tychonoff space, Hausdorff space. Compactness: Cover, open cover, finite sub cover, compact sets, Lindelof space, Locally compact, sequentially compact, Bolzano Weirstrass property and sequentially compactness, compactness for metric spaces, Lindelof theorem, Product spaces.

UNIT IV

Connectedness: Connectedness and continuity, components of a space, product of connected topological spaces, Locally connected Spaces.

UNIT V

Approximation: The Weirstrass approximation theorem, function algebra, $C(X, \mathbb{R})$ and $C(X, \mathbb{C})$, the real Stone-Weirstrass theorem, The Complex Stone-Weirstrass theorem.

Books recommended:

1. Introduction to Topology and modern analysis, McGraw Hill Book Co., George F. Simmons
2. Real analysis, H.L. Royden
3. General Topology, J. Kelley
4. Mathematical Analysis (Third Revised Edition), Malik S.C. & Arora, Savita

M. Sc. MATHEMATICS (Semester III)

MAT-632

TENSOR ANALYSIS (CC)

UNIT I

Tensors; Transformation of coordinates, Contravariant and covariant vectors, second order tensors, Higher order tensors. Addition, subtraction and multiplication of tensors, Contraction, Quotient Law, symmetric and skew symmetric tensors: Conjugate symmetric tensors of the second order, Fundamental tensor, Associated tensors.

UNIT II

Christoffel symbols, Transformation law of Christoffel symbols, Covariant differentiation of vectors and tensors.

UNIT III

Geodesics, Null Geodesics, Tensor form of gradient, divergence, Laplacian and curl, Intrinsic derivative, Riemannian and Normal Coordinates, Gaussian Coordinates, Parallel transport, Geodesics are auto parallel curves, Parallel propagation.

UNIT IV

Riemannian curvature tensor, Symmetric properties of R^i_{ljk} , Covariant curvature tensor R_{hljk} , Number of independent components of R_{hljk} in a V_n , Ricci tensor, Bianchi identities, Conformal Curvature tensor, Condition for flat space.

UNIT V

Maxwell's equations in empty space, Transformation of vector and scalar potentials, Transformations of electric and magnetic intensities, Lorentz invariance of Maxwell's equations.

Maxwell's equations in Tensor form, Energy momentum tensor for electromagnetic field, Einstein-Maxwell equation in General Relativity.

Books recommended:

1. Introduction to Theory of Relativity, P.G.Bergman
2. Tensor Analysis, J.L. Bansal
3. Theory of Relativity, Roy & Bali

Note: -

1. Students will select any three papers from the following papers.
2. Candidates who have offered Computer Programming/ Computer Science/ Computer Applications in B.A. /B.Sc. courses will not be allowed to offer DISCRETE MATHEMATICS-I in their M.A./ M.Sc. examination.
3. Candidates who have offered Mathematical Statistics / Statistics / Applied Statistics as an optional subject in their B.A. /B.Sc. examination will not be permitted to offer MATHEMATICAL THEORY OF STATISTICS-I.

M. Sc. MATHEMATICS (Semester III)

MAT-633

OPTIMIZATION TECHNIQUES-I (DSE)

UNIT I

Dual simplex method, Bounded value algorithm, Parametric linear Programming.

UNIT II

Sensitivity Analysis: (i) Changes in the coefficients of the objective function, (ii) Changes in the components of vector b , (iii) Changes on the component (a_{ij}) of the matrix A .

UNIT III

Addition of the new variable, Addition of a new constraint. Deletion of a variable, Deletion of constraint.

UNIT IV

Integer programming: Importance of interger programming problems, Gomory's cutting plane methods, δ Fractional cut and λ -cut, Branch and bound method.

UNIT V

Project Management by PERT and CPM, cost time, trade off, Resource leveling.

Books recommended:

1. Operation Research, Kanti swaroop, Mak-Mohan, P.K. Gupta.
2. Operation Research, S.D. Sharma
3. Optimization Methods in Operations Research and systems analysis, K.V. Mittal

M. Sc. MATHEMATICS (Semester III)

MAT-634

DISCRETE MATHEMATICS-I (DSE)

UNIT I

Formal logic– Statement, Symbolic Representation and Tautologies, Quantifiers, Predicate validity, Propositional logic. Semi groups and monoids, Relations and ordering. Functions definitions and examples of semi groups and monoids (including those pertaining to concatenation operation).

UNIT II

Homomorphism of semi groups and monoids. Quotient subgroups, sub semigroups and sub monoids. Direct products. Basic Homomorphism theorem.

UNIT III

Lattices: - Lattices as partially ordered sets. Their properties. Lattices as Algebraic systems. Sub lattices, direct products and Homomorphism complete, Complemented and distributive lattices.

UNIT IV

Boolean Algebras:- Boolean Algebras as lattices. Various Boolean identities. The switching Algebras examples. Sub Algebras. Direct products and Homeomorphisms, Join- irreducible elements, Atoms and minterms.

UNIT V

Boolean forms and their equivalence. Minterms, Boolean forms. Minimization of Boolean functions. Application of Boolean Algebras to switching theory (OR and not gates).The Karnaugh map method.

Books recommended:

1. Discrete Mathematical structure with applications to computer science, J.P. Tremblay & R. Manohar
2. Graph theory with applications to Engineering and Computer Science, N. Arsing Deo
3. Advanced Discrete Mathematics(Navkar Publications), Gokhroo & Gokhroo

M. Sc. MATHEMATICS (Semester III)

MAT-635

NUMERICAL ANALYSIS-I (DSE)

UNIT I

Theory of Iteration: Simple iteration, Rate of Convergence, Acceleration a convergence, method for multiple and complex roots, Convergence of iteration process in the case of several unknowns.

UNIT II

Real and complex roots, solution of transcendental and polynomial equations by using bisection method, secant method, Regula-Falsi method, Newton Raphson method, Chebyshev method and Muller method.

UNIT III

Concept of synthetic division, the Birge – vita, Bairstow and Graeffe's root squaring method. System of Simultaneous equations(Linear): Direct method of determinant, Gauss–Elimination.

UNIT IV

Gauss-Jordan Cholesky, Partition method of Successive approximation, Conjugate Gradient, Gauss or Jacobi iteration, Gauss-Seidel and Relaxation methods.

UNIT V

Eigen value problems: Basic properties of Eigen values and Eigen vector power methods, Method for finding all Eigen pairs of a matrix, Complex Eigen values.

Books recommended:

1. Numerical Analysis, Jain, lyenger and Jain
2. Numerical solutions of differential equation, Jain, M. K.
3. Studies in Numerical Analysis, Chouhan D.S., Vyas P. & Soni. V.

M. Sc. MATHEMATICS (Semester III)

MAT-636 A

MATHEMATICAL THEORY OF STATISTICS-I (DSE)

UNIT I

Elements of theory of probability; sample space, various definitions of probability, addition and multiplication laws of probability, conditional probability and statistical independence of events. Baye's theorem and its applications.

UNIT II

Mathematical expectations, conditional expectations, Moments and cumulates. Moments generating and characteristic functions. Inversion theorem, Chebyshev's inequality, Central limit theorem for i.i.d. random variables.

UNIT III

Binomial, Negative -binomial, Poisson and Hyper geometric distributions.

UNIT IV

Rectangular, Normal, Cauchy, Gamma and Beta distributions Elementary idea of Exponential and Laplace distributions.

UNIT V

Curve fitting and principle of least squares, Scatter diagram, linear regression and correlation.

Books recommended:

1. Fundamentals of Mathematical Statistics, Gupta and Kapoor
2. Mathematical Statistics, Kapur and Sexena

M. Sc. MATHEMATICS (Semester III)

MAT-636 B

VISCOUS FLUID DYNAMICS-I (DSE)

UNIT I

Viscosity, Analysis of stress, Relation between stress and rate of strain, Navier-stokes equations and equation of energy in cartesian system of coordinates.

UNIT II

Vorticity and circulation. Reynolds law of similarity, Physical importance of non-dimensional parameters, Reynolds number Froude numbers, Mach number, Prandtl number, Eckert number.

UNIT III

Some exact solutions of Navier-stokes equations-steady, motion between parallel plates, Hagen poiseuille flow a circular pipe, flow between coaxial circular pipes, flow between two concentric rotating cylinders.

UNIT IV

Pulsatile flow between parallel surfaces, flow in convergent and divergent channels (Jaffery-Hamel flow), flow in the vicinity of stagnation point.

UNIT V

Unsteady motion of a plate. Theory of very slow motion of a sphere in viscous fluid Osceen's improvement of stoke's theory.

Books recommended:

1. Viscous Fluid Dynamics, J.L. Bansal
2. Fluid Dynamics, M. D. Raisinghania
3. Fluid Dynamics, Shanti Swarup

M. Sc. MATHEMATICS (Semester III)

MAT-637

INTEGRAL EQUATIONS (DSE)

UNIT I

Linear Integral equations: Definition and classification, Conversion of initial and boundary value problem to an integral equation, Eigen values and Eigen functions.

UNIT II

Solution of Fredholm integral equations of second kind with separable kernels. Reduction to a system of Algebraic equations.

UNIT III

Solution of Fredholm and Volterra integral equations of second kind by method successive substitution and successive approximations. Resolvent Kernel and its applications.

UNIT IV

Condition of uniform convergence and uniqueness of series solutions. Integral Equation with symmetric kernels: Complex Hilbert space, Orthogonal system of functions. Fundamental Properties of Eigen values and Eigen functions for symmetric Kernels, Expansion in Eigen- functions and Bilinear form.

UNIT V

Hilbert–Schmidt theorem, Solution of Fredholm integral equations of second kind with symmetric Kernels. Classical–Fredholm theory, Fredholm theorems, Solution of Volterra integral equations with convolution type Kernels and Librated Kernels.

Books recommended:

1. Laplace and Fourier Transforms, Ranville, E.D.
2. The use of Integral Transforms, Sneddon, I.N.
3. Generalized Integral transforms, Ze manian, A.H.

M. Sc. MATHEMATICS (Semester III)

MAT-638 A

ASTRONOMY-I (DSE)

UNIT I

Spherical Trigonometry- Great and small circular spherical triangles and their properties, various spherical trigonometrically formula-Cosine, sine, supplemental cosine, sine cosine, contingent, half of an angle and side Napier's analogies.

UNIT II

Delambe's analogies, their identities formulae for, right angled triangles and their solutions.

UNIT III

Celestial sphere, diurnal motion, Hour angle rising and setting of stars motion of sun, Zenith distance and Azimuth, Twilight.

UNIT IV

Refraction: Laws, effect of refraction on sun rise and sun set, Simpson's Hypothesis, effect of refraction in right ascension and declination etc. Time: Equation of time, seasons and their lengths, precession and Nutation and their effects on right ascension and declination, planetary precession double stars.

UNIT V

Aberration and its effect of longitude, latitude, right ascension and declination, position of apex, diurnal aberration and its effect in declination, right ascension and hour angle.

Books recommended:

1. Astronomy by Gorakh Prasad
2. Astronomy by Smart.

M. Sc. MATHEMATICS (Semester III)

MAT-638 B

NUMBER THEORY-I (DSE)

UNIT I

Divisibility: Gcd and Lcm of two or more integers, Euclidean, algorithm, the linear diophantine equation $ax + by = c$. Prime Numbers, composite numbers, infinitude of primes, fundamental theorem of arithmetic.

UNIT II

Congruences: Basic properties, divisibility tests, linear Congruences. Application of Congruences: Fermat's little theorem, Euler's generalization, Wilson's theorem Chinese remainder theorem.

UNIT III

Number Theoretic functions: T.J, and, Multiplicative functions, Mobius inversion formula, the greatest integer function. Primitive Roots and Indices, Primitive roots, characterization of natural numbers having primitive roots, theory of indices, solution of certain congruence, through indices.

UNIT IV

Quadratic Residues: Quadratic residues and quadratic non residues of an integer in general and of a prime in particular, Gauss Lemma and its applications, the quadratic reciprocity law.

UNIT V

Special Numbers: Fibonacci numbers, Fermat's numbers, Perfect numbers. Diophantine Equations: Representation of integers as sums of 2, 3 and 4 squares.

Books recommended:

1. Elementary Number Theory, Allyn and Bacon Inc., Donald M. Burton
2. An Introduction to the Theory of Numbers, Willey eastern India Ltd., Niven & H.S. Zuckerman

M. Sc. MATHEMATICS (Semester III)
MAT-638 C
COMPUTER PROGRAMMING IN-C (DSE)
(Practical Oriented)

UNIT I

Definition and properties of algorithm, flow chart, conversion of flow chart to language, examples of algorithms and flow charts, introduction to program design, errors, syntax error, logical error, runtime error.

UNIT II

Character set of C, constants and variables in C, arithmetic expressions in C, assignment and multiple assignment and mode of statements in C, built in functions and libraries in C, input and output statements in C, data types, structure of C program, elementary programs in C

UNIT III

Logical if statements in C: if- else, nested if, switch, break, continue, GOTO statements in C For , while and do-while loops in C, nested loops

UNIT IV

Functions : Defining and accessing a function, passing arguments to a function, specifying arguments data types, function prototypes, Scope rules of functions, call by value, call by reference

UNIT V

Array : introduction of array, Classification of arrays, functions with arrays, Pointers in C, pointers and arrays, File input/output: create, open, write, delete, close.

Books recommended:

1. Introduction Information Technology : Satish jain, BPB Publication, New Delhi.
2. Fundamentals of computers : P. K. Sinha
3. Computer Programming in C : Y Kanetkar-B.P.B. Publication, New Delhi.

M. Sc. MATHEMATICS (Semester IV)

MAT-641

FUNCTIONAL ANALYSIS (CC)

UNIT I

Normed linear spaces; Banach spaces, Riesz Lemma, Quotient space of normed linear space and its completeness and examples Continuous linear transformations.

UNIT II

Hahn-Banach theorem; the natural embedding of a normed linear space into its second conjugate, the open mapping theorem; the closed graph theorem, the uniform boundedness theorem.

UNIT III

Inner product spaces, Hilbert spaces; Schwartz's inequality: Bessel's inequality, orthogonality, Parallelogram law, Polarization identity with examples, Pythagoras theorem, orthonormal sets.

UNIT IV

Orthonormal basis and Parseval's identity, Complete Orthonormal sets, Gram Schmidt Orthogonalization process with examples, conjugate space.

UNIT V

Riesz representation theorem, Adjoint of an operator, self adjoint operator, Normal operator, unitary operator, Matrix representation of a linear operator.

Books recommended:

1. Introduction to Topology and modern analysis, McGraw Hill Book Co., George F. Simmons
2. Elements of Real Analysis, S.I.Hu
3. Topological structure, W.J. Thron

M. Sc. MATHEMATICS (Semester IV)

MAT-642

RELATIVITY AND COSMOLOGY (CC)

UNIT I

Principle of covariance, principle of equivalence, Mach- Principle, geodesic postulates, Newton's Potential, Newtonian approximation of relativistic equation of motion. Einstein field equations with derivation and its Newtonian approximation.

UNIT II

Clock paradox, Schwarzschild exterior solution for empty space, singularities and related problems, isotopic form of Schwarzschild line element, energy momentum tensor and its expression for perfect fluid.

UNIT III

Planetary orbit, Three crucial tests, Advance of Perihelion of planets, Gravitational Deflection of light ray, Shift in the spectral lines. Radar echo delay. Analogous to Kepler's law, Schwarzschild interior solution.

UNIT IV

Principals of Cosmology, Static cosmological models. Einstein and De-Sitter Universes, their derivations, properties and comparison with the actual universe and some related problems.

UNIT V

Non static cosmological models. Hubble's law, Weyl's postulate. Derivation of Robertson-Walker Metric, Geometrical features of R-W metric. Surface brightness, source counts, Red shift. Particle and event Horizons, Expressions for FRW model upto non zero pressure.

Books recommended:

1. Introduction to Theory of Relativity, P.G. Bergman
2. Lecture on general Relativity, J.V. Narlikar
3. A first course in General Relativity, B.F. Schutz

Note: -

1. Students will select any three papers from the following papers.
2. Candidates who have offered Computer Programming/ Computer Science/ Computer Applications in B.A. /B.Sc. courses will not be allowed to offer DISCRETE MATHEMATICS-II in their M.A./ M.Sc. examination.
3. Candidates who have offered Mathematical Statistics / Statistics / Applied Statistics as an optional subject in their B.A. /B.Sc. examination will not be permitted to offer MATHEMATICAL THEORY OF STATISTICS-II.

M. Sc. MATHEMATICS (Semester IV)

MAT-643

OPTIMIZATION TECHNIQUES-II (DSE)

UNIT I

Classical Optimization Techniques: Unconstrained problems of Maxima-Minima global maximum, Local maxima method of Lagrange's Multipliers for constrained with equality constraints.

UNIT II

Constraints in the form of inequalities: Kuhn Tucker Theorem Kuhn-Tucker necessary and sufficient conditions, saddle point.

UNIT III

Quadratic programming problem: Wolfe's algorithms and Beale's algorithm, Fractional Programming problem.

UNIT IV

Dynamic Programming Problem: Bellman's principle of optimality, multiple stage decision problems, characteristics of DPP. Solution of finite number of stages problems by DPP.

UNIT V

Network flow problems: Maximal flow, minimal flow, shortest route problem.

Books recommended:

1. Operation Research, Kanti swaroop, Mak-Mohan, P.K. Gupta.
2. Optimization Methods in Operations Research and systems analysis, K.V. Mittal
3. Linear-Programming, S.I. Gass

M. Sc. MATHEMATICS (Semester IV)

MAT-644

DISCRETE MATHEMATICS-II (DSE)

UNIT I

Graph theory: Definition of (Undirected) graphs, Paths, Circuits, Cycles and Sub graphs. Induced Subgrapha..., Degree of vertex. Connectivity. Planer graphs and their properties.

UNIT II

Trees. Euler's formula for connected planar graphs Complete and Complete Bipartite graphs. Non Planar graph, Kuratowsk's theorem (Statement only). Spanning trees. Cut sets, Fundamental cut-sets, and Cycles. Minimal spanning trees and Kruskal's Algorithm.

UNIT III

Euler's theorem on the existence of eulerian paths and circuits. Directed graphs. In degree and out degree of a vertex. Weighted undirected graphs, Dijkstra's Algorithm. Strong connectivity . Directed trees. Search trees. Tree traversals.

UNIT IV

Introductory computability Theory – Finite state machines and their Transition Table Diagrams. Equivalence of finite state machines. Reduced machines. Homomorphism. Finite Automata. Acceptors. Non- deterministic Finite Automata.

UNIT V

Phrase structure Grammar. Rewriting Rules. Derivations, Sentential forms. Language generated by a Grammar. Regular context – free, and context sensitive Grammars and Languages. Regular sets, Regular expressions and pumping Lemna, Kleene's Theorem stamens.

Books recommended:

1. Discrete Mathematical structure with applications to computer science, J.P. Tremblay & R. Manohar
2. Graph theory with applications to Engineering and Computer Science, N. Arsing Deo
3. Advanced Discrete Mathematics(Navkar Publications), Gokhroo & Gokhroo

M. Sc. MATHEMATICS (Semester IV)

MAT-645

NUMERICAL ANALYSIS-II (DSE)

UNIT I

Curve fitting and Function Approximations: Least square principle, fitting a straight line, exponential functions, parabola and polynomial of n^{th} degree, Approximation of functions by Chebyshev Polynomials.

UNIT II

Numerical Solutions of ordinary differential equations using Taylor series method, Picard's method, Euler's method, modified Euler's method.

UNIT III

Solutions by Runge-Kutta method up to fourth order, solutions by multi step method: Milne's method, Adams Moulton's method, Stability Analysis of Single and Multi step methods.

UNIT IV

Difference method for solving linear boundary value problem of ODE's: Finite difference method and shooting method, Numerical integration by Trapezoidal, Simpson's and Gauss Quadrature rule.

UNIT V

Finite Difference scheme for non-linear boundary value problems of the $y' = f(x, y)$, $y'' = f(x, y, y')$, $y''' = f(x, y, y', y'')$ and $y^{(v)} = f(x, y, y', y'', y''')$.

Books recommended:

1. Numerical Analysis, Jain, Iyenger and Jain
2. Numerical solutions of differential equation, Jain, M. K.

M. Sc. MATHEMATICS (Semester IV)

MAT-646 A

MATHEMATICAL THEORY OF STATISTICS-II (DSE)

UNIT I

Chi-square and t sampling distribution with derivations, properties and applications.

UNIT II

F sampling distribution with derivations, properties and applications. Large sample theory and applications. Determination of sample size.

UNIT III

Elements of theory of estimation: Point estimation, criterion of good estimators for one parameter; Consistency, Efficiency, sufficiency and unbiasedness.

UNIT IV

Method of maximum likelihood estimation properties of maximum likelihood estimators (without proof). M.L.E. for Binomial, Poisson and Normal populations. Interval estimation for mean and variance in case of Normal population.

UNIT V

Elements of testing of hypothesis: Two kinds of error in testing of hypothesis. Critical region, Neyman-Pearson Lemma and determination of BCR in Neyman sense for testing simple v/s simple hypothesis in uniform and normal populations.

Note: Candidates who have offered Mathematical Statistics / Statistics / Applied Statistics as an optional subject in their B.Sc. examination will not be permitted to offer this course.

Books recommended:

1. Fundamentals of Mathematical Statistics, Gupta and Kapoor
2. Mathematical Statistics, Kapur and Saxena

M. Sc. MATHEMATICS (Semester IV)

MAT-646 B

VISCOUS FLUID DYNAMICS-II (DSE)

UNIT I

Boundary layer Theory: Boundary layer equations for two dimensional flows over a plane wall. Boundary layer on a flat plate (Blasius, Topper solution). Characteristic boundary layer parameters. Similar solutions of the boundary layer equations. Exact solutions of the steady state boundary layer equation in two dimensional motion, Boundary layer along a flat plate.

UNIT II

Flow past a wedge, Flow past a convergent channel. Boundary layer separation. Blasius series solution, Gortler, new series method. Prandtl-mises transformation, Axial symmetrical and three dimensional boundary layer: - Boundary layer on a Yawed cylinder.

UNIT III

Approximate methods for the solution of the boundary layer equations Karman momentum integral equation, Karman-Pohlhausen method. Energy integral equations. Walz-Thwaites method based on energy integral equation.

UNIT IV

Thermal Boundary Layer in Two Dimension Flow. Thermal boundary layer equation for a plane wall. Forced convection in a laminar boundary layer on a flat plate (i) Crocco's first integral (ii) Reynolds's analogy (iii) Crocco's second integral for $Pr = 1$.

UNIT V

Free convection from a heated vertical plate: Thermal energy integral equation. Approximate solution of the Pohlhausen's problem of free convection from a heated vertical plate.

Books recommended:

1. Boundary Layer Theory, G. Schlichting
2. Viscous Fluid Dynamics, J.L. Bansal
3. Fluid Dynamics, M. D. Raisinghania

M. Sc. MATHEMATICS (Semester IV)

MAT-647

INTEGRAL TRANSFORMS (DSE)

UNIT I

Laplace transform: Definition and its properties. Rules of manipulations, Laplace theorems of derivatives and integrals, Properties of inverse laplace transtforms, Convolution theorem, Complex inversion formulas.

UNIT II

Applications of Laplace transform to the solutions of ordinary differential equations with constant and variable coefficients and simple boundary value problems.

UNIT III

Fourier Transform: Definition and properties of fourier sine and cosine and complex transforms, Convolution theorem, Inversion theorems and Fouries transform of derivations.

UNIT IV

Applications of Fourier transforms to the solutions of partial differential equations. Mellin Transform: Definition and elementary properties, Mellin transforms of derivations and integrals Inversion theorem and convolution theorem.

UNIT V

Infinite Hankel transform: Definition and Elementary Properties, Hankel transform of derivations, Inversion theorem and parseval theorem. Application to the Solution of simple boundary value problems.

Books recommended:

1. Laplace and Fourier Transforms, Ranville, E.D.
2. The use of Integral Transforms, Sneddon, I.N.
3. Generalized Integral transforms, Ze manian, A.H.

M. Sc. MATHEMATICS (Semester IV)

MAT-648 A

ASTRONOMY-II (DSE)

UNIT I

Parallax: shape of each, geocentric parallax, distance of Moon, Parallax in declination and Hour angle and geocentric parallax in zenith dist. azimuth, right ascension and declination annual parallax in longitude, and latitude, Parallax angle and stellar parallax in right ascension and declination.

UNIT II

The meridian circle: the three errors, Besell's formula, correction for level and collimation error, total correction to the observed time of transit.

UNIT III

Kepler's Laws and planetary motion: Various definitions and laws, relation in elliptic motion, anomaly V in terms of eccentric anomaly, true anomaly V in terms of mean anomaly M , Euler's theorem.

UNIT IV

Planetary phenomena: Sydereal period and synodic period and their relation, elongation phases of moon, brightness, maximum brightness. Eclipses: Eclipses of moon angular radius of earth's shadow, duration of eclipses, the ecliptic limits, eclipses of sun and their Limits, frequency of eclipse, the metonic cycle.

UNIT V

Proper motions of stars and their relation, tangential velocity and parallax, radial velocity at different epochs, the solar motion and parallactic motion, determination of solar apex from proper motions.

Books recommended:

1. Astronomy, Gorakh Prasad

M. Sc. MATHEMATICS (Semester IV)

MAT-648 B

NUMBER THEORY-II (DSE)

UNIT I

Continued Fractions: Finite and infinite continued fraction convergent of a given continued fraction and their properties.

UNIT II

Uniqueness of a continued fraction Periodic continued fraction, Pell's equation in general, characterization of solutions of $x^2 - dy^2 = 1$ in terms of its smallest positive solution.

UNIT III

Algebraic number fields and their rings of integers, Calculations for quadratic and cubic cases. Localization, Galois extension.

UNIT IV

Dedekind rings, discrete valuation rings completion, unramified and ramified extensions.

UNIT V

Different discriminates, cyclotomic fields, roots of unity.

Books recommended:

1. Elementary Number Theory, Allyn and Bacon Inc., Donald M. Burton
2. An Introduction to the Theory of Numbers, Willey eastern India Ltd., Niven & H.S. Zuckerman

M. Sc. MATHEMATICS (Semester IV)

MAT-648 C

COMPUTER PROGRAMMING OF NUMERICAL METHODS (DSE)

UNIT I

Algorithm, Flowchart and Computer Programming in C on: Arithmetic operations with normalized floating point numbers, Number system conversions

UNIT II

Algorithm, Flowchart and Computer Programming in C for numerical solution of algebraic and transcendental equations: bisection, false position, Newton-Raphson, secant method

UNIT III

Algorithm, Flowchart and Computer Programming in C for numerical solution of simultaneous linear equation: Gauss Elimination method, Gauss-Seidel method

UNIT IV

Algorithm, Flowchart and Computer Programming in C for Differentiation & Integration: Simpson's rule, Trapezoidal rule, Gaussian Quadrature formula.

UNIT V

Algorithm, Flowchart and Computer Programming in C for Numerical Solutions of differential equations: Eulers method, Taylor's series 4th order method, Runge Kutta 4th order method, Predictor-corrector method

Books recommended:

1. The C-Programming Language: B.W. Kernyarn & D.M. Ritche - PHI Ltd.
2. Computer Programming in C : Y Kanetkar-B.P.B. Publication, New Delhi.

M. Sc. MATHEMATICS (Semester II)

MAT-626

OFFICIAL STATISTICS-I (SEC)

UNIT I

Introduction to Indian and International Statistical systems. Role, function and activities of Central and State statistical organizations.

UNIT II

Organization of large scale sample surveys. Role of National Sample Survey Organization. General and special data dissemination systems.

UNIT III

Population growth in developed and developing countries.

UNIT IV

Evaluation of performance of family welfare programmes, projections of labour force and manpower.

UNIT V

Scope and content of population census of India.

Books recommended:

1. Basic statistics Relating to the Indian Economy (CSO) 1990.
2. Guide to Official Statistics (CSO), 1999.
3. Statistical System in India (CSO) 1995).
4. Principles and Accommodation of National Population Censuses, UNESCO.

M. Sc. MATHEMATICS (Semester II)

MAT-627

MATHEMATICAL & ANALYTICAL SKILL (SEC)

Unit I

Real Number system, sets and their types, logic. Matrices and Determinants, concept of inverse of a matrix.

Unit II

Relations, functions and their types, properties of different types of function ex.: linear function, quadratic function, mod function, exponential function, logarithmic function, trigonometrical function etc.

Unit III

Periodic functions, Angles, polar coordinates, conversion of polar coordinates into cartesian and vice-versa, polar graphs, Polynomials. Inverse of logarithmic function, applications, meaning of continuous functions.

Unit IV

Differentiation and integrations: Meaning of derivative, growth rate, maxima -minima, Integration as anti-derivative, Simple algebraic integrals.

Unit V

Ordinary differential equations: Meaning of a differential equation, solution of a differential equation, order and degree of a differential equation, system of linear differential equations.

M. Sc. MATHEMATICS (Semester II)

MAT-628

INFORMATION AND COMMUNICATION TECHNOLOGY SKILL (ICT)

Topics	Lab work and Skills (Video and Online Resource)
Identification of various components of a computer system	Identify Mother board, CPU, Memory, various ports and connectors, drives, keyboards, mouse, types of monitors and its connection to computer, hardware specifications Skill: Identification of various components of a PC and writing specification of a computer.
Operating a computer system	Desktop, using help, My computer, folders and files, word pad, copy, save and print. Skill: Operation of a PC.
Word Processing	Creating New documents, Entering text, saving, closing and opening files, editing & formatting, Cut, Copy and paste, search and replace, insert page number, date, picture, page layout, spell and grammer check, headers and footer, footnoting, table of contents, table, mail merge, mailing labels using Menu items etc. Skill: Preparation of a given document.
Spreadsheet	Creating and editing a Workbook, using charts, managing workbook. Candidates should be trained to create, enter and edit data, save and close workbook, change column width, moving, centering and merging cells, using formulae, using functions, formatting worksheet, creating charts, printing. Skill: Preparation of Invoice, balance sheet, plotting selected columns of a table etc.

Database Management System	<p>Creating a database, modifying table, creating forms, queries and reports Candidates should be trained in creating, data entry, close and open table and database, customizing and inserting fields, sorting, form wizard, adding records, using queries, creating and printing reports.</p> <p>Skill: Prepare Telephone directory, catalogue and making queries and required reports.</p>
Presentation Graphics	<p>Creating, modifying and refining presentation, using advanced presentation features.</p> <p>Skill: Prepare a good presentation on given topic.</p>
Internet and Personal Information Management	<p>Internet & Intranet, Browsers and finding information, URL's, search services, e-mail, checking internet connection. Using calendar for appointment, creating and managing task, address book and its management.</p> <p>Skill: Creation of mailing list, preparing appointment and tasks.</p>
Web Authoring & IT work	<p>Creating a web page using HTML editor, Modifying and refining web page, inserting hyperlink, changing theme and layout, Inserting images, publishing web page. Skill: Creating and Publishing a web page Installation of Software including antivirus software, Printer and other devices. Installing and using image Scanner, CD writing, creating PDF files, Using FTP, using Google Drive.</p> <p>Skill: Preparing a PC for office by installing necessary software.</p>

M. Sc. MATHEMATICS (Semester IV)
MAT-649 A
BASIC STATISTICAL TECHNIQUES (SEC)

UNIT I

Presentation of raw data, Graphical representation of data, Diagrammatic representation,

UNIT II

Measures of central tendency, Dispersion, Moments, Skewness, and kurtosis.

UNIT III

Fitting of curves Straight line Parabola exponential and power curves.

UNIT IV

Calculation of correlation coefficient by karl pearson's and spearman's rank method. Construction of regression line.

UNIT V

Analysis of variance, F - Test for two population variances.

References:

1. Basic statistics Relating to the Indian Economy (CSO) 1990.
2. Guide to Official Statistics (CSO), 1999.
3. Statistical System in India (CSO) 1995).
4. Principles and Accommodation of National Population Censuses, UNESCO.

M. Sc. MATHEMATICS (Semester IV)

MAT-649 B

OFFICIAL STATISTICS-II (SEC)

UNIT I

System of collection of Agricultural statistics.

UNIT II

Crop forecasting and estimation, productivity.

UNIT III

Fragmentation of holdings, support prices, buffer stocks, impact of irrigation projects.

UNIT IV

Statistics related to industries, foreign trade.

UNIT V

Balance of payment, cost of living, inflation, educational and other social statistics.

Books recommended:

1. Basic statistics Relating to the Indian Economy (CSO) 1990.
2. Guide to Official Statistics (CSO), 1999.
3. Statistical System in India (CSO) 1995).
4. Principles and Accommodation of National Population Censuses, UNESCO.