

SCHEME & SYLLABUS

M.Sc(Mathematics)



Department of Natural sciences
University institute of Sciences and Humanity
Sant Baba Bhag Singh University
2015 onward

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Course Scheme for M.Sc. Mathematics

First Semester

S No.	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	MAT501	Real Analysis-I	5:0:0	5:0:0	5	5
2	MAT503	Complex Analysis-I	5:0:0	5:0:0	5	5
3	MAT505	Abstract Algebra-I	5:0:0	5:0:0	5	5
4	MAT507	Differential Equations-I	5:0:0	5:0:0	5	5
5	MAT511	Mechanics	5:0:0	5:0:0	5	5
Total					25	25

Second Semester

S No.	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	MAT502	Real Analysis-II	5:0:0	5:0:0	5	5
2	MAT504	Complex Analysis-II	5:0:0	5:0:0	5	5
3	MAT506	Abstract Algebra-II	5:0:0	5:0:0	5	5
4	MAT508	Differential Equations-II	5:0:0	5:0:0	5	5
5	MAT517	Advanced Discrete Mathematics	5:0:0	5:0:0	5	5
Total					25	25

Third Semester

S No.	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	MAT601	Topology-I	5:0:0	5:0:0	5	5
2	MAT603	Functional Analysis -I	5:0:0	5:0:0	5	5
3	CSE631	Fundamentals of Computer Science-I	4:0:0	4:0:0	4	4
4	MAT605	Operation Research -I	5:0:0	5:0:0	5	5
5	MAT607	Statistics-I	5:0:0	5:0:0	5	5
6	CSE633	Fundamentals of Computer Science lab-I	0:0:2	0:0:1	2	1
		Total			26	25

Fourth Semester

S No.	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	MAT602	Topology-II	5:0:0	5:0:0	5	5
2	MAT604	Functional Analysis - II	5:0:0	5:0:0	5	5
3	CSE606	Fundamentals of Computer Science-II	4:0:0	4:0:0	4	4
4	MAT606	Operation Research – II	5:0:0	5:0:0	5	5
5	MAT608	Statistics-II	5:0:0	5:0:0	5	5
6	CSE608	Fundamentals of Computer Science lab-II	0:0:2	0:0:1	2	1
		Total			26	25

Course Code	MAT501
Course Title	REAL ANALYSIS-I
Type of course	core
L T P	5 0 0
Summarized report of Course scheme for M.Sc Mathematics	
Credits	5
Course prerequisite	B.Sc. with Mathematics or B.A with Mathematics
Course Objective (CO)	To have the knowledge of basic properties of field of real numbers and convergence.

Sem	L	T	P	Contact hrs/wk	Credits
1	25	0	0	25	25
2	25	0	0	25	25
3	24	0	2	26	25
4	24	0	2	26	25
Total	98	0	4	102	100

UNIT-I

Real Number System: Ordered sets, Fields, Completeness property of real numbers, The extended real number system, Euclidean spaces, Set Theory: Finite, countable and uncountable sets. Metric spaces: definition, open sets, closed sets, interior and exterior point, adherent point, compact sets, elementary properties of compact sets, k - cells, compactness of k - cells, Compact subsets of Euclidean space, Heine-Borel Theorem. Perfect sets, The Cantor set, Separated sets, connected sets in a metric space, Connected subsets of real line, Disconnected sets, Components.

UNIT-II

Sequences in Metric Spaces: Convergent sequences (in Metric Spaces), subsequences, Complete metric spaces, Cantor's Intersection Theorem, Baire's Category Theorem, Baire's theorem, Banach contraction principle, Functions of bounded variation.

UNIT-III

Continuity: Limits of functions (in metric spaces), Continuity and Compactness, Continuity and Connectedness, Discontinuities, Monotonic functions, Uniform Continuity.

UNIT-IV

The Riemann Stieltje's Integral: Definition and existence of Riemann stieltje's integral, Properties of integral. Integration and Differentiation, Fundamental Theorem of Calculus, Mean Value Theorems of Riemann Stieltje's integral. Improper integrals: Types of improper integrals, Tests for convergence of improper integrals, Absolute and conditional convergence of improper integrals.

Text & Reference books:-

S. No	Name	Author(S)	Publisher
1	Principles of Mathematical Analysis	Walter Rudin	McGraw-Hill Ltd
2	A course of Mathematical Analysis	Shanti Narayan	S.Chand
3	Mathematical Analysis	S.C.Malik	Wiley Eastern
4	Introduction to Real Analysis	R. G. Bartle	John Wiley and Sons
5	Elements of Real Analysis	H. S. Gaskill and P. P. Narayanaswami	Printice Hall,
6	Real Analysis	H.L. Royden,	Macmillan Company Collier-Macmillan Limited

Course Code	MAT503
Course Title	Complex Analysis-1
Type of course	Core
L T P	5 0 0
Credits	5
Course prerequisite	B.Sc. with Mathematics or B.A with Mathematics
Course Objective (CO)	To provide an introduction to the theories for functions of complex variables. It helps students to visualize multi-valued complex functions.

UNIT-I

Analytic function – Definition, differentiability, and continuity, Cauchy Riemann Equations in Cartesian and Polar form , harmonic function, Formation of analytic function , Milne-Thompsons method, Stream and potential function,

UNIT-II

Complex Integration- Definition, Riemann’s definition of integration, line integrals, cauchy theorem(proof), Cauchy’s integral formulae(proof),Cauchy’s formula for derivatives Morera and Liouville’s theorem, Cauchy’s inequality, Taylor’s and laurent’s series(proof), Poisson’s integral formula for circle and a half-plane..

UNIT-III

The range of analytic function Blochs Theorem , The little Picard Theorem , Schottkys Theorem ,Montel Caratheodory and The great Picrad Theorem

UNIT-IV

Bilinear Transformations - Conformal transformations, Bilinear transformations, critical points, fixed points, cross- ratio, Problems on cross-ratio and bilinear transformation.

Text& Reference books:-

S. No	Name	Author(S)	Publisher
1	Complex Analysis	Deshpande, J.V	Tata McGraw-Hill Publishing Company
2	Complex Analysis, third edition (International student edition)	Ahlfors D.V	McGraw-Hill International Book Company.
3	An Introduction to the theory of functions of a Complex Variable	Copson, E. T.	The English Language Book Society and Oxford University Press.
4	Functions of Complex Variable and Application	James ward Brown ,Ruel V. Churchill	McGraw Hill Higher Education
5	Complex Variables	M. R. Spiegel	McGraw Hill Book Company,
6	Complex Variables and Applications	J. W. Brown, R. V. Churchill.	McGraw Hill,
8	Complex Analysis	T.W. Gamelin	Springer International Edition .

Course Code	MAT505
Course Title	Abstract Algebra-I
Type of course	Core
L T P	500
Credits	5
Course prerequisite	B.Sc. with Mathematics or B.A with Mathematics
Course Objective (CO)	It develops the techniques to simplify algebraic expressions using commutative, associative and distributive properties.

UNIT-I

Groups and Subgroups:- Normal Groups, Cyclic groups, quotient groups, Dihedral group, Permutation groups, Isomorphism, Theorems of Isomorphism, Commutators, Sylow p-subgroups, Applications of Sylow Theory, Direct Products, Classification of Finite Abelian Groups, Characteristic and fully invariant subgroups, Normal products of groups.

UNIT-II

Solvable groups :- Simple groups and Solvable groups, Nilpotent groups, Simplicity of alternating groups, Normal Series, Normal series and their refinements, Composition series, Jordan-Holder Theorem, Semi-direct products. Free groups, Free abelian groups.

UNIT-III

Rings:- Rings, Examples (including polynomial rings, formal power series rings, matrix rings and group rings), Ring of real Quaternions, Division ring, Order and Characteristics of rings.

UNIT-IV

Subrings: ideals, prime and maximal ideals, rings of fractions, Isomorphisms of rings and their standard theorems, Chinese Remainder Theorem for pairwise co maximal ideals.

Recommended books:-

S. No	Name	Author(S)	Publisher
1	Schaum's outline of modern abstract algebra	Frank Ayres	Schaum's outline series
2	Basic Abstract Algebra,	Bhattacharya, P.B., Jain, S.K. & Nagpaul, S.R.	Cambridge University Press
3	A Course in Abstract Algebra	Vijay K Khanna and S K Bhambri	Vikas Publishing house
4	Contemporary Abstract Algebra,	J. A. Gallian	Narosa Publising House,
5	A First Course in Abstract Algebra	J. B. Fraleigh	Addison-Weseley Publishing
6	The Theory of Groups	J. Rotman	Allyn and Bacon, London,
7	The Theory of Groups	I.D. Macdonald	(Oxford, Clarendon Press
8	Abstract-Algebra	Dummit, D.S. & Foote.	John-Wiley & Sons Students Edition-

Course Code	MAT507
Course Title	DIFFERENTIAL EQUATIONS-I
Type of course	Core
L T P	5 0 0
Credits	5
Course prerequisite	B.Sc. with Mathematics or B.A with Mathematics
Course Objective (CO)	It helps to define the relationships between dependent and independent variables and Homogeneous and Non-homogeneous equations.

UNIT-I

Existence and Uniqueness of Solutions of First Order Ordinary Differential Equations –Introduction, Picard's Method of Successive Approximations ,The Lipschitz Condition ,Uniqueness Of Solutions, Wronskian Boundary Value Problems and Sturm- Liouville theory- Eigen values and Eigen Functions of Linear Homogeneous Boundary Value Problems, Sturm-Liouville Boundary value problem, Normalization of Eigen Functions and Eigen Expansion Of Functions, Separation theorems, Orthogonality solution,

UNIT-II

Ordinary Differential Equations in More Than Two Variables- Surfaces and Curves in Three Dimensions, Pfaffian Differential equations, Simultaneous Differential Equations of First Order and First Degree in Three Variables, Methods to solve $dx/P= dy/Q=dz/R$, Total Differential Equations, Primitive, Differential equations of degree higher than first, Orthogonal Trajectories of a system of curves on a surface

UNIT-III

Partial Differential Equations Of First Order- partial differential equations, Origin and Formation of First Order Partial Differential Equations, Lagrange's method to the linear partial Differential Equations,, Nonlinear partial differential equations of first order, Compatible systems of first order Equations, Charpit's Methods of solving Nonlinear Partial Differential Equations of first Order and their Standard forms, Jacobi's Method.

UNIT-IV

Partial Differential Equations Of Second and Higher Order- Homogeneous and Non-homogeneous Linear Partial Differential Equations with Constant Coefficients and their complete solutions, Second order equation with variable coefficient and their classification and reduction to standard form, Solution of linear hyperbolic Equation, Non-linear equations of second order, Monge's Method, Monge's Method of Integrating.

Text & Reference books:-

S. No	Name	Author(S)	Publisher
1	Differential equations.	Piaggio	G.Bell & Sons
2	Differential equations.	Ross, S.L	John wiley and Sons
3	Introduction to Ordinary Differential Equations.	Coddington, E.A.:	McGraw-Hil
4	Elements of partial differential equations.	Sneddon, I.N.	Dover Publications
5	Ordinary Differential Equations: Theory and Applications	M. Rama Mohana Rao	East-West Press Pvt. Ltd
6	Partial Differential Equations	E. DiBenedetto	Birkhauser, Boston
8	Partial Differential Equations	F. John	Narosa Publ.Co New Delh

Course Code	MAT511
Course Title	Mechanics
Type of course	core
L T P	5 0 0
Credits	5
Course prerequisite	B.Sc. with Mathematics or B.A with Mathematics
Course Objective (CO)	To understand the theory of displacement, velocity and acceleration of functions.

UNIT-I

Kinematics of Particles and Rigid body : Velocity and acceleration of a particle along a curve, Radial & Transverse components (plane motion). Relative velocity and acceleration. Kinematics of a rigid body rotating about a fixed point. Vector angular velocity, General motion of a rigid body, General rigid body motion as a screw motion. Composition of angular velocities. Moving axes. Instantaneous axis of rotation and instantaneous centre of rotation

UNIT-II

Newton's laws of motion: Newton's laws of motion, work, energy and power. Conservative forces potential energy. Impulsive forces, Rectilinear particle motion:- (i) Uniform accelerated motion (ii) Resisted motion (iii) Simple harmonic motion (iv) Damped and forced vibrations. Projectile, motion under gravity, constrained particle motion, angular momentum of a particle.

UNIT-III

Motion of circle and Cycloidal Motion: The cycloid and its dynamical properties. Linear functional, Extremal. Euler's - Lagrange's equations of single independent and single dependent variable. Brachistochrone problem, Extension of the variational method.

UNIT-IV

Hamilton's Principle: Hamilton's Principle, Principle of Least action. Distinctions between Hamilton's Principle and the Principle of Least Action. Euler's - Lagrange equation of several dependent and several independent variables. Functional involving higher order derivatives. Approximate solution of boundary value problems:- Rayleigh-Ritz Method, Galerkin's method Kanturovich and Treffiz method. Isoperimetric problems. Geodesics.

Text&Reference books:-

S. No	Name	Author(S)	Publisher
1	Text Book of Dynamics	Chorlton, F	CBS Publishers & Distributors Pvt. Ltd., New Delhi.
2	Dynamics of rigid body	Loney, S.L	New Age International Private Limited
3	Classical Mechanics	Rutherford, D.E.	Oliver & Boyd Ltd.

Course Code	MAT502
Course Title	REAL ANALYSIS-II
Type of course	core
L T P	5 0 0
Credits	5
Course prerequisite	B.Sc. with Mathematics or B.A with Mathematics
Course Objective (CO)	To have the knowledge of basic properties of field of real numbers and convergence.

UNIT-I

Sequences and Series of Functions: Cluster Point, Definition of point-wise and uniform convergence, Uniform convergence and continuity, Uniform convergence and integration, Uniform convergence, nowhere differentiable functions, Weierstrass's non-differentiable function, Weierstrass Approximation Theorem, Stone-Weierstrass's Theorem.

UNIT-II

Lebesgue Outer Measure Function: Lebesgue and Outer Measure, Properties of Measurable Sets and Non Measurable Sets, σ -Algebra, Borel sets.

UNIT-III

Measurable Functions: Definition & Properties of Measurable functions, Characteristic functions, Step Functions and Simple Functions, Egoroff's Theorem, Lusin Theorem, Littlewood's three Principles, Signed measures, The L_p -spaces, Riesz-Fischer Theorem; Riesz Representation theorem for L_p spaces, Radon-Nikodym theorem, Dual of L_p -spaces, The extension theorem.

UNIT-IV

Lebesgue Integral: Lebesgue Integral of bounded function, Comparison of Riemann and Lebesgue Integral, Integral of a non negative function, Convergence in measure, Bounded Convergence Theorem, The general Lebesgue integral. Differentiation and Integration: Differentiation of monotone functions, Fatou's Lemma, Monotone Convergence Theorem and Differentiation of an integral, Absolute Continuity.

Text & Reference books:-

S. No	Name	Author(S)	Publisher
1	Principles of Mathematical Analysis (3rd Edition)	Walter Rudin	McGraw-Hill Ltd
2	Mathematical Analysis	S.C.Malik	Wiley Eastern
3	Introduction to Real Analysis	R. G. Bartle	John Wiley and Sons
4	Elements of Real Analysis	H. S. Gaskill and P. P. Narayanaswami	Printice Hall,
5	Real Analysis	H.L. Royden,	Macmillan Co.
6	Mathematical Analysis,	T. Apostol	Narosa Publishers
7	Elementary Analysis: The Theory of Calculus	K. Ross	Springer Int. Edition
8	Measure Theory, Graduate Text in Mathematics	P.R. Halmos	Springer-Verlag

Course Code	MAT504
Course Title	Complex Analysis-II
Type of course	core
L T P	5 0 0
Credits	5
Course prerequisite	B.Sc. with Mathematics or B.A with Mathematics
Course Objective (CO)	To provide an introduction to the theories for functions of complex variab It helps students to visualize multi –valued complex functions.

UNIT-I

Power Series- Examples related to Taylor's theorem, Laurent's theorem. Zeros and Singularities of different kinds of a analytic function, test to detect Singularities and different theorems, Meromorphic functions-Definition, residue at pole and at infinity, Schwarz's lemma. Residue theorem and Theorems on poles and zeros of Meromorphic functions, Maximum Modulus Principle, Argument principle, Fundamental theorem of Algebra, Cauchy's Rouché's theorem.

UNIT-II

Contour integration and Conformal Representation - Evaluation of integrals of real definite integrals and integrals in variable 'x' by contour integration (All Types including integration round unit circle, improper integral, infinite integral, Poles on real axis, rectangular and Miscellaneous), Jordans inequality and lemma,

UNIT-III

Integrals involving many valued functions: Definitions and examples of Conformal mappings, jacobian of transformation, rotation, inverse, bilinear transformation (mobius transformation), cross-ratio, Schwarz Christoffel's Mapping.

UNIT-IV

Expansion of Functions and Analytic Continuation- Infinite products, Weierstrass theorem, Mittag-Leffler's theorem, Canonical product, Analytic Continuation through power series (basic ideas), Natural boundary, the Gamma function and Riemann Zeta function.

Text & Reference books:-

S. No	Name	Author(S)	Publisher
1	Complex Analysis	Deshpande, J.V	Tata McGraw-Hill Publishing Company
2	Complex Analysis, third edition (International student edition)	Ahlfors D.V	McGraw-Hill International Book Company
3	Function of one complex variable' second edition, 1978. Corr4th print 1986 Graduate texts,	Conway, J.B	Springer-verlag. Indian edition by Narosa Publishing House, New Delhi
4	An Introduction to the theory of functions of a Complex Variable	Copson, E. T.	The English Language Book Society and Oxford University Press
5	Complex Variables	M. R. Spiegel	McGraw Hill Book Company
6	Complex Variables and Applications	J. W. Brown, R.V. Churchill.	McGraw Hill
7	Theory of Complex Functions	R. Remmert	Springer Verlag
8	Functions of Complex Variable and Application	J.W.Brown Ruel Churchill	McGraw Hill Higher Education

Course Code	MAT506
Course Title	Abstract Algebra-II
Type of course	Core
L T P	500
Credits	5
Course prerequisite	B.Sc. with Mathematics or B.A with Mathematics

Course Objective (CO)	It develops the techniques to simplify algebraic expressions using commutative, associative and distributive properties
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UNIT-I

Rings: Ring Division Algorithm, Embedded rings, Divisibility in commutative rings, G.C.D and L.C.M in rings, Euclidean Domains, Principal Ideal Domains and Unique Factorizations Domains. Polynomial rings over UFD's, Gauss's Lemma, Reducible and irreducible polynomials,

UNIT-II

Fields: Characteristic and prime subfields, Field extensions, algebraic and transcendental extensions, Minimal Polynomials, Finite, algebraic and finitely generated field extensions, Classical ruler and compass constructions

UNIT-III

Types of fields: Degree and basis of extension, Splitting fields and normal extensions, Stem field, algebraic closures. Finite fields, Cyclotomic fields, Separable and inseparable extensions, Perfect field.

UNIT-IV

Galois Field: Galois Field, Fundamental Theorem of Galois Theory, Theorem of Primitive element, Composite extensions, Examples (including cyclotomic extensions and extensions of finite fields) Norm, trace and discriminant, Solvability by radicals, Galois' Theorem on solvability. Cyclic extensions, Abelian extensions, Trans-cendental extensions.

Text&Reference books:-

S. No	Name	Author(S)	Publisher
1	Topics in Algebra	I. N. Herstein,	(Xerox Publishing Company Mass)
2	Schaum's outline of modern abstract algebra	Frank Ayres	Schaum's outline series
4	Basic Abstract Algebra,	Bhattacharya, P.B., Jain, S.K. & Nagpaul, S.R.	Cambridge University Press
5	A Course in Abstract Algebra	Vijay K Khanna and S K Bhambri	Vikas Publishing house
7	Contemporary Abstract Algebra,	J. A. Gallian	Narosa Publishihng
8	A First Course in Abstract Algebra	J. B. Fraleigh	Addison-Weseley Publishing
10	The Theory of Groups	J. Rotman	Allyn and Bacon, London,
11	The Theory of Groups	I.D. Macdonald	(Oxford, Clarendon Press

12	Abstract-Algebra	Dummit, D.S. & Foote.	John-Wiley & Sons
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Course Code	MAT508
Course Title	Differential Equations-II
Type of course	core
L T P	5 0 0
Credits	5
Course prerequisite	B.Sc. with Mathematics or B.A with mathematics

Course Objective (CO)	It helps to define the relationships between dependent and independent variables and Homogeneous and Non-homogeneous equations.
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UNIT-I

Volterra Equations: Integral equations and algebraic system of linear equations. Volterra equation L_2 Kernels and functions. Volterra equations of first & second kind. Volterra integral equations and linear differential equations..

UNIT-II

Fredholm equations: solutions by the method of successive approximations. Neumann's series, Fredholm's equations with Pincherte-Goursat Kernel's, The Fredholm theorem.

UNIT-III

Special Functions: Solution, Generating function, recurrence relations and orthogonality of Legendre polynomial, Bessel functions, Hermite and Laguerre polynomials.

UNIT-IV

Series Solution and Special Functions: Method of Frobenius and Singular Series Solution, Bessel and Legendre's equation, Bessel and Legendre's Functions, Generating function for Bessel and Legendre's Functions, recurrence relations of Bessel and Legendre's Functions and Orthogonality of Bessel and Legendre's Functions, Fourier Bessel function, Rodrigue's Formula, Orthogonal and Orthonormal Functions. Application of Partial Differential Equations Solution of Laplace, wave and diffusion (heat) equations by method of separation of variables and Fourier transforms with examples, D'almberts solution of One dimensional wave equation, Solution of Laplace equation in polar coordinates by method of separation of variables.

Text & Reference books:-

S. No	Name	Author(S)	Publisher
1	Special Functions.	Rainville	Macmillan, New York
2	Differential equations.	Piaggio	G.Bell & Sons Ltd
3	Differential equations.	Ross, S.L	John wiley and Sons
5	Introduction to Ordinary Differential Equations.	Coddington, E.A.:	McGraw-Hil
6	Integral Equations	Tricomi	Dover Publications
7	Linear integral Equations	Kanwal R, p.	New York /London Academic press

Course Code	MAT517
Course Title	Advanced Discrete Mathematics
Type of course	CORE
L T P	5 0 0
Credits	5
Course prerequisite	B.sc with Mathematics and B.A with Mathematics

Course Objective (CO)	To provide the excellent training in all topics related to computer and management , methods and procedures of data analysis
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UNIT-I

Lattices& Logics and Semi Group :- Formal logic-statements, Symbolic Representation and Tautologies, Quantifier, Predicates and Validity, Proportional Logic. Semi groups & Monoids -Definitions and Examples of Semigroups. Subsemigroup and submonoids. Direct products. Basic Homomorphism Theorem. Lattices-Lattices as partially ordered sets, their properties, Lattices as algebraic systems, Sublattices, Direct products, and Homomorphisms. Some special Lattices e.g. Complete, Complemented and Distributive Lattices.

UNIT-II

Boolean Algebra- Boolean Algebras as Lattices. Various Boolean identities. The Switching Algebra example, Subalgebras, Direct Products and Homomorphisms. Join-irreducible elements, Atoms and Minterms, Boolean Forms and their Equivalence. Minterm Boolean Forms, Sum of Products Canonical Forms. Minimization of Boolean Functions, Applications of Boolean Algebra to Switching Theory (using AND, OR, NOT gates). The Karnaugh Map Method.

UNIT-III

Graph Theory- Definition of (Undirected) Graphs, Paths, Circuits, Cycles & Subgraphs. Induced Subgraphs, Degree of a vertex, Connectivity, Planar Graphs and their properties, Trees, Euler's Formula for connected Planar Graphs. Complete & Complete Bipartite Graphs, Kuratowski's Theorem (statement only) and its use, Spanning Trees, Cut-sets, Fundamental Cut-sets and Cycles.

UNIT-IV

Trees Theory:- Minimal Spanning Trees and Kruskal's Algorithm, Matrix Representation of Graphs. Euler's Theorem on the existence of Eulerian Paths and Circuits, Directed Graphs, Indegree and Outdegree of a Vertex, Weighted Graphs, Dijkstra's Algorithm, Strong Connectivity & Warshell's Algorithm, Directed Trees, Search Trees, Tree Traversals

Text & Reference books:-

	Name	Author(S)	Publisher
1	Discrete Mathematics	C.P.Gandhi	Sharma Publication
2	Discrete Mathematics	Donald Knuth	Modern Publication
3	Discrete Mathematics	P.K.Sharma	Modern Publication

Course Code	MAT601
Course Title	Topology-I
Type of course	core
L T P	5 0 0
Credits	5

Course prerequisite	B.SC with Mathematics and B.A with Mathematics
Course Objective (CO)	It denotes mathematical text acc. To the standard of the profession. It exposes students to both mathematical rigor and abstractions that leads to develop mathematical maturity.

UNIT-I

Topological Spaces: Topological Spaces, Basic concept , closure , interior , exterior and boundary of set , dense set , Closure operator and interior operator. Neighborhoods and neighborhood system

UNIT-II

Bases and Sub Bases: local base ,base and sub –bases for a topologies space . Convergence of a sequence. First and second Countable spaces, lindel of spaces, Separable spaces. Sub –spaces, hereditary properties

UNIT-III

Connected and Disconnected Spaces : separated sets ,connected sets ,connected and disconnected spaces ,Connectedness on real line ,locally connected space ,Totally disconnected space.

UNIT-IV

Product of Topological Spaces Product of two space,. base for a finite product topology. The product of n spaces .General product spaces sub –base and base for product topology .product topology .productive properties, Continuous functions, Restriction and extension of a mapping .Sequential Continuity at point .Open and closed mappings. Separation Axioms: T_0, T_1, T_2 -Spaces .Regular spaces, T_3 Spaces ,normal spaces , T_4 Spaces . Tychonoff lemma Urysohn lemma, Tietze Extension theorem

Text&Reference Books:

S. No	Name	Author(S)	Publisher
1	Elementary general Topology	T.O. MOORE	Prentice-Hall
2	Topology	J.R. Munkres	Prentice-Hall
3	introduction to Topology and Modern Anlysis	: G.F.Simmons	Tata McGraw-Hill Edition

Course Code	MAT603
Course Title	FUNCTIONAL ANALYSIS -II
Type of course	THEORY
L T P	5 0 0
Credits	5
Course prerequisite	B.sc with Mathematics and B.A with Mathematics
Course Objective (CO)	To develop the identification of variables to maintain the undesirable behavior.

UNIT-I

Normed LINEAR SPACES: Normed linear spaces, L^p -spaces: Holder's and Minkowski's inequalities, Banach spaces, subspaces, quotient spaces, , Convergence and Completeness, Riesz-Fischer Theorem

UNIT-II

Projections on a Hilbert space: Spectral Theorem for normal operators, Compact linear operators on normed spaces, properties of Compact linear operators.

UNIT-III

Natural Imbedding N into N^{} :** The conjugate space N^* . The Hahn-Banach theorem and its consequences. Natural imbedding of N into N^{**} , reflexivity of normed spaces.

UNIT-IV

HILBERT and Banach spaces : Open mapping theorem, projections on a Banach space, closed graph theorem, uniform boundedness principle, conjugate operators. Inner product spaces, Hilbert spaces, orthogonal complements, orthonormal sets, the conjugate space H^* .

Text&Reference books:-

S. No	Name	Author(S)	Publisher
1	Introduction to Topology and Modern Analysis	G F Simmons	Tata McGraw-Hill Edition
2	Functional analysis	P K Jain ,O P Ahuja	New Age International (P) Ltd
3	Functional analysis	P K sharma	Sharma publications

Course Code	MAT605
Course Title	Operations Research-I
Type of course	Core
L T P	5 0 0
Credits	5
Course pre-requisite	B.sc with Mathematics and B.A with Mathematics

Course Objective (CO)	To inculcate the traits of rational decision making. To develop the research proposal and also find out the optimal solution.
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UNIT-I

Linear programming problem:- properties of a solution to the linear programming problem, generating extreme point solution, simplex computational procedure, development of minimum feasible solution, the artificial basis techniques, a first feasible solution using slack variables, two phase and Big-M method with artificial variables.

UNIT-II

Assignment and Transportation Problems :- General transportation problem, transportation table, duality in transportation problem, loops in transportation tables, Linear Programming formulation, solution of transportation problem, test for optimality, degeneracy, transportation algorithm (MODI method), time- minimization transportation problem.

UNIT--III

Replacement Problems: Replacement of equipment/Asset that deteriorates gradually, replacement of equipment that fails suddenly, recruitment and promotion problem, equipment renewal problem Mathematical formulation of assignment problem, assignment method, typical assignment problem, the traveling salesman problem.

UNIT-IV

Game Theory: Two-person zero-sum games, maximum minimum principle, games without saddle points (Mixed strategies), graphical solution of $2 \times n$ and $m \times 2$ games, dominance property, arithmetic method of $n \times n$ games, general solution of $m \times n$ rectangular games .Non Linear Programming Problem :-i.e one and multi variable unconstrained optimization Kuhn - Tucker conditions for constrained optimization .Quadratic , Convex, Non Convex Programming problem

Text& Reference books:-

S. No	Name	Author(S)	Publisher
1	Linear Programming	Gass, S. L.	Mc Graw Hill Book Company
2	Operations Research	K.K.chawla	Kalyani Publication
3	Mathematical Programming	Kambo, N. S.	East West Press
4	Operations Research	Taha, H.A.	Taha, H.A
5	Operations Research	Kanti Sawrup	Sultan Chand & Sons

Course Code	MAT607
Course Title	Statistics-I
Type of course	CORE

L T P	5 0 0
Credits	5
Course prerequisite	B.sc with Mathematics and B.A with Mathematics
Course Objective (CO)	To provide the excellent training in scientific data collection , management , methods and procedures of data analysis

UNIT-I

Moments and Mathematical expectations :Introduction, Sheppard correction for moments, Factorial moments. absolute moments. Expected value of a random variable and function of random variable, properties of expectation, properties of variance, covariance, moments of bivariate probability distribution, conditional expectation and variance.

UNIT-II

Generating Functions and law of large numbers: Moment generating function, Cummulants, Characteristics function, inversion theorem, Hally Bray theorem, Chebychev's inequality, weak law of large number, Borel- Cantelli lemma.

UNIT-III

Theory of Attributes: Introduction, Notations, Dichotomy, Classes and class frequencies, Consistency of data, Independence of attributes, association of attributes,

UNIT-IV

Correlation and Regression: Least square principle, correlation and linear regression analysis for bi- variate data, partial and multiple correlation coefficients, correlation ratio.

Text & Reference books:-

	Name	Author(S)	Publisher
1	Introduction to Mathematical Statistics	Hogg, R.V., Mckean	J.W. and Craig, A.T.
2	Mathematical Statistics.	Mukhopadhyay, P	padhyay, Publisher
4	Fundamental of mathematical statistics	S.C,Gupta	Sultan chand & sons

Course Code	CSE631
Course Title	Fundamentals of computer science -I
Type of course	CORE
L T P	4 0 0
Credits	4

Course prerequisite	B.sc with Maths and physics
Course Objective (CO)	To provide the excellent training in basic computer science ,C++,Operators and expressions

UNIT- I

Introduction to Computers Define a Computer System, Block diagram of a Computer System and its working, associated peripherals, memories, RAM, ROM, secondary storage devices, Computer Software and Hardware Introduction to the operating system, its functions and types, working knowledge of GUI based operating system, introduction to word processors and its features, creating, editing, printing and saving documents, spell check, mail merge, creating power point presentations, creating spreadsheets and simple graphs, evolution of Internet and its applications and services. introduction to MS-EXCEL and its features

UNIT-II

Problem solving & program planning:Need for problem solving and planning a program; program design tools –algorithms, flow charts, and pseudocode, illustrative examples computer programming in C++ introduction to C++, structure of C++ Program concept of compiling and linking , IDE and its features , basic terminology- Character set, tokens, identifiers, keywords, fundamental data types, literal and symbolic constants , declaring variables , initializing variables , type modifiers

UNIT-III

Operators and expressions: Operators in C++, precedence and associativity of operators expressions and their evaluation, type conversions.Beginning with C++ program Input/output using extraction (>>) and insertion (<<) operators, writing simple C++ programs, comments in C++, stages of program execution.

UNIT-IV

Control Structures :Decision making statements: if, nested if, if - else. Else if ladder, switch, Loops and iteration: while loop, for loop, do - while loop, nesting of loops, break statement, continue statement, goto statement, use of control structures through illustrative programming examples. programming in mathematics Development of small computer codes involving simple formulas in maths.

Text &Reference books:-

Sr.no.	Name	AUTHOR(S)	PUBLISHER
1	Operating Systems Concepts	A Silberschatz, P.B. Galvin, G. Gagne	John Wiley Publication
2	Operating Systems: A Modern Perspective	G. Nutt	Pearson Education
3	Fundamentals of Database Systems, Third Edition	Elmasri/Navathe	Addison Wesley

Course Code	CSE633
Course Title	Fundamentals of computer science lab-I
Type of course	CORE
L T P	0 0 2
Credits	1
Course prerequisite	B.sc with Maths and physics

1. **WiFamiliarization of the computer system and onhand practice on power on and power off ndow Closing, Maximizing, Icon shifting & Ordering. Practice with Control Panel and File manager.**
2. **Practice with MS Word.** Opening and Closing document. Preparation and setting of a document. Familiarization with various tools, mail-meerge practice.
3. **Practice with Power Point and MS Excel sheets**
4. **C++ PROGRAMS:**
 1. WAP to find the sum of two numbers.
 2. WAP to print a string on the screen.
 3. WAP to find the simple interest.
 4. WAP to find to find the greatest of two numbers.
 5. WAP to find P by using $P=(W-X)/(Y-Z)$
 6. WAP to convert temp from Celsius to Fahrenheit.
 7. WAP to convert days into years,weeks , days.
 8. WAP to display table of given number
 9. WAP to find the Arithmetic operations on two numbers.
 10. WAP which finds the square root of a number.
 11. WAP which use the if statemet.
 12. WAP which using the if-else statement.
 13. WAP which describes the functionality of switch statement.
 14. WAP which uses the conditional ternary operator.
 15. WAP which uses the for loop.
 16. WAP which describes the functionality of While loop.
 17. WAP which describes the functionality of Do-While loop.
 18. WAP which having the functionality of jumping statements(go to, break,continue).
 19. WAP to print the pattern

1

2 2

3 3 3

4 4 4 4

20. WAP to find the sum of the digits of a number.

Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	Operating Systems Concepts	A Silberschatz, P.B. Galvin, G. Gagne	John Wiley Publication
2	Operating Systems: A Modern Perspective	G. Nutt	Pearson Education
3	Fundamentals of Database Systems, Third Edition	Elmasri/Navathe	Addison Wesley
4	Database Concepts	Korth and Silberschatz Abraham	McGraw Hall
5	SQL,PL/SQL ,The programming language of oracle	Ivan Bayross	BPB Publication



Course Code	MAT602
Course Title	Topology- II
LTP	5 0 0
Credits	5
Course prerequisite	B.SC with Mathematics and B.A with Mathematics
Course Objective (CO)	It denotes mathematical text acc. To the standard of the profession. It exposes students to both mathematical rigor and abstractions that leads to develop mathematical maturity.

UNIT-I

Completely Regular Spaces and Tychonoff Spaces: Regular , Completely Regular , Normal and Completely normal Spaces Metric spaces as completely normal T_2 spaces .Tychonoff Spaces .Product of metric spaces.

UNIT-II

Compact Spaces: Compact spaces, Compact sets Subsets of compact spaces Finite intersection property . Compactness of subset of real line . Relation of Compact spaces with hausdroff spaces

UNIT-III

Sequentially Compact Spaces: Bolzano Weierstrass property . Finite Intersection property .Compact spaces .Compactness in terms of base element and sub –base elements , One point Compactness.

UNIT-IV

Embedding and Metrization: The Stone-cech Compactification , Evaluation Mappings , Separate point and closed Set family .Embedding lemma , Embedding theorem ,Tychonoff cube, Urysohn metrization theorem.

Text&Reference Books:

S. No	Name	Author(S)	Publisher
1	Elementary General Topology	T.O.MOORE:	Prentice-Hall
2	Topology	J.R. Munkres	Prentice-Hall
3	Introduction to Topology and Modern Anylysis	G.F.Simmons	Tata McGraw-Hill Edition

Course Code	MAT 604
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Course Title	Functional analysis II
Type of course	Theory
L T P	5 0 0
Credits	5
Course prerequisite	B.sc with Mathematics and B.A with Mathematics
Course Objective (CO)	. To develop the identification of variables to maintain the undesirable behavior.

UNIT-I

Convergence :Strong and weak convergence in finite and infinite dimensional normed linear spaces. Weak convergences in Hilbert spaces, weakly compact set in Hilbert spaces, Operators on Hilbert spaces The adjoint of an operator, self adjoint operators, normal operators, unitary operators, projections on a Hilbert space.

UNIT-II

Finite Dimensional spectral Theory:Eigen- values and Eigen vectors, Spectrum of a bounded linear operator, spectrum of self-adjoint, positive and Unitary operators. Spectral Theorem for normal operators.

UNIT-III

Compact Linear Operator : Compact Linear Operator on normed spaces, properties of compact linear operators, spectral properties of compact linear operators.

UNIT-IV

Banach algebras: definitions and simple examples. Regular and singular elements .Topological divisors of zero, Spectrum of an element of Banach Algebra, formula for spectral radius.

Text&Reference books:-

S. No	Name	Author(S)	Publisher
1	Functional analysis	P K sharma	Sharma publications
2	Functional Analysis	P K Jain , O P ahuja	New Age International (P) Khalil Ahmed Ltd
3	Functional analysis	V Balmohan	New Age International Limited

Course Code

MAT606

Course Title	Operations Research-II
Type of course	Core
L T P	5 0 0
Credits	5
Course pre-requisite	B.sc with Mathematics and B.A with Mathematics
Course Objective (CO)	To inculcate the traits of rational decision making. To develop the research proposal and also find out the optimal solution

UNIT-I

Queuing Theory :- Introduction, Queuing System, elements of queuing system, distributions of arrivals, inter arrivals, departure and service times. Classification of queuing models, single service queueing model with infinite capacity (M/M/1): (/FIFO). Queuing Models: (M/M/1): (N/FIFO), Generalized Model: Birth-Death Process, (M/M/C)(/FIFO), (M/M/C) (N/FIFO), (M/M/R) (KIGD), Power supply model.

UNIT-II

Inventory Control:- The inventory decisions, costs associated with inventories, factors affecting Inventory control, economic order quantity (EOQ), Deterministic inventory problems with no shortage and with shortages, EOQ problems with price breaks, Multi item deterministic Problems

UNIT-III

Simulation Models:-Need of simulation, methodology of simulation. Simulation models, event- type simulation, generation of random numbers, Monto-carlo simulation, simulation of inventory problems. queuing systems, maintenance problem, job sequencing.

UNIT-IV

Integer Programming:- Gomory's all I.P.P. method, constructions of Gomory's constraints, Fractional cut method-all integer and mixed integer, Branch-and-Bound method, applications of integer programming. .

Text&Reference books:-

S. No	Name	Author(S)	Publisher
1	Linear Programming	Gass, S. L.	Mc Graw Hill Book Company
2	Operations Research	K.K.chawla	Kalyani Publication
3	Mathematical Programming	Kambo, N. S.	East West Press
4	Operations Research	Taha, H.A.	Taha, H.A
5	Operations Research	Kanti Sawrup	Sultan Chand & Sons

Course Code	MAT608
Course Title	Statistics-II
Type of course	CORE
L T P	5 0 0
Credits	5
Course prerequisite	B.sc with Mathematics and B.A with Mathematics
Course Objective (CO)	To provide the excellent training in scientific data collection , management , methods and procedures of data analysis

UNIT-I

Distributions: Random variable, probability mass function, probability density function, cumulative distribution function, joint distribution, marginal and conditional distributions, Stochastic independence, function of random variables and their probability density functions

UNIT-II

Discrete Probability Distributions: Uniform hyper geometric, Binomial, Poisson, Geometric, Hyper geometric, Multinomial. Continuous probability distributions: Uniform, Exponential, Gamma, Beta, Normal distributions.

UNIT-III

Testing of Hypothesis: Null hypothesis and its test of significance, simple and composite Sampling Distributions: Chi-square, t and F-distributions with their properties, distribution Hypothesis, M.P. test, UMP test, Likelihood tests

Estimation: Characteristics of estimators, MUV Estimators, RAO-BLACKWELL THEOREM, Methods of Estimation

UNIT-IV

Application of sampling: sample mean and variance, distribution of order statistics and sample range from continuous populations Applications of Sampling Distributions: Test of mean and variance in the normal distribution, Tests of single proportion and equality of two proportions

Text & Reference books:-

	Name	Author(S)	Publisher
1	Introduction to Mathematical Statistics	Hogg, R.V., Mckean	J.W. and Craig, A.T.
2	Mathematical Statistics.	Mukhopadhyay, P	padhyay, Publisher
3	Statistical inference	Casella, G. and Berger,	R. L
4	Fundamental of mathematical statistics	S.C,Gupta	Sultan chand & sons

Course Code	CSE 606
Course Title	Fundamentals of Computer II
Type of Course	
L T P	4 0 0
Credits	4
Course Prerequisites	Basics of Computers
Course Objectives (CO)	This course provides the knowledge about the role of an operating system, issues in the management of resources like processor, memory and input-output, design of an operating system. It will also provide knowledge about concepts database and its query language.

SYLLABUS

UNIT-I

Introduction to Operating System: Operating Systems functions, Types of operating systems, Multiprogramming systems, Batch systems, Time-sharing systems, Operating system operations, distributed system

Process Management: Process states, Process Scheduling, Threads, Multi-threading models, Non-pre-emptive and pre-emptive scheduling algorithms, Critical section, Semaphores, methods for inter-process communication, Deadlocks.

UNIT-II

Memory Management: Physical and virtual address space, Memory allocation strategies, Paging, Segmentation, Virtual memory and Demand paging, Page replacement algorithms.

OS and Security: Security breaches, types of attacks, attack prevention methods, security policy and access control

UNIT-III

Introduction to Databases: Introduction to database system, purpose of database system, view of data, relational databases, database architecture.

Relational database model: Concepts of relational model, Keys, integrity rules, Relational Database design: features of good relational database design, Functional Dependencies, Normalization (1NF, 2NF, 3NF, BCNF).

UNIT IV

Constraint, View and SQL: Introduction to SQL, Features, Data Types, Database Languages, Introduction to view, Integrity constraints and their types.

RECOMMENDED BOOKS			
Sr. no.	Name	AUTHOR(S)	PUBLISHER
1	Operating Systems Concepts	A Silberschatz, P.B. Galvin, G. Gagne	John Wiley Publication
2	Operating Systems: A Modern Perspective	G. Nutt	Pearson Education
3	Fundamentals of Database Systems, Third Edition	Elmasri/Navathe	Addison Wesley
4	Database Concepts	Korth and Silberschatz Abraham	McGraw Hall
5	SQL,PL/SQL ,The programming language of oracle	Ivan Bayross	BPB Publication



Course Code	CSE 608
Course Title	Fundamentals of Computers Lab-II
Type of Course	PC
L T P	0 0 2
Credits	1
Course Prerequisites	Knowledge of any high level Programming Language
Course Objective	To make students skillful in using operating system & database commands.

List of Practical's

1: Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir

2: Write programs using the I/O System calls of UNIX operating system. (open, read, write, etc)

3: Implementation of different CPU algorithms.

4: Study Of SQL Statements

4.1: Data types, creating tables, retrieval of rows using select statement, conditional retrieval of rows, alter and drop statements.

4.2: working with null values, matching a pattern from a table, ordering the result of a query, aggregate functions, grouping the result of a query, update and delete statements.

5: Operators

5.1: arithmetic operators- add, subtract, multiply, divide

5.2: rename field

5.3: logical operations-and, or, not

6: Other Operations

6.1: working with dummy table

6.2: aggregate function- average, minimum, maximum, sum, count, count(*)

6.3: numeric functions- absolute, power, sqrt, round

6.4: string functions: lower, upper, initcap, length, ltrim, rtrim, substring, lpad, rpad

7: Joins And Sequences

7.1: program to illustrate use of join.

7.2: program to illustrate use of sequence.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	DBMS – Complete Practical Approach	Sharad Maheshwari, Ruchin Jain	Firewall Media
2	Database Systems: A Practical Approach To Design, Implementation And Management	Connolly	Pearson Education India

3	Fundamentals of Database Systems	Ramez Elmasri	Pearson Education India
4	A Practical Guide to UNIX System V Release 4	M. G. Sobell	Benjamin/Cummings Publishing Company
5	100 Shell Programs in Unix	Sarika Jain	Pinnacle Technology

