DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester I

AM –101T **Paper-I**

Algebra

Unit I

Automaphisms- Conjugacy and G-sets- Normal series solvable groups- Nilpotent groups. (Pages 104 to 128 of [1])

Unit II

Structure theorems of groups: Direct product- Finitly generated abelian groups- Invariants of a finite abelian group- Sylow's theorems- Groups of orders p^2,pq . (Pages 138 to 155)

Unit III

Ideals and homomsphism- Sum and direct sum of ideals, Maximal and prime ideals- Nilpotent and nil ideals- Zorn's lemma (Pages 179 to 211).

Unit-IV

Unique factorization domains - Principal ideal domains- Euclidean domains- Polynomial rings over UFD- Rings of traction.(Pages 212 to 228)

Text Books:

[1] Basic Abstract Algebra by P.B. Bhattacharya, S.K. Jain and S.R. Nagpanl.

Reference:

[1] Topics in Algebra by I.N. Herstein.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester I

AM – 102T **Paper-II**

Real Analysis

Unit I

Metric spaces- Compact sets- Perfect sets- Connected sets

Unit II

Limits of functions- Continuous functions- Continuity and compactness Continuity and connectedness- Discontinuities – Monotone functions.

Unit III

Rieman- Steiltjes integral- Definition and Existence of the Integral- Properties of the integral- Integration of vector valued functions- Rectifiable waves.

Unit-IV

Sequences and series of functions: Uniform convergence- Uniform convergence and continuity- Uniform convergence and integration- Uniform convergence and differentiation- Approximation of a continuous function by a sequence of polynomials.

Text Books:

[1] Principles of Mathematical Analysis (3^{rd} Edition)
(Chapters 2, 4, 6)
by
Mc Graw-Hill Internation Edition

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester I

AM –103T **Paper-III**

Complex Analysis

Unit I

Regions in the complex plane- Functions of a complex variable- Mappings by exponential functions- Limits- Continuity- Derivatives- Cauchy-Riemans equations- Sufficient conditions for differentiation- Polar coordinates.

Unit II

Analytic functions- Uniquely determined analytic functions- Reflection principle- The exponential function- The logarithmic function- Complex exponents- Trigonometric functions- Hyperbolic functions- Inverse trigonometric- Hyperbolic functions.

Unit III

Derivatives of functions w(t)- Definite integrals of functions w(t)- Contours- Contour integrals- Upper bounds for moduli of contour integrals- Anti derivatives.

Unit-IV

Cauchy-Goursat theorem and its proof- Simply and multiply connected domains- Cauchy's integral formula- Derivatives of analytic functions- Liouville's theorem and fundamental theorem of algebra- Maximum modulus principle.

Text Books:

[1] Complex Variable and Application (8^{th} Edition)
by
James Ward Brown,
Ruel V-churchill

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester I

AM –104T **Paper-IV**

Mechanics

Unit I

Dynamics of systems of Particles:- Introduction - Centre of Mass and Linear Momentum of a system- Angular momentum and Kinetic Energy of a system, Mechanics of Rigid bodies- Planar motion:- Centre of mass of Rigid body- some theorem of Static equilibrium of a Rigid body- Equilibrium in a uniform gravitational field- Rotation of a Rigid body about a fixed axis.

Unit II

Moment of Inertia:- calculation of moment of Inertia Perpendicular and Parallel axis theorem- Physical pendulum-A general theorem concerning Angular momentum-Laminar Motion of a Rigid body-Body rolling down an inclined plane (with and without slipping).

Unit III

Motion of Rigid bodies in three dimension-Angular momentum of Rigid body products of Inertia, Principles axes-Determination of principles axes-Rotational Kinetic Energy of Rigid body- Momentum of Inertia of a Rigid body about an arbitrary axis- The momental ellipsoid - Euler's equation of motion of a Rigid body.

Unit IV

Lagrange Mechanics:-Generalized Coordinates-Generalized forces-Lagrange's Equations and their applications-Generalized momentum-Ignorable coordinates-Hamilton's variational principle-Hamilton function-Hamilton's Equations- Problems-Theorems.

Text Book:

[1] G.R.Fowles, Analytical Mechanics, CBS Publishing, 1986.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester I

AM – 105T **Paper- V**

Mathematical Methods

Unit I

Existence and Uniqueness of solution of $\frac{dy}{dx} = f(x,y)$. The method of successive approximation- Picard's theorem- Sturm-Liouville's boundary value problem.
Partial Differential Equations: Origins of first-order PDES-Linear equation of first-order-Lagrange's method of solving PDE of $P_p+Qq = R$ – Non-Linear PDE of order one-Charpit method- Linear PDES with constant coefficients.

Unit II

Partial Differential Equations of order two with variable coefficients- Canonical form Classification of second order PDE- separation of variable method solving the one-dimensional Heat equation and Wave equation- Laplace equation.

Unit III

Power Series solution of O.D.E. – Ordinary and Singular points- Series solution about an ordinary point -Series solution about Singular point-Frobenius Method.
Lagendre Polynomials: Lengendre's equation and its solution- Lengendre Polynomial and its properties- Generating function-Orthogonal properties- Recurrance relations-Laplace's definite integrals for $P_n(x)$- Rodrigue's formula.

Unit-IV
Bessels Functions: Bessel's equation and its solution- Bessel function of the first kind and its properties- Recurrence Relations- Generating function- Orthogonality properties.
Hermite Polynomials: Hermite's equation and its solution- Hermite polynomial and its properties- Generating function- Alternative expressions (Rodrigue's formula)-Orthogonality properties- Recurrence Relations.

Text Books:

[1] "Elements of Partial Differential Equations", By Ian Sneddon, Mc.Graw-Hill International Edition.
[2] "Text book of Ordinary Differential Equation", By S.G.Deo, V. Lakshmi Kantham, V. Raghavendra, Tata Mc.Graw Hill Pub. Company Ltd.
[3] "Ordinary and Partial Differential Equations", By M.D. Raisingania, S. Chand Company Ltd., New Delhi.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester II

AM –201T **Paper-I**

Advanced Algebra

Unit I

Algebraic extensions of fields: Irreducible polynomials and Eisenstein criterion- Adjunction of roots- Algebraic extensions-Algebraically closed fields (Pages 281 to 299)

Unit II

Normal and separable extensions: Splitting fields- Normal extensions- Multiple roots- Finite fields- Separable extensions (Pages 300 to 321)

Unit III

Galois theory: Automorphism groups and fixed fields- Fundamental theorem of Galois theory- Fundamental theorem of Algebra (Pages 322 to 339)

Unit-IV

Applications of Galoes theory to classical problems: Roots of unity and cyclotomic polynomials- Cyclic extensions- Polynomials solvable by radicals- Ruler and Compass constructions. (Pages 340-364)

Text Books:

[1] Basic Abstract Algebra- S.K. Jain, P.B. Bhattacharya, S.R. Nagpaul.

Reference Book:

Topics in Algrbra
By
I. N. Herstein

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester II

AM –202T **Paper-II**

Advanced Real Analysis

Unit I

Algebra of sets- Borel sets- Outer measure- Measurable sets and Lebesgue measure- A non-measurable set- Measurable functions- Little word's three principles.

Unit II

The Rieman integral- The Lebesgue integral of a bounded function over a set of finite measure- The integral of a non-negative function- The general Lebesgue integral.

Unit III

Convergence in measure- Differentiation of a monotone functions- Functions of bounded variation.

Unit-IV

Differentiation of an integral- Absolute continuity- The L^p-spaces- The Minkowski and Holder's inequalities- Convergence and completeness.

Text Books:

[1] Real Analysis (3^{rd} Edition)
(Chapters 3, 4, 5)
by
H. L. Royden
Pearson Education (Low Price Edition)

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester II

AM –203T **Paper- III**

Advanced Complex Analysis

Unit I

Convergence of sequences and of series- Taylors series- Laurent's series- Absolute and uniform convergence of power series- Continuity of sums of power series- Uniqueness of series representation.

Unit II

Residues- Cauchy's residue theorem- Using a single residues the three types of isolated singular points- Residues at poles- Zeroes of analytic functions- Zeroes and poles- Behaviour of f near isolated singular points.

Unit III

Evaluation of improper integrals- Improper integrals from Fourier analysis- Jordan's lemma- Indented paths- Definite integrals involving sines and cosines- Argument principle- Rouche's theorem.

Unit-IV

Linear transformations- The transformation $w = \frac{1}{z}$ mappings by $w = \frac{1}{z}$, Linear fractional transformations- An implicit form- Mapping of the upper half plane- The transformation w = sin z, Mapping by z^2.

Text Books:

[1] Complex Variable and Application (8^{th} Edition)
by
James Ward Brown,
Ruel V.churchill
Mc Graw Hall Int. Edition.

Reference:

[1] Complex Analysis
by
Serge Lang
Springer- Varlag

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester-II

AM –204T **Paper- IV**

Fluid Mechanics

Unit I

General orthogonal curvilinear coordinates - Kinematics - Lagrangian and Eulerian methods - Equation of continuity - Boundary surface - Stream lines, Path lines and Streak lines - Velocity potential - Irrotational and rotational motions - Vortex lines

Unit II

Equation of motion - Lagrange's and Euler's equation of motion - Bernoulli's theorem - Stream functions - Irrotational motion in two-dimensions - Complex velocity potential sources – Sinks, doublets and their images - Milne-Thompson Circle theorem

Unit III

Two dimensional irrotational motion produced by motion of Circular, Co-axial and elliptic cylinders in an infinite mass of liquid - Theorem of Blasius motion of a sphere through a liquid at rest at infinity - Liquid streaming past a fixed sphere.

Unit IV

Stress components in a real fluid - Relation between rectangular components of stress - Connection between stresses and gradient of velocity - Navier-Stoke's equations of motion - Plane Poiseulle and couette flows between two parallel plates.

Text Books:

[1] W.H. Besaint and A.S.Ramsay, A Treatise on Hydromechanics, Part-II. CBS Publishers, Delhi, 1988.
[2] F.Chorlton, Text book of Fluid Dynamics, CBS Publishers, Delhi, 1985.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester-II

AM –205T **Paper- V**

Integral Transforms

UNIT –I
Laplace Transforms-Existence theorem-Laplace transforms of derivatives and integrals – shifting theorems- Transform of elementary functions-Inverse Transformations-Convolution theorem-Applications to ordinary and Partial differential equations.

UNIT-II
Fourier Transforms- Sine and cosine transforms-Inverse Fourier Transforms(Infinite and Finite Transforms)-Applications to ordinary and Partial differential equations .

UNIT-III
Hankel Transforms- Hankel Transform of the derivatives of a function.- Application of Hankel Transforms in boundary value problems-The finite Hankel Transofrm.

UNIT-IV
Mellin Transforms-The Mellin inversion theorem- some elementary properties of Mellin Transforms and Mellin Transfroms of derivatives – Mellin Integrals-Convolution Theorem.

Text Books:-

1). R.V.Churchill, “Operational Mathematics”.
2). A.R.Vasishta and R.K.Guptha, “Integral Transforms”

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester III

AM – 301T **Paper I**

Viscous Flows

Unit I

Motion of sphere through a liquid at rest - Liquid streaming past a fixed sphere - Equation of motion of a sphere - Vertex motion and its elementary properties - Kelvin's proof of permanence - Motions due to circular and rectilinear vortices.

Unit II

Stress components in a real fluid - Relations between rectangular components of stress - Connection between stresses and gradients of velocity - Navier-Stokes equations of motion.

Unit III

Plane poiseuille and Couette flows between two parallel plates - Flow through tube of uniform cross section in the form of circle, ellipse and equilateral triangle under constant pressure gradient - unsteady flows over a flat plate.

Unit IV

Dynamical similarity - Buckingham P-Theorem - Reynolds number - Prandtl's boundary layer. Boundary layer equations in two dimensions - Boundary layer thickness - Displacement thickness - Karman Integral conditions - Separation of boundary layer flow

Text Books:

[1] W.H.Besant and ,A.S.Ramsay, A Treatise on Hydromechanics Part-II, C.B.S. Publishers, Delhi, 1988.
[2] F.Cholton, Text Book of Fluid Dynamics, C.B.S. Publishers, Delhi, 1985.
[3] G.K.Batchelor, An Introduction to Fluid Mechanics, Foundation Books, New Delhi, 1994.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester III

AM – 302 T **Paper III**

Finite Difference Methods

Unit I
Partial differential Equations – Introduction - Difference method - Routh Hurwitz criterion - Domain of Dependence of Hyperbolic Equations. (1.1 to 1.4)

Unit II
Difference methods for parabolic partial differential equations - Introduction – One space dimension - two space dimensions - Spherical and cylindrical coordinate System.(2.1 to 2.3, 2.5)

Unit III
Difference methods for Hyperbolic partial differential equations - Introduction - one space dimensions - two space dimensions - First order equations.(3.1 to 3.4)

Unit IV
Numerical methods for elliptic partial differential equations – Introduction - Difference methods for linear boundary value problems - General second order linear equation - Equation in polar coordinates.(4.1 to 4.4)

Text Book:

[1] M. K. Jain, S. R. K. Iyengar, R. K. Jain,
Computational Methods for Partial Differential Equations, Wiley Eastern Limited, New Age International Limited, New Delhi.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester III

AM – 303 AT **Paper III**

Compressible Flows

Unit I

Thermodynamics and Physical properties of Gases: Introduction to equation of state - Perfect gas -First law of Thermodynamics - Second law of Thermodynamics and perfect gas mixture - Dessociation and Ionization - Real gases - Physical properties of gases.

Unit II

Fundamental equations of the aerodynamics of a compressible inviscid and non-heat conducting fluid - Equation of State - Equation of Continuity - Equation of motion - Equation of energy.

Unit III

Maxwell's thermodynamic relations – Kelvin's theorem - Two dimensional flow – Irrotational motion - Vortex motion - Helmholtz's theorem - Diabatic flow.

Unit IV

One dimensional flow of an inviscid compressible Fluid - Energy Equation - Velocity of sound and Mach number - Steady flow in a Nozzle - Pressure and velocity relations in isentropic flow - Non-steady one dimensional flow - Sound wave with finite amplitude - Formation of a Shock.

Text Books:

[1] S.I.Pai, Introduction to Theory of Compressible Flow, Van Nostrand Reinhold Company.

[2] F.Chorlton, Text Book of Fluid Dymunics, CBS Publications and Distributors, New Delhi.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)

Semester-III

AM – 303 BT **Paper-III**

Theory of Ordinary Differential Equations

UNIT-I

Linear differential equations of higher order: Introduction-Higher order equations- A Modelling problem -Linear Independence- Equations with constant coefficients- Equations with variable coefficients- Wronskian- Variation of parameters- Some standard methods.

UNIT-II

Existence and Uniqueness of solutions: Introduction – preliminaries – successive approximations – Picard's theorem – continuation and dependence on initial conditions – existence of solutions in the large – existence and uniqueness of solutions of systems – fixed point method.

UNIT-III

Analysis and methods of non-linear differential equations:-Introduction – Existence theorem- Extremal solutions – Upper and Lower solutions- Monotone iterative method and method of quasi linearization- Bihari's inequality.

UNIT-IV

Oscillation theory for linear Differential Equation of Second Order:- The adjoint equation- Self adjoint linear differential equation of second order- Abel's formula- the number of zeros in a finite interval- The sturm separation theorem- the sturm comparison theorem- the sturm picone theorem- The Bocher Osgood theorem- A special pair of solution- Oscillation on half axis.

Text Book :

1) Text book of Ordinary Differential Equations
by S.G. Deo, V. Lakshmikantham, V. Raghavendra

2) An Introduction to the Theory of Ordinary Differential Equations
by Walter Leighton

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester III

AM – 304 AT **Paper IV**

Operations Research

Unit I
Formulation of Linear Programming problems, Graphical solution of Linear Programming problem, General formulation of Linear Programming problems, Standard and Matrix forms of Linear Programming problems, Simplex Method, Two-phase method, Big-M method, Method to resolve degeneracy in Linear Programming problem, Alternative optimal solutions. Solution of simultaneous equations by simplex Method, Inverse of a Matrix by simplex Method, Concept of Duality in Linear Programming, Comparison of solutions of the Dual and its primal.

Unit II
Mathematical formulation of Assignment problem, Reduction theorem, Hungarian Assignment Method, Travelling salesman problem, Formulation of Travelling Salesman problem as an Assignment problem, Solution procedure.
Mathematical formulation of Transportation problem, Tabular representation, Methods to find initial basic feasible solution, North West corner rule, Lowest cost entry method, Vogel's approximation methods, Optimality test, Method of finding optimal solution, Degeneracy in transportation problem, Method to resolve degeneracy, Unbalanced transportation problem.

Unit III
Concept of Dynamic programming, Bellman's principle of optimality, characteristics of Dynamic programming problem, Backward and Forward recursive approach, Minimum path problem, Single Additive constraint and Multiplicatively separable return, Single Additive constraint and Additively separable return, Single Multiplicatively constraint and Additively separable return.

Unit-IV
Historical development of CPM/PERT Techniques - Basic steps - Network diagram representation - Rules for drawing networks - Forward pass and Backward pass computations - Determination of floats - Determination of critical path - Project evaluation and review techniques updating.

Text Books:
[1] S. D. Sharma, Operations Research.
[2] Kanti Swarup, P. K. Gupta and Manmohan, Operations Research.
[3] H. A. Taha, Operations Research – An Introduction.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester III

AM – 304 BT **Paper IV**

Numerical Techniques

Unit I

Transcendental and polynomial equations: Introduction, Bisection method, Iteration methods based on first degree equation; Secant method, Regulafalsi method, Newton-Raphson method, Iteration method based on second degree equation; Mullers method, Chebyshev method, Multipoint iterative method, Rate of convergence of secant method, Newton Raphson method,(Algorithms of above methods)

Unit II

System of linear algebraic equation: Direct methods, Guass elimination method, Triangularization method, Cholesky method, Partition method, Iteration method: Gauss seidel Iterative method, SOR method.

Unit III

Interpolation and Approximation: Introduction,Lagrange and Newton's divided difference interpolation,Finite difference operators, stirling and Bessel interpolation, Hermite interpolation,piecewise and Spline Interpolation,least square approximation.(Algorithms on Lagrange and Newton divided difference Interpolation).

Unit IV

Numerical Differentiation: methods based on Interpolation, methods based on Finite difference operators Numerical Integration: methods based on Interpolation, Newton's cotes methods, methods based on Undertermined coefficients, Guass legendre Integration method, Numerical methods ODE: Singlestep methods: Eulers method, Taylor series method, Rungekutte second and forth order methods, Multistep methods: Adam Bash forth method, Adam Moulton methods, Milne-Simpson method. (Algorithms on Trapezoidal, Simpson, Eulers & Runggekutte. methods only)

Text Book:

[1] Numerical Methods for Scientific and Engineering computation by M.K. Jain, S.R.K. Iyengar, R.K. Jain, New Age Int. Ltd., New Delhi.

[2] Computer Oriented Numerical Methods by V. Rajaraman.

Reference:

[1] Introduction to Numerical Analysis, by S.S. SastryPrentice Hall Flied.

Department of Mathematics
Osmania University
M.Sc (Applied Mathematics)

AM-304C
Paper-IV

DYNAMICAL SYSTEMS

Unit-1

Fixed Points and stability, population growth, Linear stability analysis, Existence and Uniqueness, Impossibility of oscillations.

Unit-2

Saddle- Node Bifurcation, Trans critical bifurcation, Pitchfork bifurcation, Over damped bead on a rotating hoop, Imperfect bifurcations and catastrophes.

Unit-3

Linear systems: Definitions and examples, Classification of linear systems, Love affairs.

Phase plane: phase portraits, Existence and uniqueness and topological consequences, Fixed points and linearization, Rabbits versus sheep, conservative systems, Reversible systems, Pendulum.

Unit-4

Limit cycles: Ruling out closed orbits, poin care Bendixson thermo, Lienard systems Relaxatin oscillators, Weakly, Non- linear oscillators.

Text Book:

Nonlinear Dynamics and Chaos, Steven H Stogatz, perseus Books Publishing, L.L.C.

Reference Book:

Chaos and Nonlinear Dynamics, Robert C Hilborn, Oxford University press.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)

Semester-III

AM – 305 AT **Paper-V**

Discrete Mathematics

Unit I

LATTICES: Partial Ordering – Lattices as Posets – some properties of Lattices – Lattices as Algebraic Systems – Sublattices, Direct products and Homomorphisms – some special Lattices – Complete, complemented and distributive lattices. (Pages 183-192, 378-397 of [1])

Unit II

BOOLEAN ALGEBRA: Boolean Algebras as Lattices – Bolean Identities – the switching Algebra – sub algebra, Direct product and homomorphism – Join irreducible elements – Atoms (minterms) – Boolean forms and their equivalence – minterm Boolean forms – Sum of products canonical forms – values of Boolean expressions and Boolean functions – Minimization of Boolean functions – the Karnaugh map method. (Pages 397 – 436 of [1])

Unit III

GRAPHS AND PLANAR GRAPHS : Directed and undirected graphs – Isomorphism of graphs – subgraph – complete graph – multigraphs and weighted graphs – paths – simple and elementary paths – circuits – connectedness – shortest paths in weighted graphs – Eulerian paths and circuits – Incoming degree and outgoing degree of a vertex - Hamiltonian paths and circuits – Planar graphs – Euler's formula for planar graphs. (Pages 137-159, 168-186 of [2])

Unit IV

TREES AND CUT-SETS: Properties of trees – Equivalent definitions of trees - Rooted trees – Binary trees – path lengths in rooted trees – Prefix codes – Binary search trees – Spanning trees and Cut-sets – Minimum spanning trees. (Pages 187-213 of [2])

Text Books:

[1] J P Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw Hill Book Company

[2] C L Liu, Elements of Discrete Mathematics, Tata McGraw Hill Publishing Company Ltd. New Delhi. (Second Edition).

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester III

AM – 305 BT **Paper V**

Integral Equations

Unit I

Basic concepts - Relationship between Linear differential equations and Volterra Integral equations - Resolvent Kernel of Volterra Integral equation. Differentiation of some resolvent kernels - Solution of Integral equation by resolvent kernel - The method of successive approximations - Convolution type equations.

Unit II

Solution of Integro-differential equations with the aid of the Laplace Transformation – VIE with limits (x,α), Volterra integral equation of the first kind -VIE of the first kind of the convolution type - Euler integrals - Beta and Gamma functions and their elementary properties - Relationship between Beta and Gamma functions - Abel's problem - Abel's integral equation and its generalizations. VIE of the first kind of the convolution type.

Unit III

Fredholm integral equations of the second kind - Fundamentals - Method of Fredholm Determinants-Iterated kernels constructing the resolvent kernel with the aid of iterated kernels - Integral equations with degenerated kernels - Hammerstein type equation - Characteristic numbers and Eigen functions and its properties. Solution of homogeneous equations with degenerated kernel. Non homogeneous symmetric equations.

Unit IV

Applications of integral equations to problems- Longitudinal vibrations of a rod, Deformation of a rod, Deformation of periodic solutions. - Green's function - Construction of Green's function for ordinary differential equations - Special case of Green's function - Using Green's function in the solution of boundary value problem – Boundary value problems containing a parameter- Reducing to integral equation- singular integral equations.

Text Book:

[1] M. Krasnov, A. Kiselev, G. Makarenko, Problems and Exercises in Integral Equations (1971)
[2] S. Swarup, Integral Equations (2008)

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester III

AM – 305 CT **Paper V**

Differential Geometry

Unit I

Curves with Torsion - Tangent, Principal normal curvature – Binormal, torsion - Serret - Frenet formulae - Examples thereon - Lines of centre of curvature - spherical curvature - Locus of centre of spherical curvature - Curve determined by its intrinsic equation - Helices Involutes - Evolutes and Betrand curves - Examples thereon.

Unit II

Envelops - Developable surfaces - Surfaces - Tangent plane - Normal - Envelop characteristics - Edge of regression - Developable surfaces - osculating developable - polar developable - Rectifying developable Envelopes - characterstic points - Examples thereon.

Unit III

Curvilinear coordinates on a surface - First order magnitudes - Directions on a surface - The normal - Second order magnitudes - Derivatives of $\bar{n}$ - curvature of normal section - Meunier's theorem - Examples thereon.

Unit IV

Curves on a surface - Principal directions and curvatures - First and Second curvatures Joachimsthal's theorem - Euler's theorem - The surface z=f(x,y) - Surface of revolution - Examples thereon.

(Art. 1-8, 10-31, 33, 34 Pages 10-28, 30-79 of [1])

Text Book:

[1] C.E .Weatherburn, Differential Geometry of Three Dimensions, (E.L.B.S.Edition,1964)

Reference Book:

[2] T.J.Willmore, An Introduction to Differential Geometry (Oxford University Press), 11th Edition, New Delhi,1993.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester IV

AM – 401T Paper-I

Functional Analysis

UNIT-I

Normed Space, Banach Space, further properties of normed spaces, Finite dimensional normed spaces and subspaces, compactness and finite dimension linear operators, Bounded and continuous linear operators, linear functionals, linear operators and functionals on finite dimensional spaces, normed spaces of operators, Dual spaces. (See Sections 2.2 to 2.10)

UNIT-II

Inner product space, Hilbert space, further properties of inner product spaces, orthogonal complements and direct sums, orthonormal sets and sequences, series related to orthonormal sequences and sets. (Sections 3.1 to 3.5)

UNIT-III

Total Orthonormal sets and sequences, Representation of functionals on Hilbert Spaces, Hilbert-adjoint operator, self-adjoint, unitary and normal operators.
(See Sections 3.6, 3.8, 3.9 and 3.10)

UNIT-IV

Hahn-Banach theorems for Complex vector spaces and normed spaces, adjoint operator, Reflexive spaces, uniform boundedness theorem, convergence of sequences of operators and Functionals. Open mapping theorem, closed graph theorem.
(See Sections 4.3, 4.5, 4.6, 4.7, 4.12 and 4.13).

Text Book:-Introductory Functional Analysis by E.Kreyszig, John-wiley and Sons, New York, 1978.

References Books:-

1).B.V.Limaye, "Functional Analysis", 2nd Edition
2).Brown and Page, "Elements of Functional Analysis"
3).P.K.Jain, O.P.Ahuja and Khalil Ahmed, "Functional Analysis".

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Applied Mathematics
Semester IV

AM – 402T

Paper -II

Finite Element Methods

Unit- I

Weighted residual methods: - Least square method - Partition method - Galerkin method - Moment method - Collocation method – Variational Methods: Ritz method. (one- dimensional only)

Unit -II

Finite Elements - Line segment elements - Triangular element - Rectangular elements with examples.

Unit- III

Finite Element Methods: Ritz finite element method - Least square finite element method - Galerkin finite element method - Boundary value problem in ordinam differential equations- Assembly of element equations- Boundary value problem in PDE-Linear tringular element- Mixed boundary conditions- Boundary points- Examples.

Unit-IV

Eigen value problems- Finite Element Error Analysis- Approximation Errors- Various measures of Errors- Convergence of solution- Accuracy of the solution- Examples. (5.1 to 5.4) of [2]

Text Books:

[1] M.K.Jain, Numerical Solution of Differential Equations.
New Age Int.(P).Ltd., New Delhi.(for Units I, II and III)
[2] J. N. Reddy, Finite Element Methods, McGraw-Hill International Edition, Engineering Mechanics Series. (for Unit IV)

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester IV

AM – 403 AT **Paper III**

Calculus of Variations

Unit I

Definitions of Functionals - Strong and Weak Variations - Derivations of Euler's' equation - Other forms of Euler's equation - Special cases – Examples - Fundamental Lemma of Calculus of Variation

Unit II

The problem of minimum surface of revolution - Minimum Energy Problem Brachistochrone Problem - Variational notation - Variational problems involving Several functions.

Unit III

Isoperimetric problem - Examples - Eulers's equations in two dependent variables variational problems in parametric form - Functional dependent on higher order derivatives. Euler Poisson equation.

Unit IV

Application of Calculus of Variation - Hamilton's principle - Lagrange's Equation, Hamilton's equations. Variational problems with movable boundaries- Simplest problem with movable boundaries- Examples there on- Problems with movable boundaries for functionals of the form $\int_{x_0}^{x_1} F\,(x,y,z,y^1,z^1)dx$ and $\int_{x_0}^{x_1} F\,(x,y,y^1,y^{11})dx$ – examples thereon.

Text Book:

[1] L. Elsgolts, Differential Equation and Calculus of Variations.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Applied Mathematics
Semester IV

AM – 403 BT Paper -III

Bio-Mechanics

Unit I

Introduction - Continuum Approach - Blood Flow in Heart, Lung, Arteries and Veins: Introduction - The geometry of the circulation system - Field equations and Boundary conditions - Coupling of Left Ventricle to Aorta and Right Ventricle to Pulmonary Artery - Pulsatile Flow in Arteries - Progressive Waves superposed on a Steady Flow - Reflection and Transmission of Waves at Junctions - Velocity profile of a steady flow in a Tube - Steady Laminar Flow in an Elastic Tube. Velocity Profile of Pulsatile flow. (1.1, 1.7, 5.1, 5.2, 5.4, 5.6 - 5.12 of [1])

Unit II

The Reynolds Number, Stokes Number, and Womersley Number - Equations of Balance of Energy and Work - Systemic Blood Pressure - Flow in a Collapsible Tubes – Micro and Macro Circulation: Introduction - Major Feature of Microcirculation - The Rheological Properties of Blood - Pulmonary Blood Flow - Waterfall Phenomenon in Zone 2- (5.13-5.17, 6.1,6.3, 6.4, 6.7-6.8 of [1])

Unit III

Respiratory Gas FIow: Introduction - Gas flow in the airway - Interaction between convection and diffusion - Exchange between Alveolar gas and Erythrocytes - Ventilation / Perfusion Ratio - Pulmonary Function Tests . (7.1 to 7.6 of [1])

Unit IV

Basic Transport Equations According to Thermodynamics - Molecular Diffusion,- Mechanisms in Membranes And Multiphasic Structure: Introduction - The laws of Thermodynamics - The Gibbs and Gibbs-Dhem Equations - Chemical Potential -Entropy in a system with Heat and Mass transfer - Diffusion, Filtration, and Fluid movement in Interstitial Space from the point of view of Thermodynamics - Diffusion from the Molecular Point of view (8.1-8.7)

Text Book:

[1] I.Y.C.Fung, Biomechanics, Springer-Verlag, New York Inc., 1990.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester IV

AM – 403 CT **Paper III**

Magneto Hydro Dynamics

Unit I

Electrodynamics: Magnetic induction - Biot and Savart Law - Lorentz force law -Magnetic scalar potential - Magnetic vector potential - Magnetization and Magnetization current - pointing vector.

Unit II

Energy in Electromagnetic potential fields produced by an arbitrary moving charged particle - Ferrarov's law of isorotation - Faraday's law - Ampere's law - Maxwell's equations.

Unit III

Magneto hydrodynamics: Basic equation of Viscous Magneto-Hydrodynamics - Alfven's theorem - Equations or incompressible MHD flow - parallel steady flow - One dimensional steady viscous flow Hartmann flow - couette flow - temperature distribution.

Unit IV

MHD approximations and equations - Equations under the MHD Approximation. Very high frequency phenomena - Magnetic transport - Bernoulli's equations and Kelvin's circulation theorem in MHD - The static MHD pinch.

Text Books :

[1] K.K.Chopra and G.O.Aggarwal, Electrodynamics.
[2] F. Chorlton, A Text book of Fluid Dynamics.
[3] Allan Joffrey, Magnetohydrodynamics.
[4] W.E. Huges and E. J. Young, The Electro Magneto Dynamics

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics with Computer Science
Semester IV

AM – 404 A **Paper IV**

Advanced Operations Research

Unit I

Characteristics of Game theory - Minimax (Maxmin) criterion and optimal strategy - Saddle points - Solution of Games with saddle points - Rectangular Games without saddle points - Minimax (Maxmin) principle for Mixed strategy Games - Equivalence of Rectangular Game and Linear Programming problem - Solution of (m x n) Games by Simplex method - Arithmetic method for (2 x2) Games - Concept of Dominance - Graphical method for (2 x n) and (m x 2) Games - Method of subgames - Matrix method for (3 x 3) Games without saddle point.

Unit II

Inventory Problems: Analytical Structure of inventory Problem, ABC analysis, EOQ Problems with and without shortages, with (a) production is instantaneous (b) finite constant rate (c) shortages permitted random models where the demand follows uniform distribution.

Unit III

Non-Linear programming - Unconstrained problems of Maxima and Minima - Constrained problems of Maxima and Minima - Constraints in the form of Equations – Lagrangian Method - Sufficient conditions for Max (Min) of Objective function with single equality constraint - With more than one equality constraints - Constraints in the form of inequalities - Formulation of Non-Linear programming problems - General Nonlinear programming problem - Canonical form - Graphical Solution

Unit IV

Quadratic Programming - Kuhn-Tucker Conditions - Non-negative constraints, General Quadratic Programming problem – Wolfe's modified simplex method - Beale's Method - Simplex method for Quadratic Programming.

Text Books:

[1] S.D. Sharma, Operations Research.
[2] Kanti Swarup, P.K.Gupta and Manmohan, Operations Research.
[3] O. L. Mangasarian, Non-Linear Programming,McGraw Hill, New Delhi.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)

Semester-III

AM – 404 AT **Paper-IV**

Mechanics of Solids

Unit I

Tensor Analysis: Introduction - Transformation of co-ordinates - Summation convention - Kronecker's delta – covariant and contravariant tensors - Second order tensors - Higher order tensors – Symmetric and skew-symmetric tensors -Fundamental operations with tensor - Conjugate tensors, metric and relative tensors - Associate tensors - Christoffel symbols.

Unit II

Deformation of Strain - Affine transformations - Infinitesimal affine deformations - Geometrical interpretation of the components of strain of first and second type - Strain Quadric of Cauchy - Principal strains and Invariants.

Unit III

General Infinitesimal deformation - Types of Strain uniform dilatation - Simple Extension - Shearing strain and plane strain of Strain Equations of Compatibility- Body and surface forces - Stress tensor - Equations of equilibrium - Transformation of coordinates - stress quadric of Cauchy.

Unit IV

Maximum Normal and shear stresses - Mohr's Diagram types of stress - Purely Normal stress - Simple tension - Shearing stress and plane stress - Hooke's Law - Generalised Hooke’s Law - Homogeneous Isotropic media - Elastic Moduli for isotropic media - simple tension - pure shear and Hydrostatic pressures.

Text Books:

[1] I.S.Sokolnikoff, Mathematical Theory of Elasticity, Tata McGraw Hill, 2nd Edition, New Delhi, 1978

[2] A.N.Srivastava, Tensor Calculus, University Press 1994.

[3] I.S.Sokolnikoff, Tensor Analysis Theory and Applications, John Wiley and Sons Inc., 1951

[4] P.D.S.Verma, Theory of Elasticity, Vikas Publishing House Pvt. Ltd., 1997

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester IV

AM – 404 BT **Paper IV**

OOPS through C++

Unit I

Object - oriented programming - Procedural oriented programming - OOP Terminology - Data Abstraction - Data Encapsulation - Objects, classes - Defining member functions - constructors -dynamic initialization of the objects - polymorphism - Function overloading, operator overloading

Unit II

Introduction to computer programming - Programming Fundamentals - Higher Level Language, Operating Systems, Compiling Programs, writing a program in C++ by usage of variables, Data types, Constants, Arithmetic Expression

Unit III

Programming using Control Structures - looping - for statement-while statement do statement - decision making - if statement - switch statement - conditional expression operator - Arrays-Initializing arrays, character arrays-Multi dimensional arrays

Unit IV

Inheritance: Defining derived classes-single and multiple inheritance, virtual base classes, abstract classes, runtime polymorphism and its implementation, virtual functions, dynamic binding. I/O - Console I/O operator in C++, Streams-stream classes - unformatted I/O operations. Exception handling - Templates-Functional Templates.

Text Book:

[1] E.Balaguruswamy : Introduction to C++ , Tata Mc Graw Hill

Reference Book:

[2] Venugopal, Ravishankar and Rajkumar : Mastering C++, Tata McGraw Hill

Department of Mathematics
Osmania University
M.Sc (Applied Mathematics)

AM-404C
Paper-IV

NON-LINEAR DYNAMICAL SYSTEMS

Unit-1

Lorenz equations: A chaotic water wheel, simple properties of the Lorenz equations, chaos on a strange attractor, Lorenz map, exploring parameter space, using chaos to send secret messages.

Unit-2

One- Dimensional Maps: Fixed points and cobwebs, logistic map: Numerics, logistic map: Analysis, periodic windows, liapunov exponent, universality and experiments, Renormalization.

Unit-3

Fractals: countable and uncountable sets, counter set, Dimension of self – similar fractals, Box dimension, point wose and correlation Dimensions.

Unit-4

Strange Attractors: the simplest examples, Henon map, Rossler system, chemical chaos and Attractor Reconstruction Forced Double- well oscillator.

Text Book: Nonlinear Dynamics and Chaos-Steven H. Strogatz (see back)

Ref: Book:

See back

DEPARTMENT OF MATHEMATICS
Osmania University
M.Sc. (Mathematics)
Semester-IV

CBAM-405 AT

Paper V

Elements of Information Technology

Unit – I:

Digital Age: Digital basis of Computers, Data/Information, Hardware Input, Output, Memory, Communication Hardware, Software, Application Software, System Software, Communications, and Five kinds of Computers, Development in communication Technology, Connectivity and Interactivity, Five Generations of Programming Languages, Programming Languages uses today, Object Oriented & Visual Programming.

Operating Systems: Booting, Managing Storage, Resources, Files tasks, Common Operating Systems: Windows 95/98, DOS, and Windows - NT

Unit – II:

Processors: The CPU and Main Memory, Data Representation, Micro Computer System Unit, Input & Output devices, Keyboard, Pointing devices, Source data entry devices, Soft copy output, Hardcopy output, more output devices, Diskettes, Hard – disks, Optical disks, Flash memory, Magnetic tape, Compression and Decompression.

Unit-III:

Telecommunications: Data, Video, Audio Communication, the Internet, the World Wide Web, new Internet technologies, Communication Channels, Networks, conduits of communication, Communication networks, Local networks, factors affecting communication among devices.

Unit-IV:

Files & Databases: Data storage hierarchy, File management, Files Management Systems, Database Management Systems, type of database organization, and features of a DBMS.

Application Software: Common features of software, Word processing, Spread sheet, software for Cyber space, Internet programming, HTML, XML, & Active X.

Suggested Reading:

1. Williams B.K. Sawyer et.al., "*Using Information Technology"*, Sixth Edition, Tata McGraw Hill, 2006.

Books:

1. Aksoy & DeNardis "*Introduction to Information Technology",* Cengage Learning, 2006.
2. Dennis P. Curtin & Kim Folley, et.al., *"Inforamtion Technology, The Braking Wave",* Tata McGraw Hill, 1998.
3. ITL Edn Solutions Ltd, *"Introducation to Inforamtion Technology",* Pearson Education, 2005.

DEPARTMENT OF MATHEMATICS
Osmania University
M.Sc. (Applied Mathematics)
Semester-IV

CBAM-405 B **Paper V**

Elements of Information Technology

Unit – I:

Digital Age: Digital basis of Computers, Data/Information, Hardware Input, Output, Memory, Communication Hardware, Software, Application Software, System Software, Communications, and Five kinds of Computers, Development in communication Technology, Connectivity and Interactivity, Five Generations of Programming Languages, Programming Languages uses today, Object Oriented & Visual Programming.

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Telecommunications: Data, Video, Audio Communication, the Internet, the World Wide Web, new Internet technologies, Communication Channels, Networks, conduits of communication, Communication networks, Local networks, factors affecting communication among devices.

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2. Dennis P. Curtin & Kim Folley, et.al., *"Inforamtion Technology, The Braking Wave",* Tata McGraw Hill, 1998.
3. ITL Edn Solutions Ltd*, "Introducation to Inforamtion Technology",* Pearson Education, 2005.

DEPARTMENT OF MATHEMATICS
Osmania University

M.Sc. (Mathematics)
Semester-IV

CBMCS-404 A

Paper IV

Elements of Information Technology

Unit – I:

Digital Age: Digital basis of Computers, Data/Information, Hardware Input, Output, Memory, Communication Hardware, Software, Application Software, System Software, Communications, and Five kinds of Computers, Development in communication Technology, Connectivity and Interactivity, Five Generations of Programming Languages, Programming Languages uses today, Object Oriented & Visual Programming.

Operating Systems: Booting, Managing Storage, Resources, Files tasks, Common Operating Systems: Windows 95/98, DOS, and Windows - NT

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Unit-III:

Telecommunications: Data, Video, Audio Communication, the Internet, the World Wide Web, new Internet technologies, Communication Channels, Networks, conduits of communication, Communication networks, Local networks, factors affecting communication among devices.

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Files & Databases: Data storage hierarchy, File management, Files Management Systems, Database Management Systems, type of database organization, and features of a DBMS.

Application Software: Common features of software, Word processing, Spread sheet, software for Cyber space, Internet programming, HTML, XML, & Active X.

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1. Williams B.K. Sawyer et.al., "*Using Information Technology"*, Sixth Edition, Tata McGraw Hill, 2006.

Books:

1. Aksoy & DeNardis "*Introduction to Information Technology",* Cengage Learning, 2006.
2. Dennis P. Curtin & Kim Folley, et.al., *"Inforamtion Technology, The Braking Wave",* Tata McGraw Hill, 1998.
3. ITL Edn Solutions Ltd, *"Introducation to Inforamtion Technology",* Pearson Education, 2005.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (APPLIED Mathematics)
Semester IV

CBAM405BT **Paper V**

Applicable Mathematics

Unit I

Differential Equations: Definition of differential equation, formation of differential equation, order and degree of differential equation, variable separable method for solving differential equations, definition of homogenous differential equations, homogeneous functions, general solution of homogenous equations, non- homogeneous equation of first degree in x and y , solution of differential equation of the form $Mdx + Ndy = 0$, solution of Exact differential equation, solution of non-exact differential equation.

Unit II

Numerical Methods: Introduction- Solution of algebraic and transcendental equations- Bisection Method- method of False Position- Newton-Raphson Method- Approximate Solution of Equations- Horner's Method- Solution of Linear Simultaneous Equations- Gauss Elimination Methods- Gauss Jordan Method- Factorisation Method.

Unit III

Sample spaces- Events- The concept of probability- The axioms of probability- Assignment of probabilities- Conditional probability- Theorems on conditional probability- Independent events- Baye's theorem.

Unit-IV

Linear Programming: Introduction: Formulation of linear programming problem, graphical solution of two variable problems, Graphical solution in some exceptional cases, general formulation of linear programming problem, slack and surplus variables, standard form of linear programming problem, matrix form of linear programming problem, simplex method.

Text Books:

[1] Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Publishing Company Ltd.

[2] Highen Engineering Mathematics by B.S. Grewal.

[3] Theory and problems of probability and Statistics, Schaums Outline McGraw Hill Company

[4] Operations Research by S.D Sharma

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc.(Applied Mathematics)
Semester IV

AM 451P (Practicals:**)**

OOPS through C++

1. Write a programme to find the GCD of two given integers.

2. Write a programme to generate the first fifty numbers of Fibonacci Sequence.

3. Write a programme for finding the Sum of two matrices A_{mxn} and B_{mxn}.

4. Write a function sub-programme to find the transpose of a given matrix A_{mxn} and call it in main programme.

5. Write a Programme for finding the product of two matrices A_{mxn} and B_{nxm},

6. Write a programme for finding the root of an equation using Regular- Falsi method.

7. Write a programme for finding the root of an equation using Newton - Raphson method

8. Write a programme for implementing Gauss - Elimination method

9. Write a programme to implement Trapezoidal Rule.

10. Write a programme to implement Simpsons 1/3 Rule

11. Write a programme to implement modified Euler's method.

12. Write a programme to implement Runge - Kutta method.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester I

MM –101 T **Paper-I**

Algebra

Unit I

Automaphisms- Conjugacy and G-sets- Normal series solvable groups- Nilpotent groups. (Pages 104 to 128 of [1])

Unit II

Structure theorems of groups: Direct product- Finitly generated abelian groups- Invariants of a finite abelian group- Sylow's theorems- Groups of orders p^2,pq . (Pages 138 to 155)

Unit III

Ideals and homomsphism- Sum and direct sum of ideals, Maximal and prime ideals- Nilpotent and nil ideals- Zorn's lemma (Pages 179 to 211).

Unit-IV

Unique factorization domains - Principal ideal domains- Euclidean domains- Polynomial rings over UFD- Rings of traction.(Pages 212 to 228)

Text Books:

[1] Basic Abstract Algebra by P.B. Bhattacharya, S.K. Jain and S.R. Nagpanl.

Reference:

[1] Topics in Algebra by I.N. Herstein.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester I

MM – 102T **Paper-II**

Real Analysis

Unit I

Metric spaces- Compact sets- Perfect sets- Connected sets

Unit II

Limits of functions- Continuous functions- Continuity and compactness Continuity and connectedness- Discontinuities – Monotone functions.

Unit III

Rieman- Steiltjes integral- Definition and Existence of the Integral- Properties of the integral- Integration of vector valued functions- Rectifiable waves.

Unit-IV

Sequences and series of functions: Uniform convergence- Uniform convergence and continuity- Uniform convergence and integration- Uniform convergence and differentiation- Approximation of a continuous function by a sequence of polynomials.

Text Books:

[1] Principles of Mathematical Analysis (3rd Edition)
(Chapters 2, 4, 6)
by
Mc Graw-Hill Internation Edition

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester I

MM –103 T Paper-III

Discrete Mathematics

UNIT- I

LATTICES: Partial Ordering – Lattices as Posets – some properties of Lattices – Lattices as Algebraic Systems – Sublattices, Direct products and Homomorphisms – some special Lattices – Complete, complemented and distributive lattices.
(Pages 183-192, 378-397 of [1])

UNIT- II

BOOLEAN ALGEBRA: Boolean Algebras as Lattices – Bolean Identities – the switching Algebra – sub algebra, Direct product and homomorphism – Join irreducible elements – Atoms (minterms) – Boolean forms and their equivalence – minterm Boolean forms – Sum of products canonical forms – values of Boolean expressions and Boolean functions – Minimization of Boolean functions – the Karnaugh map method.
(Pages 397 – 436 of [1])

UNIT- III

GRAPHS AND PLANAR GRAPHS **:** Directed and undirected graphs – Isomorphism of graphs – subgraph – complete graph – multigraphs and weighted graphs – paths – simple and elementary paths – circuits – connectedness – shortest paths in weighted graphs – Eulerian paths and circuits – Incoming degree and outgoing degree of a vertex - Hamiltonian paths and circuits – Planar graphs – Euler's formula for planar graphs.
(Pages 137-159, 168-186 of [2])

UNIT- IV

TREES AND CUT-SETS: Properties of trees – Equivalent definitions of trees - Rooted trees – Binary trees – path lengths in rooted trees – Prefix codes – Binary search trees – Spanning trees and Cut-sets – Minimum spanning trees
(Pages 187-213 of [2])

Text Books:-

[1] J P Tremblay and R. Manohar: Discrete Mathematical Structures with applications to Computer Science, McGraw Hill Book Company
[2] C L Liu : Elements of Discrete Mathematics, Tata McGraw Hill Publishing Company Ltd. New Delhi. (Second Edition).

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester I

MM 104 T **Paper-IV**

Elementary Number Theory

UNIT-I

The Fundamental Theorem of arithmetic**:** Divisibility, GCD, Prime Numbers, Fundamental theorem of Arithemtic, the series of reciprocal of the Primes, The Euclidean Algorithm.

UNIT-II

Arithmetic function and Dirichlet Multiplication, The functions $\phi(n)$, $\mu(n)$ and a relation connecting them, Product formulae for $\phi(n)$, Dirichlet Product, Dirichlet inverse and Mobius inversion formula and Mangoldt function $\Lambda(n)$, multiplication function, multiplication function and Dirichlet multiplication, Inverse of a completely multiplication function, Liouville's function $\lambda(n)$, the divisor function is $\sigma_\alpha(n)$

UNIT-III

Congruences, Properties of congruences, Residue Classes and complete residue system, linear congruences conversion, reduced residue system and Euler Fermat theorem, polynomial congruence modulo P, Lagrange's theorem, Application of Lagrange's theorem, Chinese remainder theorem and its application, polynomial congruences with prime power moduli

UNIT-IV

Quadratic residue and quadratic reciprocity law, Quadratic residues, Legendre's symbol and its properties, evaluation of (-1/p) and (2/p), Gauss Lemma, the quadratic reciprocity law and its applications.

Text Book:- Introduction to analytic Number Theory by Tom N. Apostol.
Chapters 1,2,5,9

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Mathematics)
Semester I

MM – 105 T **Paper- V**

Mathematical Methods

Unit I

Existence and Uniqueness of solution of $\frac{dy}{dx} = f(x,y)$. The method of successive approximation- Picard's theorem- Sturm-Liouville's boundary value problem.
Partial Differential Equations: Origins of first-order PDES-Linear equation of first-order-Lagrange's method of solving PDE of $P_p+Qq = R$ – Non-Linear PDE of order one-Charpit method- Linear PDES with constant coefficients.

Unit II

Partial Differential Equations of order two with variable coefficients- Canonical form Classification of second order PDE- separation of variable method solving the one-dimensional Heat equation and Wave equation- Laplace equation.

Unit III

Power Series solution of O.D.E. – Ordinary and Singular points- Series solution about an ordinary point -Series solution about Singular point-Frobenius Method.
Lagendre Polynomials: Lengendre's equation and its solution- Lengendre Polynomial and its properties- Generating function-Orthogonal properties- Recurrance relations- Laplace's definite integrals for $P_n(x)$- Rodrigue's formula.

Unit-IV
Bessels Functions: Bessel's equation and its solution- Bessel function of the first kind and its properties- Recurrence Relations- Generating function- Orthogonality properties.
Hermite Polynomials: Hermite's equation and its solution- Hermite polynomial and its properties- Generating function- Alternative expressions (Rodrigue's formula)- Orthogonality properties- Recurrence Relations.

Text Books:

[1] "Elements of Partial Differential Equations", By Ian Sneddon, Mc.Graw-Hill International Edition.
[2] "Text book of Ordinary Differential Equation", By S.G.Deo, V. Lakshmi Kantham, V. Raghavendra, Tata Mc.Graw Hill Pub. Company Ltd.
[3] "Ordinary and Partial Differential Equations", By M.D. Raisingania, S. Chand Company Ltd., New Delhi.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Mathematics)
Semester II

MM –201 T **Paper-I**

Advanced Algebra

Unit I

Algebraic extensions of fields: Irreducible polynomials and Eisenstein criterion- Adjunction of roots- Algebraic extensions-Algebraically closed fields (Pages 281 to 299)

Unit II

Normal and separable extensions: Splitting fields- Normal extensions- Multiple roots- Finite fields- Separable extensions (Pages 300 to 321)

Unit III

Galois theory: Automorphism groups and fixed fields- Fundamental theorem of Galois theory- Fundamental theorem of Algebra (Pages 322 to 339)

Unit-IV

Applications of Galoes theory to classical problems: Roots of unity and cyclotomic polynomials- Cyclic extensions- Polynomials solvable by radicals- Ruler and Compass constructions. (Pages 340-364)

Text Books:

[1] Basic Abstract Algebra- S.K. Jain, P.B. Bhattacharya, S.R. Nagpaul.

Reference Book:

Topics in Algrbra
By
I. N. Herstein

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester II

MM –202 T **Paper-II**

Advanced Real Analysis

Unit I

Algebra of sets- Borel sets- Outer measure- Measurable sets and Lebesgue measure- A non-measurable set- Measurable functions- Little word's three principles.

Unit II

The Rieman integral- The Lebesgue integral of a bounded function over a set of finite measure- The integral of a non-negative function- The general Lebesgue integral.

Unit III

Convergence in measure- Differentiation of a monotone functions- Functions of bounded variation.

Unit-IV

Differentiation of an integral- Absolute continuity- The L^p-spaces- The Minkowski and Holder's inequalities- Convergence and completeness.

Text Books:

[1] Real Analysis (3^{rd} Edition)
(Chapters 3, 4, 5)
by
H. L. Royden
Pearson Education (Low Price Edition)

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester II

MM –203 T Paper-III

Functional Analysis

UNIT-I

Normed Space, Banach Space, further properties of normed spaces, Finite dimensional normed spaces and subspaces, compactness and finite dimension linear operators, Bounded and continuous linear operators, linear functionals, linear operators and functionals on finite dimensional spaces, normed spaces of operators, Dual spaces.

(See Sections 2.2 to 2.10)

UNIT-II

Inner product space, Hilbert space, further properties of inner product spaces, orthogonal complements and direct sums, orthonormal sets and sequences, series related to orthonormal sequences and sets. (Sections 3.1 to 3.5)

UNIT-III

Total Orthonormal sets and sequences, Representation of functionals on Hilbert Spaces, Hilbert-adjoint operator, self-adjoint, unitary and normal operators.
(See Sections 3.6, 3.8, 3.9 and 3.10)

UNIT-IV

Hahn-Banach theorems for Complex vector spaces and normed spaces, adjoint operator, Reflexive spaces, uniform boundedness theorem, convergence of sequences of operators and Functionals. Open mapping theorem, closed graph theorem.
(See Sections 4.3, 4.5, 4.6, 4.7, 4.12 and 4.13).

Text Book:-Introductory Functional Analysis by E.Kreyszig, John-wiley and Sons, New York, 1978.

References Books:-

1).B.V.Limaye, "Functional Analysis", 2nd Edition
2).Brown and Page, "Elements of Functional Analysis"
3).P.K.Jain, O.P.Ahuja and Khalil Ahmed, "Functional Analysis".

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. – Mathematics

Semester-II

MM – 204 T **Paper-IV**

Theory of Ordinary Differential Equations

UNIT-I

Linear differential equations of higher order: Introduction-Higher order equations- A Modelling problem -Linear Independence- Equations with constant coefficients- Equations with variable coefficients- Wronskian- Variation of parameters- Some standard methods.

UNIT-II

Existence and Uniqueness of solutions: Introduction – preliminaries – successive approximations – Picard's theorem – continuation and dependence on initial conditions – existence of solutions in the large – existence and uniqueness of solutions of systems – fixed point method.

UNIT-III

Analysis and methods of non-linear differential equations:-Introduction – Existence theorem- Extremal solutions – Upper and Lower solutions- Monotone iterative method and method of quasi linearization- Bihari's inequality.

UNIT-IV

Oscillation theory for linear Differential Equation of Second Order:- The adjoint equation- Self adjoint linear differential equation of second order- Abel's formula- the number of zeros in a finite interval- The sturm separation theorem- the sturm comparison theorem- the sturm picone theorem- The Bocher Osgood theorem- A special pair of solution- Oscillation on half axis.

Text Book :

1) Text book of Ordinary Differential Equations

by S.G. Deo, V. Lakshmikantham, V. Raghavendra

3) An Introduction to the Theory of Ordinary Differential Equations
by Walter Leighton

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester-II

MM – 205 T **Paper- V**

Topology

UNIT I

Topological Spaces: The Definition and examples- Elementary concepts- Open bases and open subbases- Weak topologies.

UNIT II

Compactness: Compact spaces- Products of spaces- Tychonoff's theorem and locally compact spaces- Compactness for metric spaces- Ascoli's theorem.

UNIT III

Separation: T_1- spaces and Hausdorff spaces- Completely regular spaces and normal spaces- Urysohn's lemma and the Tietze extension theorem- The Urysohn imbedding theorem.

UNIT-IV

Connectedness: Connected spaces- The components of a spaces- Totally disconnected spaces- Locally connected spaces.

Text Books:

[1] Introduction to Topology and Modern Analysis (Chapters 3,4,5,6)
By
G.F. Simmon's
Tota Mc Graw Hill Edition

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester III

MM –301 T **Paper-I**

Complex Analysis

Unit I

Regions in the complex plane- Functions of a complex variable- Mappings by exponential functions- Limits- Continuity- Derivatives- Cauchy-Riemans equations- Sufficient conditions for differentiation- Polar coordinates.

Unit II

Analytic functions- Uniquely determined analytic functions- Reflection principle- The exponential function- The logarithmic function- Complex exponents- Trigonometric functions- Hyperbolic functions- Inverse trigonometric- Hyperbolic functions.

Unit III

Derivatives of functions w(t)- Definite integrals of functions w(t)- Contours- Contour integrals- Upper bounds for moduli of contour integrals- Anti derivatives.

Unit-IV

Cauchy-Goursat theorem and its proof- Simply and multiply connected domains- Cauchy's integral formula- Derivatives of analytic functions- Liouville's theorem and fundamental theorem of algebra- Maximum modulus principle.

Text Books:

[1] Complex Variable and Application (8^{th} Edition)
by
James Ward Brown,
Ruel V-churchill

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester-III

MM – 302 T **Paper-II**

Elementary Operator Theory

Unit I

Spectral theory in finite dimensional normed spaces - Basic concepts of spectrum - Resolvent sets - Spectral properties of bounded linear operators - Further properties of resolvent and spectrum. (Sections 7.1, 7.5)

Unit II

Compact linear operators on normed spaces - Properties of compact linear operators - Spectral properties of compact linear operators on normed spaces - Operator equations involving compact linear operators. (Sections 8.1, 8.2, 8.3 and 8.5 of [1])

Unit III

Spectral properties of bounded self adjoint linear operators - Further spectral properties of bounded linear operators - Positive operators - Square root of a positive operator. (Sections 9.1, 9.2, 9.3 and 9.4 of [1])

Unit IV

Projection operators - Properties of projection operators - Spectral family - Spectral family of a bounded self adjoint linear operator.
(Sections 9.5, 9.6, 9.7 and 9.8 of [1])

Text Book :

[1] E. Kreyszig : Introductory Functional Analysis, John Wiley and Sons, New York, 1978.

Reference Books:

[1] Brown and Page: Elements of Functional Analysis, D.V.N. Comp.
[2] B.V. Limaye : Functional Analysis, Wiley Eastern Limited, (2nd Edition)
[3] P.R.Halmos : A Hilbert Space Problem Book,
D.Van Nostrand Company, Inc. 1967.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester III

MM –303 AT **Paper-III**

Mechanics

Unit I

Dynamics of systems of Particles:- Introduction - Centre of Mass and Linear Momentum of a system- Angular momentum and Kinetic Energy of a system, Mechanics of Rigid bodies- Planar motion:- Centre of mass of Rigid body- some theorem of Static equilibrium of a Rigid body- Equilibrium in a uniform gravitational field- Rotation of a Rigid body about a fixed axis.

Unit II

Moment of Inertia:- calculation of moment of Inertia Perpendicular and Parallel axis theorem- Physical pendulum-A general theorem concerning Angular momentum-Laminar Motion of a Rigid body-Body rolling down an inclined plane (with and without slipping).

Unit III

Motion of Rigid bodies in three dimension-Angular momentum of Rigid body products of Inertia, Principles axes-Determination of principles axes-Rotational Kinetic Energy of Rigid body- Momentum of Inertia of a Rigid body about an arbitrary axis- The momental ellipsoid - Euler's equation of motion of a Rigid body.

Unit IV

Lagrange Mechanics:-Generalized Coordinates-Generalized forces-Lagrange's Equations and their applications-Generalized momentum-Ignorable coordinates-Hamilton's variational principle-Hamilton function-Hamilton's Equations- Problems-Theorems.

Text Book:

[1] G.R.Fowles, Analytical Mechanics, CBS Publishing, 1986.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester-III

MM – 303 BT **Paper-III**

Analytic Number Theory

Unit I

Averages of arithmetical function: The big oh notation- Asymptotic equality of functions- Euler summation formula- Some asymptotic formulas- The average order of d(n)- The average order of the divisor functions $\sigma\alpha(n)$- The average order of $\emptyset(n)$- An application to the distribution of lattice points visible trona the origin- The average order of $\mu(n)$ and $\Lambda(n)$- The partial sums of dirichlet product- Applications to $\mu(n)$ and $\Lambda(n)$- Another identity for the partial sums of a dirichlet product. (Sections3.1 to 3.12)

Unit II

Some elementary theorems on the distribution of prime numbers- Introduction chebyshev's functions- $\psi(x)$ and $\theta(x)$- Relation connecting $\theta(n)$and $\pi(n)$- Some equivalent forms of the prime number theorem- Inequalities for $\pi(n)$ and p_n. (Sections4.1 to 4.5)

Unit III

Shapiro's Tauberian theorem- Applications of shapiro's theorem An asymptotic formula for the partial sums $\sum_{p\le x} 1/p$ - The partial sums of the mobins function- Selberg Asymptotic formula. (Sections4.6 to 4.11 except 4.10)

Unit-IV

Finite Abelian groups and their character: Construction of sub groups- Characters of finite abelian group- The character group- The orthogonality relations for characters Dirichlet characters- Sums involving dirichelt characters the non vanishing of $L(1, \chi)$ for real non principal χ . (Sections 6.4 to 6.10)

Text Books:

[1] Tom M. Apostol- Introduction to Analytic Number Theory.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester IV

MM – 303 CT **Paper III**

Dynamical Systems

Unit I

Linear System: Uncoupled linear system- Diagonalization- Exponentials of Operators- the fundamental theorem for linear system- linear system in R^2 - Complex Eigen values- Multiple Eigen values.

Unit II

Jordan forms- stability theory- Non homogonous linear systems- Non linear system: local theory: Some preliminary concepts and definitions- The fundamental existence uniqueness theorem- Dependence on initial condition and parameters-The maximal interval of existence.

Unit III

The flow defined by a differential equation- linearization- the stable manifold theorem- the Hartman- Grobman theorem- Stability and Liapunov functions- saddles- nodes-Foci and centres.

Unit IV

Equation with Deviating arguments: Introduction- Equation with constant delay- equation with piecewise constant delay-A few other types of delay equations.

Text Books:

[1] Differential Equations and Dynamical System; by Lawrence perko, third Edition, Springer
[2] Text Book of Ordinary Differential Equations by S.G.Deo, V. Lakshmikantham and V. Raghavendra,

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester III

MM – 304 AT **Paper IV**

Operations Research

Unit I

Formulation of Linear Programming problems, Graphical solution of Linear Programming problem, General formulation of Linear Programming problems, Standard and Matrix forms of Linear Programming problems, Simplex Method, Two-phase method, Big-M method, Method to resolve degeneracy in Linear Programming problem, Alternative optimal solutions. Solution of simultaneous equations by simplex Method, Inverse of a Matrix by simplex Method, Concept of Duality in Linear Programming, Comparison of solutions of the Dual and its primal.

Unit II

Mathematical formulation of Assignment problem, Reduction theorem, Hungarian Assignment Method, Travelling salesman problem, Formulation of Travelling Salesman problem as an Assignment problem, Solution procedure.
Mathematical formulation of Transportation problem, Tabular representation, Methods to find initial basic feasible solution, North West corner rule, Lowest cost entry method, Vogel's approximation methods, Optimality test, Method of finding optimal solution, Degeneracy in transportation problem, Method to resolve degeneracy, Unbalanced transportation problem.

Unit III

Concept of Dynamic programming, Bellman's principle of optimality, characteristics of Dynamic programming problem, Backward and Forward recursive approach, Minimum path problem, Single Additive constraint and Multiplicatively separable return, Single Additive constraint and Additively separable return, Single Multiplicatively constraint and Additively separable return.

Unit-IV

Historical development of CPM/PERT Techniques - Basic steps - Network diagram representation - Rules for drawing networks - Forward pass and

Backward pass computations - Determination of floats - Determination of critical path - Project evaluation and review techniques updating.

Text Books:

[1] S. D. Sharma, Operations Research.

[2] Kanti Swarup, P. K. Gupta and Manmohan, Operations Research.

[3] H. A. Taha, Operations Research – An Introduction.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Mathematics)
Semester III

MM – 304 BT **Paper IV**

Numerical Techniques

Unit I

Transcendental and polynomial equations: Introduction, Bisection method, Iteration methods based on first degree equation; Secant method, Regulafalsi method, Newton-Raphson method, Iteration method based on second degree equation; Mullers method, Chebyshev method, Multipoint iterative method, Rate of convergence of secant method, Newton Raphson method,(Algorithms of above methods)

Unit II

System of linear algebraic equation: Direct methods, Guass elimination method, Triangularization method, Cholesky method, Partition method, Iteration method: Gauss seidel Iterative method, SOR method.

Unit III

Interpolation and Approximation: Introduction,Lagrange and Newton's divided difference interpolation,Finite difference operators, stirling and Bessel interpolation, Hermite interpolation,piecewise and Spline Interpolation,least square approximation.(Algorithms on Lagrange and Newton divided difference Interpolation).

Unit IV

Numerical Differentiation: methods based on Interpolation, methods based on Finite difference operators Numerical Integration: methods based on Interpolation, Newton's cotes methods, methods based on Undertermined coefficients, Guass legendre Integration method, Numerical methods ODE: Singlestep methods: Eulers method, Taylor series method, Rungekutte second and forth order methods, Multistep methods: Adam Bash forth method, Adam Moulton methods, Milne-Simpson method. (Algorithms on Trapezoidal, Simpson, Eulers & Runggekutte. methods only)

Text Book:

[1] Numerical Methods for Scientific and Engineering computation by M.K. Jain, S.R.K. Iyengar, R.K. Jain, New Age Int. Ltd., New Delhi.

[2] Computer Oriented Numerical Methods by V. Rajaraman.

Reference:

[1] Introduction to Numerical Analysis, by S.S. SastryPrentice Hall Flied.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Mathematics)
Semester III

MM – 304 CT **Paper IV**

Graph Theory

Unit I

Graphs, introduction- Finite and infinite graphs, Incidence and degree, Null graph, isolated and pendent vertices.

Paths and circuits- Isomorphism, Subgraphs- Walks, paths and circuits- Connected and disconnected graphs, components- Euler graphs- Operations on graphs- Hamiltonian paths and circuits-Travelling salesman problem.

Unit II

Trees- Their properties- pendent Vertex in a tree- Distance and centers in a tree- Rooted and binary Trees- Counting trees- Spanning trees. Fundamental circuits- Finding all spanning trees of a graph- spanning trees in a weighted graph.

Cut sets- properties- All cut sets in a graph- Fundamental Circuits and cutsets.

Unit III

Planar and Dual graphs- Combinatorial Vs Geometric graphs- Planar graphs- Kuratowski two graphs- Different representations of a planar graph- Detection of planarity- Geometric and combinatorial duals Criteria of planarity- Thickness and crossings.

Vector spaces of a graphs- Vector space Associated with a graph- Basis vector of a graph- circuit and cut set subspaces- Intersection and join of W and W_s.

Unit IV

Matrix representation of graphs- Incidence matrices, sub matrix of A(G)- circuit matrix- Fundamental circuit matrix and rank of B- An application of switching network- cut set matrix- Relations among A_f, B_f and C_f- pathmatrix and Adgacency matrix- Para coloring, covering and partitioning- Chromatic number, Chromatic Partitioncing-Chromatic polynomial- matchings- covering and the four colour problem (and its present status.)

Text Book:

[1] Narsing Deo, Graph Theory with application to Engineering and computer science, Prentice Hall of India.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester III

MM – 305 AT **Paper V**

Algebraic Number Theory

Unit I

The Gaussian integers – Introduction – The Fundamental theorem of arithmetic in the Gaussian integers - The two square problems.

Unit II

Arithmetic in quadratic fields – Introduction - Quadratic fields - The integers of a quadratic field - Binary quadratic forms - Modules

Unit III

The coefficient ring of a module - The Unit theorem - Factorization theory in quadratic field - The failure of unique factorization.

Unit IV

Generalized congruences and norm of a module - Product and Sum of modules - The Fundamental factorization theorem.

Text Book:

[1] William W. Adam, Lory Joel Goldstein, Introduction to Number Theory. (Sections: 7.1 to 7.3, 8.1 to 8.7, 9.1 to 9.4)

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Mathematics)
Semester III

MM – 305 BT **Paper V**

Integral Equations

Unit I

Basic concepts - Relationship between Linear differential equations and Volterra Integral equations - Resolvent Kernel of Volterra Integral equation. Differentiation of some resolvent kernels - Solution of Integral equation by resolvent kernel - The method of successive approximations - Convolution type equations.

Unit II

Solution of Integro-differential equations with the aid of the Laplace Transformation – VIE with limits (x,α), Volterra integral equation of the first kind -VIE of the first kind of the convolution type - Euler integrals - Beta and Gamma functions and their elementary properties - Relationship between Beta and Gamma functions - Abel's problem - Abel's integral equation and its generalizations. VIE of the first kind of the convolution type.

Unit III

Fredholm integral equations of the second kind - Fundamentals - Method of Fredholm Determinants-Iterated kernels constructing the resolvent kernel with the aid of iterated kernels - Integral equations with degenerated kernels - Hammerstein type equation - Characteristic numbers and Eigen functions and its properties. Solution of homogeneous equations with degenerated kernel. Non homogeneous symmetric equations.

Unit IV

Applications of integral equations to problems- Longitudinal vibrations of a rod, Deformation of a rod, Deformation of periodic solutions. - Green's function - Construction of Green's function for ordinary differential equations - Special case of Green's function - Using Green's function in the solution of boundary value problem – Boundary value problems containing a parameter- Reducing to integral equation- singular integral equations.

Text Book:

[1] M. Krasnov, A. Kiselev, G. Makarenko, Problems and Exercises in Integral Equations (1971)
[2] S. Swarup, Integral Equations (2008)

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester III

AM – 305 CT **Paper V**

Differential Geometry

Unit I

Curves with Torsion - Tangent, Principal normal curvature – Binormal, torsion - Serret - Frenet formulae - Examples thereon - Lines of centre of curvature - spherical curvature - Locus of centre of spherical curvature - Curve determined by its intrinsic equation - Helices Involutes - Evolutes and Betrand curves - Examples thereon.

Unit II

Envelops - Developable surfaces - Surfaces - Tangent plane - Normal - Envelop characteristics - Edge of regression - Developable surfaces - osculating developable - polar developable - Rectifying developable Envelopes - characterstic points - Examples thereon.

Unit III

Curvilinear coordinates on a surface - First order magnitudes - Directions on a surface - The normal - Second order magnitudes - Derivatives of $\vec{n}$ - curvature of normal section - Meunier's theorem - Examples thereon.

Unit IV

Curves on a surface - Principal directions and curvatures - First and Second curvatures Joachimsthal's theorem - Euler's theorem - The surface z=f(x,y) - Surface of revolution - Examples thereon.

(Art. 1-8, 10-31, 33, 34 Pages 10-28, 30-79 of [1])

Text Book:

[1] C.E .Weatherburn, Differential Geometry of Three Dimensions, (E.L.B.S.Edition,1964)

Reference Book:

[2] T.J.Willmore, An Introduction to Differential Geometry (Oxford University Press), 11th Edition, New Delhi,1993.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester IV

MM – 401T **Paper- I**

Advanced Complex Analysis

Unit I

Convergence of sequences and of series- Taylors series- Laurent's series- Absolute and uniform convergence of power series- Continuity of sums of power series- Uniqueness of series representation.

Unit II

Residues- Cauchy's residue theorem- Using a single residues the three types of isolated singular points- Residues at poles- Zeroes of analytic functions- Zeroes and poles- Behaviour of f near isolated singular points.

Unit III

Evaluation of improper integrals- Improper integrals from Fourier analysis- Jordan's lemma- Indented paths- Definite integrals involving sines and cosines- Argument principle- Rouche's theorem.

Unit-IV

Linear transformations- The transformation $w = \frac{1}{z}$ mappings by $w = \frac{1}{z}$, Linear fractional transformations- An implicit form- Mapping of the upper half plane- The transformation $w = \sin z$, Mapping by z^2.

Text Books:

[1] Complex Variable and Application (8^{th} Edition)
by
James Ward Brown,
Ruel V.churchill
Mc Graw Hall Int. Edition.

Reference:

[1] Complex Analysis
by
Serge Lang
Springer- Varlag

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester-IV

MM – 402 T **Paper- II**

General Measure Theory

Unit I

Measure spaces- Measurable functions- Integration- General Convergence theorem.

Unit II

Signed measures- The Radon- Nikodym theorem.

Unit III

Outer measure and measurability- The Extension theorem- The Product measure.

Unit-IV

Inner measure- Extension by sets of measure zero- Caratheodory outer measure

Text Books:

[1] Real Analysis (Chapters 11, 12)
by
H.L. Royden
Pearson Ediation.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester-IV

MM – 403 AT **Paper- III**

Fluid Mechanics

Unit I

General orthogonal curvilinear coordinates - Kinematics - Lagrangian and Eulerian methods - Equation of continuity - Boundary surface - Stream lines, Path lines and Streak lines - Velocity potential - Irrotational and rotational motions - Vortex lines

Unit II

Equation of motion - Lagrange's and Euler's equation of motion - Bernoulli's theorem - Stream functions - Irrotational motion in two-dimensions - Complex velocity potential sources – Sinks, doublets and their images - Milne-Thompson Circle theorem

Unit III

Two dimensional irrotational motion produced by motion of Circular, Co-axial and elliptic cylinders in an infinite mass of liquid - Theorem of Blasius motion of a sphere through a liquid at rest at infinity - Liquid streaming past a fixed sphere.

Unit IV

Stress components in a real fluid - Relation between rectangular components of stress - Connection between stresses and gradient of velocity - Navier-Stoke's equations of motion - Plane Poiseulle and couette flows between two parallel plates.

Text Books:

[1] W.H. Besaint and A.S.Ramsay, A Treatise on Hydromechanics, Part-II. CBS Publishers, Delhi, 1988.
[2] F.Chorlton, Text book of Fluid Dynamics, CBS Publishers, Delhi, 1985.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester IV

MM – 403 C **Paper III**

Prime Number Theory

Unit I
Dirichlet theorem as primes in an arithmetic progression - primes of the form 4n-l, 4n+1 - Dirichlet of primes in arithmetic progression - Dirichlet series and Euler products - the half plane of convergence of a Dirichlet series - function defined by a Dirichlet series - Multiplication of Dirichlet series - Euler products - the half plane of convergence of a Dirichlet series.

Unit II
Analytic properties of Dirichlet series - Dirichlet series with non negative coefficients - Dirichlet series expressed as exponentials of Dirichlet series - Mean value simule for Dirichlet series - on integral principle for the coefficients of a Dirichlet series and for the partial sum of a Dirichlet series.

Unit III
The function $\zeta(s)$ and $L(s, \chi)$ - integral representation for the Hurwitz function - a contour integral representation for the Hurwitz zeta function - Analytic continuation of the Hurwitz zeta function - analytic continuation of $\zeta(s)$ and $L(s, \chi)$ - Hurwitz formulae for $\zeta(s, a)$ for functional equation for the Riemann Zeta function and Hurwitz zeta function.

Unit IV
Analytic proof of the prime number theorem - plan of the proof - two lemmas proving $[\psi_1(x)]/x^2$ implies prime number theorem - a contour integral representation for $[\psi_1(x)]/x^2$ - upper bounds for $|\zeta(s)|$ and $|\zeta'(s)|$ near the line $\sigma=1$ - the non vanishing of $\zeta(s)$ on the line $\sigma=1$ - inequalities for $|1/\zeta(s)|$ and $\left|\frac{\zeta'(s)}{\zeta(s)}\right|$ - completion of the proof of prime number theorem.

Scope as in Chapters: 7, 11, 12, 13 of [1]

Text Book:

[1] Tom. M. Apostol, Introduction to Analytic Number Theory, Springer International Student Edition.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Applied Mathematics)
Semester IV

MM – 404 AT **Paper IV**

Calculus of Variations

Unit I

Definitions of Functionals - Strong and Weak Variations - Derivations of Euler's' equation - Other forms of Euler's equation - Special cases – Examples - Fundamental Lemma of Calculus of Variation

Unit II

The problem of minimum surface of revolution - Minimum Energy Problem Brachistochrone Problem - Variational notation - Variational problems involving Several functions.

Unit III

Isoperimetric problem - Examples - Eulers's equations in two dependent variables variational problems in parametric form - Functional dependent on higher order derivatives. Euler Poisson equation.

Unit IV

Application of Calculus of Variation - Hamilton's principle - Lagrange's Equation, Hamilton's equations. Variational problems with movable boundaries- Simplest problem with movable boundaries- Examples there on- Problems with movable boundaries for functionals of the form $\int_{x_0}^{x_1} F\,(x,y,z,y^1,z^1)dx$ and $\int_{x_0}^{x_1} F\,(x,y,y^1,y^{11})dx$ – examples thereon.

Text Book:

[1] L. Elsgolts, Differential Equation and Calculus of Variations.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester IV

MM – 404 BT **Paper IV**

OOPS through C++

Unit I

Object - oriented programming - Procedural oriented programming - OOP Terminology - Data Abstraction - Data Encapsulation - Objects, classes - Defining member functions - constructors -dynamic initialization of the objects - polymorphism - Function overloading, operator overloading

Unit II

Introduction to computer programming - Programming Fundamentals - Higher Level Language, Operating Systems, Compiling Programs, writing a program in C++ by usage of variables, Data types, Constants, Arithmetic Expression

Unit III

Programming using Control Structures - looping - for statement-while statement do statement - decision making - if statement - switch statement - conditional expression operator - Arrays-Initializing arrays, character arrays-Multi dimensional arrays

Unit IV

Inheritance: Defining derived classes-single and multiple inheritance, virtual base classes, abstract classes, runtime polymorphism and its implementation, virtual functions, dynamic binding. I/O - Console I/O operator in C++, Streams-stream classes - unformatted I/O operations. Exception handling - Templates-Functional Templates.

Text Book:

[1] E.Balaguruswamy : Introduction to C++ , Tata Mc Graw Hill

Reference Book:

[2] Venugopal, Ravishankar and Rajkumar : Mastering C++, Tata McGraw Hill

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester IV

MM – 404 CT **Paper IV**

Banach Algebra

Unit I

Definition of Banach Algebra and examples- Invertib1lity in a Banach Algebra with unity- singular and non-singular elements- Resolvent and spectrum of an element- the spectral radius- Gelfand formula.(Sections 49, 50, 51 and 55 of Ch.6)

Unit II

Multiplicative linear functionals and the maxima1 ideal space- the Gelfand Transforms (i.e.:section:Gelfand representation theorem)- the spectral mapping theorem- isometric Gelfand Transform- Topological divisors of zero- boundary
of the spectrum- spectrum in L (E).(Sections: 52, 53, 56 and 57 of Ch. 6)

Unit III

Definition and examples of C-algebra - Self adjoint, unitary, normal, positive elements in C – homomorphisms - representation of commutative algebras, states onC-algebras.(Sections: 58, 59, 60 and 61 of Ch. 7)

Unit IV

Gelfand Newmark representation theorem - the spectral theorem - the continuous functional calculus - spectral sets. (Sections: 62 of Ch. 7 and 65, 66 of Ch. 8)

Text Book:

[1] S.K.Berberian, Lectures in Functional Analysis and Operator Theory, Springer International student Ed.

Reference Books:

[2] Keue Zhu, An Introduction to Operator Algebras, CRC Press, 1963.
[3] T.W.Palmea, Banach Algebra, Vol- 1, Cambridge University Press, 1994.

DEPARTMENT OF MATHEMATICS
Osmania University
M.Sc. (Mathematics)
Semester-IV

CBMM-405 AT

Paper V

Elements of Information Technology

Unit – I:

Digital Age: Digital basis of Computers, Data/Information, Hardware Input, Output, Memory, Communication Hardware, Software, Application Software, System Software, Communications, and Five kinds of Computers, Development in communication Technology, Connectivity and Interactivity, Five Generations of Programming Languages, Programming Languages uses today, Object Oriented & Visual Programming.

Operating Systems: Booting, Managing Storage, Resources, Files tasks, Common Operating Systems: Windows 95/98, DOS, and Windows - NT

Unit – II:

Processors: The CPU and Main Memory, Data Representation, Micro Computer System Unit, Input & Output devices, Keyboard, Pointing devices, Source data entry devices, Soft copy output, Hardcopy output, more output devices, Diskettes, Hard – disks, Optical disks, Flash memory, Magnetic tape, Compression and Decompression.

Unit-III:

Telecommunications: Data, Video, Audio Communication, the Internet, the World Wide Web, new Internet technologies, Communication Channels, Networks, conduits of communication, Communication networks, Local networks, factors affecting communication among devices.

Unit-IV:

Files & Databases: Data storage hierarchy, File management, Files Management Systems, Database Management Systems, type of database organization, and features of a DBMS.

Application Software: Common features of software, Word processing, Spread sheet, software for Cyber space, Internet programming, HTML, XML, & Active X.

Suggested Reading:

2. Williams B.K. Sawyer et.al., "*Using Information Technology"*, Sixth Edition, Tata McGraw Hill, 2006.

Books:

4. Aksoy & DeNardis "*Introduction to Information Technology"*, Cengage Learning, 2006.
5. Dennis P. Curtin & Kim Folley, et.al., *"Inforamtion Technology, The Braking Wave",* Tata McGraw Hill, 1998.
6. ITL Edn Solutions Ltd, *"Introducation to Inforamtion Technology",* Pearson Education, 2005.

DEPARTMENT OF MATHEMATICS

Osmania University

M.Sc. (Applied Mathematics)

Semester-IV

CBAM-405 B **Paper V**

Elements of Information Technology

Unit – I:

Digital Age: Digital basis of Computers, Data/Information, Hardware Input, Output, Memory, Communication Hardware, Software, Application Software, System Software, Communications, and Five kinds of Computers, Development in communication Technology, Connectivity and Interactivity, Five Generations of Programming Languages, Programming Languages uses today, Object Oriented & Visual Programming.

Operating Systems: Booting, Managing Storage, Resources, Files tasks, Common Operating Systems: Windows 95/98, DOS, and Windows - NT

Unit – II:

Processors: The CPU and Main Memory, Data Representation, Micro Computer System Unit, Input & Output devices, Keyboard, Pointing devices, Source data entry devices, Soft copy output, Hardcopy output, more output devices, Diskettes, Hard – disks, Optical disks, Flash memory, Magnetic tape, Compression and Decompression.

Unit-III:

Telecommunications: Data, Video, Audio Communication, the Internet, the World Wide Web, new Internet technologies, Communication Channels, Networks, conduits of communication, Communication networks, Local networks, factors affecting communication among devices.

Unit-IV:

Files & Databases: Data storage hierarchy, File management, Files Management Systems, Database Management Systems, type of database organization, and features of a DBMS.

Application Software: Common features of software, Word processing, Spread sheet, software for Cyber space, Internet programming, HTML, XML, & Active X.

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1. Williams B.K. Sawyer et.al., "*Using Information Technology"*, Sixth Edition, Tata McGraw Hill, 2006.

Books:

4. Aksoy & DeNardis "*Introduction to Information Technology"*, Cengage Learning, 2006.

5. Dennis P. Curtin & Kim Folley, et.al., *"Inforamtion Technology, The Braking Wave"*, Tata McGraw Hill, 1998.
6. ITL Edn Solutions Ltd, *"Introducation to Inforamtion Technology"*, Pearson Education, 2005.

DEPARTMENT OF MATHEMATICS
Osmania University
M.Sc. (Mathematics)
Semester-IV

CBMCS-404 A
Paper IV

Elements of Information Technology

Unit – I:

Digital Age: Digital basis of Computers, Data/Information, Hardware Input, Output, Memory, Communication Hardware, Software, Application Software, System Software, Communications, and Five kinds of Computers, Development in communication Technology, Connectivity and Interactivity, Five Generations of Programming Languages, Programming Languages uses today, Object Oriented & Visual Programming.

Operating Systems: Booting, Managing Storage, Resources, Files tasks, Common Operating Systems: Windows 95/98, DOS, and Windows - NT

Unit – II:

Processors: The CPU and Main Memory, Data Representation, Micro Computer System Unit, Input & Output devices, Keyboard, Pointing devices, Source data entry devices, Soft copy output, Hardcopy output, more output devices, Diskettes, Hard – disks, Optical disks, Flash memory, Magnetic tape, Compression and Decompression.

Unit-III:

Telecommunications: Data, Video, Audio Communication, the Internet, the World Wide Web, new Internet technologies, Communication Channels, Networks, conduits of communication, Communication networks, Local networks, factors affecting communication among devices.

Unit-IV:

Files & Databases: Data storage hierarchy, File management, Files Management Systems, Database Management Systems, type of database organization, and features of a DBMS.

Application Software: Common features of software, Word processing, Spread sheet, software for Cyber space, Internet programming, HTML, XML, & Active X.

Suggested Reading:

1. Williams B.K. Sawyer et.al., "*Using Information Technology"*, Sixth Edition, Tata McGraw Hill, 2006.

Books:

4. Aksoy & DeNardis "*Introduction to Information Technology"*, Cengage Learning, 2006.

5. Dennis P. Curtin & Kim Folley, et.al., *"Inforamtion Technology, The Braking Wave"*, Tata McGraw Hill, 1998.
6. ITL Edn Solutions Ltd, *"Introducation to Inforamtion Technology"*, Pearson Education, 2005.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (APPLIED Mathematics)
Semester IV

CBAM405BT **Paper V**

Applicable Mathematics

Unit I

Differential Equations: Definition of differential equation, formation of differential equation, order and degree of differential equation, variable separable method for solving differential equations, definition of homogenous differential equations, homogeneous functions, general solution of homogenous equations, non- homogeneous equation of first degree in x and y , solution of differential equation of the form Mdx + Ndy = 0, solution of Exact differential equation, solution of non-exact differential equation.

Unit II

Numerical Methods: Introduction- Solution of algebraic and transcendental equations- Bisection Method- method of False Position- Newton-Raphson Method- Approximate Solution of Equations- Horner's Method- Solution of Linear Simultaneous Equations- Gauss Elimination Methods- Gauss Jordan Method- Factorisation Method.

Unit III

Sample spaces- Events- The concept of probability- The axioms of probability- Assignment of probabilities- Conditional probability- Theorems on conditional probability- Independent events- Baye's theorem.

Unit-IV

Linear Programming: Introduction: Formulation of linear programming problem, graphical solution of two variable problems, Graphical solution in some exceptional cases, general formulation of linear programming problem, slack and surplus variables, standard form of linear programming problem, matrix form of linear programming problem, simplex method.

Text Books:

[1] Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Publishing Company Ltd.
[2] Highen Engineering Mathematics by B.S. Grewal.
[3] Theory and problems of probability and Statistics, Schaums Outline McGraw Hill Company

[4] Operations Research by S.D Sharma

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics
Semester IV

MM – 451P (Practicals:**)**

OOPS through C++

1. Write a programme to find the GCD of two given integers.

2. Write a programme to generate the first fifty numbers of Fibonacci Sequence.

3. Write a programme for finding the Sum of two matrices A_{mxn} and B_{mxn}.

4. Write a function sub-programme to find the transpose of a given matrix A_{mxn} and call it in main programme.

5. Write a Programme for finding the product of two matrices A_{mxn} and B_{nxm},

6. Write a programme for finding the root of an equation using Regular- Falsi method.

7. Write a programme for finding the root of an equation using Newton - Raphson method

8. Write a programme for implementing Gauss - Elimination method

9. Write a programme to implement Trapezoidal Rule.

10. Write a programme to implement Simpsons 1/3 Rule

11. Write a programme to implement modified Euler's method.

12. Write a programme to implement Runge - Kutta method.

DEPARTMENT OF MATHEMATICS
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M.Sc. Mathematics with Computer Science
Semester I

MCS –101T **Paper-I**

Algebra

Unit I

Automaphisms- Conjugacy and G-sets- Normal series solvable groups- Nilpotent groups. (Pages 104 to 128 of [1])

Unit II

Structure theorems of groups: Direct product- Finitly generated abelian groups- Invariants of a finite abelian group- Sylow's theorems- Groups of orders p^2,pq . (Pages 138 to 155)

Unit III

Ideals and homomsphism- Sum and direct sum of ideals, Maximal and prime ideals- Nilpotent and nil ideals- Zorn's lemma (Pages 179 to 211).

Unit-IV

Unique factorization domains - Principal ideal domains- Euclidean domains- Polynomial rings over UFD- Rings of traction.(Pages 212 to 228)

Text Books:

[1] Basic Abstract Algebra by P.B. Bhattacharya, S.K. Jain and S.R. Nagpanl.

Reference:

[1] Topics in Algebra by I.N. Herstein.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics with Computer Science
Semester I

MCS –102T **Paper-II**

Real Analysis

Unit I

Metric spaces- Compact sets- Perfect sets- Connected sets

Unit II

Limits of functions- Continuous functions- Continuity and compactness Continuity and connectedness- Discontinuities – Monotone functions.

Unit III

Rieman- Steiltjes integral- Definition and Existence of the Integral- Properties of the integral- Integration of vector valued functions- Rectifiable waves.

Unit-IV

Sequences and series of functions: Uniform convergence- Uniform convergence and continuity- Uniform convergence and integration- Uniform convergence and differentiation- Approximation of a continuous function by a sequence of polynomials.

Text Books:

[1] Principles of Mathematical Analysis (3^{rd} Edition)
(Chapters 2, 4, 6)
by
Mc Graw-Hill Internation Edition

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics with Computer Science
Semester I

MCS –103T Paper-III

Discrete Mathematics

UNIT- I

LATTICES: Partial Ordering – Lattices as Posets – some properties of Lattices – Lattices as Algebraic Systems – Sublattices, Direct products and Homomorphisms – some special Lattices – Complete, complemented and distributive lattices.(Pages 183-192, 378-397 of [1])

UNIT- II

BOOLEAN ALGEBRA: Boolean Algebras as Lattices – Bolean Identities – the switching Algebra – sub algebra, Direct product and homomorphism – Join irreducible elements – Atoms (minterms) – Boolean forms and their equivalence – minterm Boolean forms – Sum of products canonical forms – values of Boolean expressions and Boolean functions – Minimization of Boolean functions – the Karnaugh map method.(Pages 397 – 436 of [1])

UNIT- III

GRAPHS AND PLANAR GRAPHS : Directed and undirected graphs – Isomorphism of graphs – subgraph – complete graph – multigraphs and weighted graphs – paths – simple and elementary paths – circuits – connectedness – shortest paths in weighted graphs – Eulerian paths and circuits – Incoming degree and outgoing degree of a vertex - Hamiltonian paths and circuits – Planar graphs – Euler's formula for planar graphs.
(Pages 137-159, 168-186 of [2])

UNIT- IV

TREES AND CUT-SETS: Properties of trees – Equivalent definitions of trees - Rooted trees – Binary trees – path lengths in rooted trees – Prefix codes – Binary search trees – Spanning trees and Cut-sets – Minimum spanning trees
(Pages 187-213 of [2])

Text Books:-

[1] J P Tremblay and R. Manohar: Discrete Mathematical Structures with applications to Computer Science, McGraw Hill Book Company

[2] C L Liu : Elements of Discrete Mathematics, Tata McGraw Hill Publishing Company Ltd. New Delhi. (Second Edition).

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc-Mathematics with Computer Science
Semester-I

MCS 104T **Paper-IV**

Operating Systems

UNIT – I

Operating Systems: Introduction, Early system, Multi Programmed, Batch, Time sharing, Real Time Distributed systems, Operating System Structure, Operating System services, System Calls.
Processes: Process concept, PCB, Process scheduling, Process Operation, Inter process communication.
CPU scheduling: Basic Concepts, Scheduling criteria, FCFS, SJF, Priority scheduling, RR, Multilevel, Multi process scheduling.

UNIT II

Deadlocks: System Model – Dead lock Characterisation-methods of handling deadlocks-deadlocks prevention – deadlock avoidance-deadlock detection-recovery from deadlock.

UNIT III

Memory Management: overlay Technique, Swapping, Static, Dynamic Partition Techniques, Fragmentation.
Paged memory management, Demand Paged. Page Replacement, Algorithms for page removal, Segmentation, Thrashing.

UNIT IV

File system interface: file concept , access methods, directory structure and protection, file system implementation, file allocation methods, free space management.

TEXT BOOK:-

1).Silberschatz and Galvin : Operating Systems Concepts Addison Wesley publishing company.
2) K A Sumitra Devi, N P Banashree, Operating Systems, SHROFF Publishers and Distributors (SPD).

REFERENCE:-

1).Andrew S.Tanenbaum- Modern Operating System- Prentice Hall of India.
2).Operating System- William Stallings, Prentice Hall of India (2002).
3).Operating System- Dharmadhrere, Tata Mc Grawhill.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc-Mathematics with Computer Science
Semester-I

MCS 105T **Paper-V**

OOPS through C++

UNIT – I

Object - oriented programming - Procedural oriented programming - OOP Terminology - Data Abstraction - Data Encapsulation - Objects, classes - Defining member functions - constructors -dynamic initialization of the objects - polymorphism - Function overloading, operator overloading

UNIT - II

Introduction to computer programming - Programming Fundamentals - Higer Level Languge, Operating Systems, Compiling Programs, writing a progam in C++ by usage of variables, Datatypes, Constants, Arithmetic Expression

UNIT - III

Programming using Control Structures - looping - for satement-while stament do statement - decision making - if statement - switch statement - conditional expression opreator. Arrays-Initializing arrays,character arrays-Multi dimensional arrays

UNIT-IV

Inheritence: Defining derived classes-single and multiple inheritence, virtual base classes, abstract classes, runtime polymorphism and its implementation,virtual functions, dynamic binding. I/O - Console I/O operator in C++, Streams-stream classes- unformatted I/O operations. Exception handling-Templates-Functional Templates.

Text Book:-

1) E.Balaguruswamy : Introduction to C++ , Tata Mc Graw Hill

References:

1) Venugopal, Ravishankar. Rajkumar : Mastering C++, Tata McGraw Hill

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY
M.Sc-Mathematics with Computer Science
Semester-I

MCS 199P (Practicals)

Unix & C++

Unix

a) Shell Programmes
1. Program using **case**, **if** and **then**
2. Program to identify the type of a given file
3. Program using **grep**
4. Program to wish the user 'Good Morning' and 'Good Evening' depending on the time

b) Programs using System Calls
1. Implementation of Cp (Copy) command of a Unix.
2. Program to implement fork() and exec() system calls
3. Process communication using signals
4. To convert upper case to lower case letter of a given ASCII file.

C++

1. Write C++ program to determine tomorrow's date
2. Write C++ program for multiplication of two matrices by overloading various operators (such as *, >>, <<)
3. a. Write C++ program using operator overloading to concatenate two strings
4. b. Write C++ program overloading assignment operator
5. Write C++ program by declaring and using virtual functions for generating random numbers
6. Write C++ to generate window with a menu bar
7. By using polymorphism concept write C++ program to draw different shapes (ex. Rectangle, triangle etc.)
8. Write C++ program that opens a file, writes as many objects as the user wants and reads and displays the entire contents of the file.
9. Write C++ program to search a value using binary methods

DEPARTMENT OF MATHEMATICS
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M.Sc. Mathematics with Computer Science
Semester II

MCS –201T **Paper-I**

Complex Analysis

Unit I

Regions in the complex plane- Functions of a complex variable- Mappings by exponential functions- Limits- Continuity- Derivatives- Cauchy-Riemans equations- Sufficient conditions for differentiation- Polar coordinates.

Unit II

Analytic functions- Uniquely determined analytic functions- Reflection principle- The exponential function- The logarithmic function- Complex exponents- Trigonometric functions- Hyperbolic functions- Inverse trigonometric- Hyperbolic functions.

Unit III

Derivatives of functions w(t)- Definite integrals of functions w(t)- Contours- Contour integrals- Upper bounds for moduli of contour integrals- Anti derivatives.

Unit-IV

Cauchy-Goursat theorem and its proof- Simply and multiply connected domains- Cauchy's integral formula- Derivatives of analytic functions- Liouville's theorem and fundamental theorem of algebra- Maximum modulus principle.

Text Books:

[1] Complex Variable and Application (8^{th} Edition)
by
James Ward Brown,
Ruel V-churchill

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc-Mathematics with Computer Science
Semester-II

MCS 202T **Paper-II**

Computer Organisation

UNIT – I

Digital logic circuits: Logic gates, boolean algebra, map simplification, combinational circuits - half adder, full adder, Half-subtractor, full-subtractor, Flip-flops, excitation tables, sequential circuits, state tables, state diagrams, integrated circuits and digital functions, digital integrated circuits, M-S Flip-flop, decoders, multiplexers, binary counters, shift registers, RAM and ROM.

UNIT III

Data representation: Number systems, binary, octal, hexadecimal representation, decimal representation, alphanumeric representation, fixed point representation: floating point representation, gray-codes-error-codes, register transfer and micro-operation, register transfer langauage, inter register transfer, parallel transfer, serial transfer, bus transfer, memory transfer, arithmetic micro operation, logic micro operation, shift micro-opearation.

UNIT III

Basic Computer Organisation and Design: Instruction code – computer instruction, timing and control – fetch cycle – instruction cycle – execute cycle, execution of I nstruction, input-output –interrupt cycle, central processor organization, arithmetic logic unit, stack organization, instruction formats, addressing modes.

UNIT IV

Arithmetic processor design: Comparison and subtraction of unsigned binary numbers, addition, subtraction, multiplication, and division algorithm. Input – Output Organisation: I/O interface, Asynchronous data transfer, hand-shaking, three wire hand shaking, direct memory access.

TEXT BOOK:-

1)M. Morris Mano : Computer System Architecture, Prentice Hall of India Pvt. Ltd., New Delhi

DEPARTMENT OF MATHEMATICS
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M.Sc. Mathematics with Computer Science
Semester II

MCS –203T Paper-III

Functional Analysis

UNIT-I

Normed Space, Banach Space, further properties of normed spaces, Finite dimensional normed spaces and subspaces, compactness and finite dimension linear operators, Bounded and continuous linear operators, linear functionals, linear operators and functionals on finite dimensional spaces, normed spaces of operators, Dual spaces.

(See Sections 2.2 to 2.10)

UNIT-II

Inner product space, Hilbert space, further properties of inner product spaces, orthogonal complements and direct sums, orthonormal sets and sequences, series related to orthonormal sequences and sets. (Sections 3.1 to 3.5)

UNIT-III

Total Orthonormal sets and sequences, Representation of functionals on Hilbert Spaces, Hilbert-adjoint operator, self-adjoint, unitary and normal operators.
(See Sections 3.6, 3.8, 3.9 and 3.10)

UNIT-IV

Hahn-Banach theorems for Complex vector spaces and normed spaces, adjoint operator, Reflexive spaces, uniform boundedness theorem, convergence of sequences of operators and Functionals. Open mapping theorem, closed graph theorem.
(See Sections 4.3, 4.5, 4.6, 4.7, 4.12 and 4.13).

Text Book:-Introductory Functional Analysis by E.Kreyszig, John-wiley and Sons, New York, 1978.

References Books:-

1).B.V.Limaye, "Functional Analysis", 2nd Edition
2).Brown and Page, "Elements of Functional Analysis"
3).P.K.Jain, O.P.Ahuja and Khalil Ahmed, "Functional Analysis".

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics with Computer Science
Semester III

MCS – 204T **Paper IV**

Design and Analysis of Algorithms

Unit I

Introduction and elementary data structures - Order notation - Analysis of Algorithm - Review of elementary data structures – Heap and Heapsort – Hashing - Sets representation – UNION, FIND operation.

Unit II

Divide-and-conquer and the Greedy Model - The General Method - Binary search - Finding maximum and minimum - Merge sort - Quick sort and Selection sort – Knapsack problem - Optimal storage on tapes - job sequencing with deadlines - optimal merge pattern - minimum spanning trees and single sources shortest pattern.

Unit III

Dynamic programming and transversal techniques - Multistage graphs - all pairs shortest pattern - optimal binary search trees - 0/1 Knapsack - reliability design - travelling sales man problem - game trees - biconnected components and depth first search.

Unit IV

Back Tracking and branch bound Technique - 8 queens problems - graph colouring - Hamiltonian cycles - Knapsack problem, 0/l Knapsack problems - Travelling sales person problems - Lower-bound theory - NP-Hard and NP-completeness - Basic concepts - Cook's theorem – NP-Hard Graph problem and scheduling problem – NP-Hard code generation problem - decision problem - node covering theorem.

Text Books:

[1] E.Horowitz and S. Sahni, Fundamentals of Computer Algorithms, Galgotia Publication,1984.
[2] A.V.Aho, J.V.Hopcroft and J.D.Ullmann, The Design and Analysis of Computer Algorithms, Addison Wesley Publication Company 1974.

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M.Sc-Mathematics with Computer Science
Semester-II

MCS 205T **Paper V**

Data Structures through C++

UNIT-I:
Introduction to Data Structures-Importance and Meaning_ Arrays (single and Multi Dimensional)-Address calculations using column and row major ordering.

UNIT-II:
Stack and Queues in C++ : Stack definition-Examples-Representation of Stack-Postfix, Prefix, Infix-Recursion definition and Process-Queues.

UNIT-III:
Linked Lists in C++: Linked Lists-Single Linked, Double Linked Lists, Circular Lists-Example.

UNIT-IV:

Trees & Sorts: Binary Trees-Representation of lists as Binary Trees and their Applications-Searches :Sequential search, Binary search, Sorts: Selection sort ,Shell sort, Merge sort, Quick sort, Insertion sort.

Text Book:-Tanenbaum, "Data Structures Using C and C++", Prentice Hall.of India.

DEPARTMENT OF MATHEMATICS
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M.Sc. Mathematics with Computer Science
Semester II

MCS –299 P

Practicals: Data Structures

1. Write a Program to implement Stack by means of an array and implementation the Operations PUSH and POP
2. Write a Program to implement Queues by means of an array and implementation the Operations PUSH and POP
3. Write a Program to convert a given infix expression to postfix form
4. Write a Program to convert a given infix expression to prefix form
5. Write a Program to create a Single Linked Lists and write function to implement the following operations.
   i. Search for an Element
   ii. Insert an Element at a Specified Position
   iii. Delete a Specified Element in the List
   iv. Find the Element Position
6. Do problem (4) using Double Linked Lists and Sort the Elements in the list ascending order.
7. Do problem (4) using Circular Linked Lists.
8. Write a Program to create a Binary Tree and implement the 3 traversal techniques: Pre Order, In Order and Post Order.
9. Write a function sub-program for sorting the numbers in ascending order using the Bubble Sort and use it in the main program.
10. Do problem (9) using Selection Sort.
11. Do problem (9) using Insertion Sort.
12. Do problem (9) using Quick Sort.
13. Do problem (9) using Heap Sorts.
14. Write a Program which implement binary search method to search a given integer x in an array of n integers.
15. Do Problem (14) using recursions.

DEPARTMENT OF MATHEMATICS
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M.Sc. Mathematics with Computer Science
Semester III

MCS – 301T **Paper I**

Networks

Unit I

Introduction – Uses of computer networks – Network structures - Network architecture - OSI reference – Model transmission media - Twisted pair - Coaxial cables - Fibre optics - Communication satellite - Modern X.21 digital interface -Multiplexing – Circuits - Packet and Hybrid switching – ISDN - Digital FBX – Terminal handling.

Unit II

Terminal Handling - Medium Access sublayer - Aloha protocol - LAN protocols –IEEE standards for LANS - Data link layer - Design issues – Elementary data link protocols - Sliding window protocols.

Unit III

Network layer - Design issues - Routing algorithms - Congestion control - Transport layer design issues - Internet working connection management - Transport protocols -- Session layer - Design issues - Remote procedure call.

Unit IV

Presentation layer – Design issues - Data compression techniques – Cryptography -Application layer - Design issues - File Transfer - Access and Management - Electronic mail - Virtual Mail.

Text Books:

[1] Andrew S. Tanenbaum, Computer Networks, Prentice Hall of India, New Delhi.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Mathematics with Computer Science)
Semester III

MCS – 302T **Paper- II**

Mathematical Methods

Unit I

Existence and Uniqueness of solution of $\frac{dy}{dx} = f(x,y)$. The method of successive approximation- Picard's theorem- Sturm-Liouville's boundary value problem.

Partial Differential Equations: Origins of first-order PDES-Linear equation of first-order-Lagrange's method of solving PDE of $P_p+Qq = R$ – Non-Linear PDE of order one-Charpit method- Linear PDES with constant coefficients.

Unit II

Partial Differential Equations of order two with variable coefficients- Canonical form Classification of second order PDE- separation of variable method solving the one-dimensional Heat equation and Wave equation- Laplace equation.

Unit III

Power Series solution of O.D.E. – Ordinary and Singular points- Series solution about an ordinary point -Series solution about Singular point- Frobenius Method.

Lagendre Polynomials: Lengendre's equation and its solution- Lengendre Polynomial and its properties- Generating function-Orthogonal properties- Recurrance relations- Laplace's definite integrals for $P_n(x)$- Rodrigue's formula.

Unit-IV

Bessels Functions: Bessel's equation and its solution- Bessel function of the first kind and its properties- Recurrence Relations- Generating function- Orthogonality properties.

Hermite Polynomials: Hermite's equation and its solution- Hermite polynomial and its properties- Generating function- Alternative expressions (Rodrigue's formula)- Orthogonality properties- Recurrence Relations.

Text Books:

[1] "Elements of Partial Differential Equations", By Ian Sneddon, Mc.Graw-Hill International Edition.

[2] "Text book of Ordinary Differential Equation", By S.G.Deo, V. Lakshmi Kantham, V. Raghavendra, Tata Mc.Graw Hill Pub. Company Ltd.

[3] "Ordinary and Partial Differential Equations", By M.D. Raisingania, S. Chand Company Ltd., New Delhi.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics with Computer Science
Semester III

MCS – 303T **Paper III**

Relational Database Management Systems with SQL

Unit I

Introduction – Purpose of database systems – Data Abstraction – Data Independence – DDL – DML – Role of DBA – Overall System Structure – Relational Algebra – Tuple and Domain Relational Calculus – ER Model – Introduction – Entities – Relationships - Ordinary Constraints

Unit II

Enhanced ER Model – Representing Super Type - Subtype specialization and generalization – Specifying Constrains in Super type / Sub type – Integrity Constraints -Transforming ER Diagrams – Relations Normalization – SQL – DDL – DML – DCL.

Unit III

File organization - Indexing – Hashing - B-Tree - Index Files - Static and Dynamic Hashing - Client Server Architecture - File Server Architecture - Limitations of File Servers - Database Server Architecture - Three Tier Architecture - PL/SQL cursors – Procedures – Functions – Triggers - Packages

Unit IV

Transaction Concurrency Control - Concept State of transaction – Concurrent Execution – Serializabitlity – Recoverability - Implementation of Isolation-Lock based - Time stamp based - Validation based protocol - Deadlock prevention-Avoidance detection - Detection and Recovery – Front-end Developer 2000 / VB.

Text Books:

[1] H.F.Korth, Database System Concepts.

[2] Fred.R.Mcfodden, Jeffrey A., Happer, B.Murray, Prescott, Modern Database Management, Addison Wesley Publication.

[3] Ivan Byrass, Book on Oracle Application Development.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics with Computer Science
Semester IV

MCS – 304T **Paper IV**

Software Engineering

Unit I

Introduction to Software Engineering - Project Size and its categories - Planning a software project - Software Development Life Cycle - Planning an organizational structure.

Unit II

Software Cost Estimation - Least factor cost estimation techniques - Maintenance Cost Estimation - Software requirement specifications - Formal Specification Techniques.

Unit III

Software Design – Fundamental Design Concepts and Relations – Modularization - Module Design Techniques - Detail Design Considerations - Implementation issues -Structure Coding Techniques - Coding Style – Documentation - Verification and Validation Techniques - Quality Assurance - Walkthrough and Inspection -Testing format verification.

Unit IV

Software Tools - Overview CASE - Software reliability – Software errors – Faults -Repairs and availability - Software maintenance – Managerial Aspects of Maintenance - Maintenance Tools and Techniques

Text Books:

[1] R.S.Pressman, Software Engineering

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics with Computer Science
Semester III

MCS – 305 AT **Paper V**

Neural Networks and Fuzzy Logic

Unit I

Introduction-knowledge - Based information processing - Neutral and fuzzy machine intelligence - Fuzziness as multi-variance - Dynamical system approach to machine intelligence - The Brain as a dynamical system - intelligent behaviour as adaptive free estimation. (p.2 – p.32)

Unit II

Neuronal Dynamics - Activation of signals - Neurons as function – Biological activation and signals - Neuron fields - Neuron dynamical system - Common signal function plug-coded signal function. (p.39 – p.50)

Activation Models Neuronal dynamical – System - Additive neuronal dynamics -Additive neuronal feedback - Additive activation and Bivalent model (p.55 – p.73).

Unit III

Learning: Supervised and unsupervised statistical learning – Al learning - Neural net work learning - Back propagation algorithm and derivation - Stopping criteria - Complexity of learning generalization (p.111 - p.127 and p.180 – p.212).

Unit IV

Fuzzy Logic: Fuzzy sets and system – Universe as a Fuzzy sets - Geometry of Fuzzy sets (p.-263, p.268 – p.274).Fuzzy and neural function estimation (p.302 – p.207) - Fuzzy and Meta-model controllers - Real line target tracking - Fuzzy controller - Fuzzy and Kalman – Filter controller surfaces (p.379 – p.394)

Hopfield Networks: The Hopfield model - Hopfield network algorithm - Bollizman`s machine algorithm - Neural network and fuzzy system application(p.92, p.253– p.255)

Text Books:

[1] Bart Kosko, Neural Net works and Fuzzy Structures, prentice Hall of India, 1994

Reference Books:

[2] Limin Fr., Neural Networks in Computer Intelligence, Mc Graw Hill Publication, Company, 1995.

[3] James A. Freeman, Similarity Neural Networks, Addison Wesley Publications Company, 1995.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. – Mathematics with Computer Science
Semester-III

MCS 305 BT **Paper-V**

Elementary Number Theory

UNIT-I

The Fundamental Theorem of arithmetic: Divisibility, GCD, Prime Numbers, Fundamental theorem of Arithemtic, the series of reciprocal of the Primes, The Euclidean Algorithm.

UNIT-II

Arithmetic function and Dirichlet Multiplication, The functions $\phi(n)$, $\mu(n)$ and a relation connecting them, Product formulae for $\phi(n)$, Dirichlet Product, Dirichlet inverse and Mobius inversion formula and Mangoldt function $\Lambda(n)$, multiplication function, multiplication function and Dirichlet multiplication, Inverse of a completely multiplication function, Liouville's function $\lambda(n)$, the divisor function is $\sigma_\alpha(n)$

UNIT-III

Congruences, Properties of congruences, Residue Classes and complete residue system, linear congruences conversion, reduced residue system and Euler Fermat theorem, polynomial congruence modulo P, Lagrange's theorem, Application of Lagrange's theorem, Chinese remainder theorem and its application, polynomial congruences with prime power moduli

UNIT-IV

Quadratic residue and quadratic reciprocity law, Quadratic residues, Legendre's symbol and its properties, evaluation of (-1/p) and (2/p), Gauss Lemma, the quadratic reciprocity law and its applications.

Text Book:-

[1]Introduction to analytic Number Theory by Tom N. Apostol.
Chapters 1,2,5,9

DEPARTMENT OF MATHEMATICS
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M.Sc. Mathematics with Computer Science
Semester III

MCS – 305 CT **Paper V**

Operations Research

Unit I

Formulation of Linear Programming problems, Graphical solution of Linear Programming problem, General formulation of Linear Programming problems, Standard and Matrix forms of Linear Programming problems, Simplex Method, Two-phase method, Big-M method, Method to resolve degeneracy in Linear Programming problem, Alternative optimal solutions. Solution of simultaneous equations by simplex Method, Inverse of a Matrix by simplex Method, Concept of Duality in Linear Programming, Comparison of solutions of the Dual and its primal.

Unit II

Mathematical formulation of Assignment problem, Reduction theorem, Hungarian Assignment Method, Travelling salesman problem, Formulation of Travelling Salesman problem as an Assignment problem, Solution procedure.
Mathematical formulation of Transportation problem, Tabular representation, Methods to find initial basic feasible solution, North West corner rule, Lowest cost entry method, Vogel's approximation methods, Optimality test, Method of finding optimal solution, Degeneracy in transportation problem, Method to resolve degeneracy, Unbalanced transportation problem.

Unit III

Concept of Dynamic programming, Bellman's principle of optimality, characteristics of Dynamic programming problem, Backward and Forward recursive approach, Minimum path problem, Single Additive constraint and Multiplicatively separable return, Single Additive constraint and Additively separable return, Single Multiplicatively constraint and Additively separable return.

Unit-IV

Historical development of CPM/PERT Techniques - Basic steps - Network diagram representation - Rules for drawing networks - Forward pass and Backward pass computations - Determination of floats - Determination of critical path - Project evaluation and review techniques updating.

Text Books:

[1] S. D. Sharma, Operations Research.
[2] Kanti Swarup, P. K. Gupta and Manmohan, Operations Research.
[3] H. A. Taha, Operations Research – An Introduction.

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M.Sc. Mathematics with Computer Science
Semester III

MCS –306P (Practicals)

RDBMS & Network Programming

List of Practicals for RDBMS

1. Creation of Database Tables using SQL Commands.

2. DML, DDL, DCL, Commands execution .

3.i) Creating View using SQL Commands.

ii) Creating function using PL/SQL Commands.

4. Creating procedures using PL/SQL Commands.

1. Socket creation programme using socketpair( ) system call
2. Stream Server programme, Stream Client programme
3. "Listener" Programme, "Talker" Programme
4. Remote File Access implementation
5. Remote Log on implementation

DEPARTMENT OF MATHEMATICS
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M.Sc. Mathematics with Computer Science
Semester IV

MCS – 401 T **Paper I**

Network Security

Unit I

Conventional Encryption - Security Attacks - Security Model for network security - Conventional encryption model - Encryption techniques – DES - Triple DES - Key distribution - Random number generation.

Unit II

Public key cryptography - Principles of public key cryptosystems - RSA algorithm - Key management - Distribution of public keys - Public key distribution of secret keys.

Unit III

Authentication and digital systems - Authenticate requirements – Functions - Cryptographic checksum - Hash function - Digital signatures - authentication protocols – Kerberos - X-509 directory - Authentication service - Diffie-Hellman key exchange - Digital signature standards.

Unit IV

Cryptographic algorithms - The MD5 message digest algorithm - Secure hash algorithm - International data encryption algorithm - LUC public key encryption – email and management security – Pretty good privacy (PGP) - Privacy enhanced mail.

Text Book:

[1] William Stallings, Network Security and Internet Work Security, PHI

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M.Sc. Mathematics with Computer Science
Semester IV

MCS – 402T **Paper II**

Computer Graphics

Unit I

A survey of Computer Graphics - Overview of Graphics Systems - Video Display Devices, Raster Scan Systems, Random Scan Systems, Graphics Input Devices, Hard-Copy devices, Graphics Software

Output Primitives: Line Drawing Algorithms – DDA - Bresenham line algorithm Midpoint Circle Algorithm - Ellipse Algorithm

Polygonal Algorithms: Scan Line - Boundary Fill - Flood Fill Algorithms

Unit II

Attributes of output primitives - Line Attributes Curve Attributes - Area Fill and character attributes Two Dimensional Transformations: Basic Transformations, Homogeneous Representation - Composite Transformation - Reflection and shear transformation.

Unit III

Two Dimensional Viewing: Viewing pipeline - window to viewport coordinate transformation

Clipping Operations: Cohen-Sutherland line clipping - Sutherland-Hodgman polygon clipping - Weiler Artherton polygon clipping

Unit IV

Three Dimensional Objects Representation - Polygon Surfaces - Polygon tables plane Eqn - Cubic Bezier Curves - Bspline - Octrees - 3D-Transformations – Translation - Rotation about an arbitrary point - Projections - Perspective projections and parallel projections - Visible Surface Detection - Back face detection - Z-buffer Algorithm - Depth Sorting Algorithm - Area Subdivision Algorithm

Text Book:

[1] M. Pauline Baker, Computer Graphics, C-Version.

Reference Book:

[2] S. Harrington, Computer Graphics.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics with Computer Science
Semester IV

MCS – 403AT **Paper III**

Automata Languages and Computation

Unit I

Strings, alphabets and Languages – Graphs and trees - Finite automata and regular expressions – Finite state systems – Non-deterministic finite automata – Finite automata with E-moves – Regular expressions.

Unit II

Two-way finite automata - Finite automata with output – Pumping Lemma for regular sets – Closure properties of regular sets – Decision algorithms for regular sets – The Myhill – Nerode theorem and Minimization of finite automata

Unit III

Context free grammars – Motivation and introduction – Context free grammars – Derivation trees – Chomsky normal form – Greibach normal form – Push down automata - Properties of CFL

Unit IV

Turing Machines – Introduction – Turing Machine Model – Computable languages and functions – Church's Hypothesis – Regular Grammars – Unrestricted grammars – Context–Sensitive languages – Chomsky Hierarchy.

Text Book:

[1] John E. Hopcroft, Jeffrey D. Ullman, Introduction to Automata Theory, Languages and Computation, Narosa Publishing House, New Delhi, 1994.

IMAGE PROCESSING

MCS403B
Paper III

UNIT-I

Image formation and description – Digital image representation – Elements of Visual
perception – Sampling and quantisation – Elements of digital image processing systems. (pages 1-16 and 21-45).

UNIT-II

Image transforms, Digital Image transforms – Fourier transform – Extension to 2D.
DCT Walsh, Hadamard Transforms (pages 81 – 143).

UNIT-III

Image Enhancements and Segmentation – Histograms modification – Image smoothing – Image sharpening – Thresholding – Edge detection – Segmentation Point and region dependent techniques (pages 162, 187, 413 – 423 and 443 – 445).
Color Image Processing: Color fundamentals, color models psuedo – Color image
processing – intensity slicing gray level to color transformation, filtering approach, full – Color image processing (pages 221-248).

UNIT IV

Image encoding – fidelity criteria – Transform compression – K. L. Fourier, DCT, Spatial compression run length coding – Huffman coding – Contour Coding restoration – Restoration models, Inverse filtering – Least Squares Filtering – Recursive Filtering. (pages 307 – 315, 343 – 358, 331 – 339, 148 – 150, 189 – 209,
207 – 280).

TEXT BOOK:

Gonzalez R.C., Woods R. E. Digital Image Procesing, Addison Wesley, 1992.

REFERENCE BOOKS:

1. Rosenfeld A, Kak A.C., Digital Picture Processing, Vol. I & II, Academic Press, (Second Edition) 1982.
2. Fundamentals of Digital Image Processing, Anil K. Jain, Prentice – Hall of India Pvt. Ltd., New Delhi.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics with Computer Science
Semester IV

MCS – 403 C T **Paper III**

Artificial Intelligence and Expert Systems

Unit I

AI – Definition, introduction to AI techniques Problems - Problem Spaces and search - State space search problem – Production system – Problem characteristics – Heuristic Search – Generate and test - Hill climbing – Breadth first search - Problem reduction - Constraint satisfaction - Knowledge representation issues- Representation using predicate logic – Predicate logic unification - Resolution

Unit II

Procedural vs. Declarative knowledge – Logic programming – Forward vs. Backward Reasoning – Matches - Declarative knowledge representation – Semantic Nets – Frames – Conceptual dependency scripts – CYC - Symbolic reasoning under uncertainty – Non-Monotonic reasoning – Logic for non-monotonic reasoning – Implementation of Depth First Search and Breadth First Search - Statistical reasoning - Certainty factors and rule based systems – Bayesian Networks – Dempster Shafer Theory –Fuzzy logic

Unit III

Game playing – Minimax search – Alpha beta heuristics – Refinement iterative deepening - Planning – Components - Goal stack planning – Nonlinear planning – Hierarchical planning - Learning - Rote learning - Learning by taking advice -Learning from examples – Explain based learning - connectist models - Neural networks - Applications – Natural Language Processing - Syntax – Semantic and Pragmatic processing perception. Expert System Representation and using domain knowledge – Expert system shells- Explanation knowledge acquisition

Unit IV

The brain as a dynamical system - Neurons as functions - Signal monotonicity - Biological activations and signals - Neuron fields. Theory of Fuzzy sets - Definition – Dilation – Concentration – Normalization - Reasoning with fuzzy logic – Natural Language computations - Fuzzy Matching Algorithms

Text Books:

[1] W.F. Clocksin and C.S.Mellish. Programming in PROLOG, Spinger International Student Edition

[2] Dan W. Patterson- Introduction to Artificial Intelligence and Expert Systems, Prentice Hall of India.

DEPARTMENT OF MATHEMATICS
Osmania University
M.Sc. (Mathematics)
Semester-IV

CBMM-404 AT

Paper IV

Elements of Information Technology

Unit – I:

Digital Age: Digital basis of Computers, Data/Information, Hardware Input, Output, Memory, Communication Hardware, Software, Application Software, System Software, Communications, and Five kinds of Computers, Development in communication Technology, Connectivity and Interactivity, Five Generations of Programming Languages, Programming Languages uses today, Object Oriented & Visual Programming.

Operating Systems: Booting, Managing Storage, Resources, Files tasks, Common Operating Systems: Windows 95/98, DOS, and Windows - NT

Unit – II:

Processors: The CPU and Main Memory, Data Representation, Micro Computer System Unit, Input & Output devices, Keyboard, Pointing devices, Source data entry devices, Soft copy output, Hardcopy output, more output devices, Diskettes, Hard – disks, Optical disks, Flash memory, Magnetic tape, Compression and Decompression.

Unit-III:

Telecommunications: Data, Video, Audio Communication, the Internet, the World Wide Web, new Internet technologies, Communication Channels, Networks, conduits of communication, Communication networks, Local networks, factors affecting communication among devices.

Unit-IV:

Files & Databases: Data storage hierarchy, File management, Files Management Systems, Database Management Systems, type of database organization, and features of a DBMS.

Application Software: Common features of software, Word processing, Spread sheet, software for Cyber space, Internet programming, HTML, XML, & Active X.

Suggested Reading:

3. Williams B.K. Sawyer et.al., "*Using Information Technology"*, Sixth Edition, Tata McGraw Hill, 2006.

Books:

7. Aksoy & DeNardis "*Introduction to Information Technology",* Cengage Learning, 2006.

8. Dennis P. Curtin & Kim Folley, et.al., *"Inforamtion Technology, The Braking Wave",* Tata McGraw Hill, 1998.
9. ITL Edn Solutions Ltd, *"Introducation to Inforamtion Technology",* Pearson Education, 2005.

DEPARTMENT OF MATHEMATICS
Osmania University
M.Sc. (Applied Mathematics)
Semester-IV

CBAM-405 B **Paper V**

Elements of Information Technology

Unit – I:

Digital Age: Digital basis of Computers, Data/Information, Hardware Input, Output, Memory, Communication Hardware, Software, Application Software, System Software, Communications, and Five kinds of Computers, Development in communication Technology, Connectivity and Interactivity, Five Generations of Programming Languages, Programming Languages uses today, Object Oriented & Visual Programming.

Operating Systems: Booting, Managing Storage, Resources, Files tasks, Common Operating Systems: Windows 95/98, DOS, and Windows - NT

Unit – II:

Processors: The CPU and Main Memory, Data Representation, Micro Computer System Unit, Input & Output devices, Keyboard, Pointing devices, Source data entry devices, Soft copy output, Hardcopy output, more output devices, Diskettes, Hard – disks, Optical disks, Flash memory, Magnetic tape, Compression and Decompression.

Unit-III:

Telecommunications: Data, Video, Audio Communication, the Internet, the World Wide Web, new Internet technologies, Communication Channels, Networks, conduits of communication, Communication networks, Local networks, factors affecting communication among devices.

Unit-IV:

Files & Databases: Data storage hierarchy, File management, Files Management Systems, Database Management Systems, type of database organization, and features of a DBMS.

Application Software: Common features of software, Word processing, Spread sheet, software for Cyber space, Internet programming, HTML, XML, & Active X.

Suggested Reading:

1. Williams B.K. Sawyer et.al., "*Using Information Technology"*, Sixth Edition, Tata McGraw Hill, 2006.

Books:

7. Aksoy & DeNardis "*Introduction to Information Technology",* Cengage Learning, 2006.
8. Dennis P. Curtin & Kim Folley, et.al., *"Inforamtion Technology, The Braking Wave",* Tata McGraw Hill, 1998.

9. ITL Edn Solutions Ltd, *"Introducation to Inforamtion Technology"*, Pearson Education, 2005.

DEPARTMENT OF MATHEMATICS
Osmania University
M.Sc. (Mathematics)
Semester-IV

CBMCS-404 A

Paper IV

Elements of Information Technology

Unit – I:

Digital Age: Digital basis of Computers, Data/Information, Hardware Input, Output, Memory, Communication Hardware, Software, Application Software, System Software, Communications, and Five kinds of Computers, Development in communication Technology, Connectivity and Interactivity, Five Generations of Programming Languages, Programming Languages uses today, Object Oriented & Visual Programming.

Operating Systems: Booting, Managing Storage, Resources, Files tasks, Common Operating Systems: Windows 95/98, DOS, and Windows - NT

Unit – II:

Processors: The CPU and Main Memory, Data Representation, Micro Computer System Unit, Input & Output devices, Keyboard, Pointing devices, Source data entry devices, Soft copy output, Hardcopy output, more output devices, Diskettes, Hard – disks, Optical disks, Flash memory, Magnetic tape, Compression and Decompression.

Unit-III:

Telecommunications: Data, Video, Audio Communication, the Internet, the World Wide Web, new Internet technologies, Communication Channels, Networks, conduits of communication, Communication networks, Local networks, factors affecting communication among devices.

Unit-IV:

Files & Databases: Data storage hierarchy, File management, Files Management Systems, Database Management Systems, type of database organization, and features of a DBMS.

Application Software: Common features of software, Word processing, Spread sheet, software for Cyber space, Internet programming, HTML, XML, & Active X.

Suggested Reading:

1. Williams B.K. Sawyer et.al., "*Using Information Technology"*, Sixth Edition, Tata McGraw Hill, 2006.

Books:

7. Aksoy & DeNardis "*Introduction to Information Technology",* Cengage Learning, 2006.
8. Dennis P. Curtin & Kim Folley, et.al., *"Inforamtion Technology, The Braking Wave",* Tata McGraw Hill, 1998.

9. ITL Edn Solutions Ltd, *"Introducation to Inforamtion Technology"*, Pearson Education, 2005.

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. (Mathematics)
Semester IV

CBMCS- 404BT **Paper IV**

Applicable Mathematics

Unit I

Differential Equations: Definition of differential equation, formation of differential equation, order and degree of differential equation, variable separable method for solving differential equations, definition of homogenous differential equations, homogeneous functions, general solution of homogenous equations, non- homogeneous equation of first degree in x and y , solution of differential equation of the form Mdx + Ndy = 0, solution of Exact differential equation, solution of non-exact differential equation.

Unit II

Numerical Methods: Introduction- Solution of algebraic and transcendental equations- Bisection Method- method of False Position- Newton-Raphson Method- Approximate Solution of Equations- Horner's Method- Solution of Linear Simultaneous Equations- Gauss Elimination Methods- Gauss Jordan Method- Factorisation Method.

Unit III

Sample spaces- Events- The concept of probability- The axioms of probability- Assignment of probabilities- Conditional probability- Theorems on conditional probability- Independent events- Baye's theorem.

Unit-IV

Linear Programming: Introduction: Formulation of linear programming problem, graphical solution of two variable problems, Graphical solution in some exceptional cases, general formulation of linear programming problem, slack and surplus variables, standard form of linear programming problem, matrix form of linear programming problem, simplex method.

Text Books:

[1] Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Publishing Company Ltd.

[2] Highen Engineering Mathematics by B.S. Grewal.

[3] Theory and problems of probability and Statistics, Schaums Outline McGraw Hill Company

[4] Operations Research by S.D Sharma

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

M.Sc. Mathematics with Computer Science
Semester IV

MCS – 405P (Practicals)

Computer Graphics

1. Line Drawing Algorithms – DDA and Bresenham's Method

2. Circle and Ellipse drawing algorithms – Parametric and Bresenham's Method

3. Algorithm for Polygon inside tests and testing convexity

4. Polygon filling using scan conversion method

5. Transformation on 2-d composite objects

6. Line Clipping Algorithms – Cohen Sutherland outcode method and parametric methods

7. Polygon clipping using Sutherland-Hodgman Method

8. 3-D Transformation Cube

9. Bezier Curves Drawing

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

Scheme of Instruction and Examination
(w.e.f. The Academic year 2009-2010)

M.Sc. APPLIED MATHEMATICS

SEMESTER-I

S.No	Sub. Code.	Subject	Instructions Hrs./ Week	Duration of Exam	Internal Assessment	Semester Examination	Max. Marks	Credits
		THEORY						
1.	AM 101	Algebra	6	3	20	80	100	6
2.	AM 102	Real Analysis	6	3	20	80	100	6
3.	AM103	Complex Analysis	6	3	20	80	100	6
4.	AM 104	Mechanics	6	3	20	80	100	6
5.	AM 105	Mathematical Methods	6	3	20	80	100	6
6.	AM 199	Seminar	2					
		Total	32				500	30

SEMESTER –II

S.No.	Sub. Code.	Subject	Instructions Hrs./ Week	Duration of Exam	Internal Assessment	Semester Examination	Max. Marks	Credits
		THEORY						
1.	*AM 201*	Advanced Algebra	6	3	20	80	100	6
2.	*AM 202*	Advanced Real Analysis	6	3	20	80	100	6
3.	*AM203*	Advanced Complex Analysis	6	3	20	80	100	6
4.	*AM 204*	Fluid Mechanics	6	3	20	80	100	6
5.	*AM 205*	Integral Transforms	6	3	20	80	100	6
6.	*AM 299*	Seminar	2					
		Total	32				500	30

M.Sc. APPLIED MATHEMATICS
Scheme of Instruction and Examination

(w.e.f. The Academic year 2011-2012)

SEMESTER-III

S. No.	Sub. Code.	Subject	Instructions Hrs./ Week	Duration of Exam	Internal Assessment	Semester Examination	Max. Marks	Credits
		THEORY						
1.	AM 301	Viscous Flows	6	3	20	80	100	6
2.	AM 302	Finite Difference Methods	6	3	20	80	100	6
3.		Elective	6	3	20	80	100	6
	AM303A	Compressible Flows						
	AM 303 B	Theory of O.D.E.						
	AM 303 C	Topology						
4.		Elective	6	3	20	80	100	6
	AM 304A	Operations Research						
	AM 304B	Numerical Techniques						
	AM 304C	Dynamical systems						
5.		Elective	6	3	20	80	100	6
	AM 305A	Discrete Mathematics						
	AM 305B	Integral Equations						
	AM 305C	Differential Geometry						
6.	AM 399	Seminar	2				25	1
		Total	32				525	31

SEMESTER-IV

S. No	Sub. Code.	Subject	Instructions Hrs./ Week	Duration of Exam	Internal Assessment	Semester Examination	Max. Marks	Credits
		THEORY						
1.	AM 401	Functional Analysis	6	3	20		100	6
2.	AM 402	Finite Element Methods	6	3	20		100	6
3.		Elective	6	3	20		100	6
	AM 403A	Cal. Of variation						
	AM 403 B	Bio-Mechanics						
	AM 403 C	MHD						
4.		Elective	6	3	20		100	6
	AM 404A	Advanced Operations Research						
	AM 404B	OOPS through C++						
	AM 404C	Non Linear Dynamical Systems						
5.		CB Paper	4	3	20		100	4
	CBAM405A	Elements of Information Technology.						
	CBAM405B	Applicable Mathematics						
6.	AM 406	Practical: OOPS through C++	2*	3			50	1
7.	AM 499	Seminar	2				25	1
		Total	32				575	30

**** per batch***

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY

Scheme of Instruction and Examination

(w.e.f. The Academic year 2009-2010)
(Choice Based Credit System)

M.Sc. MATHEMATICS

SEMESTER-I

S no	Sub. Code.	Subject	Instructio-ns Hrs./ Week	Duration of Exam	Intern-al Assessment	Semester Exam	Total Marks	Credits
1.	*MM 101*	*Algebra*	6	3	20	80	100	6
2.	*MM 102*	*Real Analysis*	6	3	20	80	100	6
3.	*MM103*	*Discrete Mathematics*	6	3	20	80	100	6
4.	*MM 104*	*Elementary Number Theory*	6	3	20	80	100	6
5.	*MM 105*	*Mathematical Methods*	6	3	20	80	100	6
6.	*MM 199*	*Seminar*	2					
		Total	**32**				**500**	**30**

SEMESTER –II

S. No	Sub. Code.	Subject	Instructio-ns Hrs./ Week	Duration of Exam	Intern-al Assessment	Semester Exam	Total Marks	Credits
1.	*MM 201*	Advanced Algebra	6	3	20	80	100	6
2.	*MM 202*	*Advanced Real Analysis*	6	3	20	80	100	6
3.	*MM 203*	*Functional Analysis*	6	3	20	80	100	6
4.	*MM 204*	*Theory of Ordinary Differential Equns*	6	3	20	80	100	6
5.	*MM 205*	*Topology*	6	3	20	80	100	6
6.	*MM 299*	*Seminar*	2					
		Total	**32**				**500**	**30**

M.Sc. Mathematics

Scheme of Instruction and Examination
(w.e.f. The Academic year 2011-2012)

SEMESTER-III

S.	Sub. Code.	Subject	Instructions	Duration	Intern-al	Semester	Total	Credits

No			Hrs./ Week	of Exam	Assessment	Exam	marks	
1.	MM 301	Complex Analysis	6	3	20	80	100	6
2.	MM 302	Elementary Operator Theory	6	3	20	80	100	6
3.		Elective	6	3	20	80	100	6
	MM303A	Mechanics						
	MM 303 B	Analytic Number Theory						
	MM 303 C	Dynamical Systems						
4.		Elective	6	3	20	80	100	6
	MM 304A	Operations Research						
	MM 304B	Numerical Techniques						
	MM 304C	Graph Theory						
5.		Elective	6	3	20	80	100	6
	MM 305 A	Algebraic Number Theory						
	MM 305 B	Integral Equations						
	MM 305 C	Differential Geometry						
6.	MM 399	Seminar	2				25	1
		Total	**32**				**525**	**31**

SEMESTER-IV

S. No.	Sub. Code.	Subject	Instructions Hrs./ Week	Duration of Exam	Intern-al Assessment	Semester Exam	Total marks	Credits
1.	MM 401	Advanced Complex Analysis	6	3	20	80	100	6
2.	MM 402	General Measure Theory	6	3	20	80	100	6
3.		Elective	6	3	20	80	100	6
	MM 403A	Fluid Mechanics						
	MM 403 B	Application of Functional Analysis						
	MM 403 C	Prime Number Theory						
4.		Elective	6	3	20	80	100	6
	MM 404A	Calculus of Variations						
	MM 404B	OOPS through C++						
	MM 404C	Banach Algebra						
		Elective	4	3	20	80	100	4
5.	CBMM 405A	Elements of Information Technology						
	CBMM405B	Applicable Mathematics						
6.	MM 406	Practical: OOPS through C++	2*	3			50	1
7.	MM 499	Seminar	2				25	1
		Total	**32**				**575**	**30**

**** per batch***

DEPARTMENT OF MATHEMATICS
OSMANIA UNIVERSITY
(Choice Based Credit System)

Scheme of Instruction and Examination
(w.e.f. The Academic year 2009-2010)

M.Sc. MATHEMATICS with Computer Science

SEMESTER-I

S.No.	Sub. Code.	Subject	Instructions Hrs./ Week	Duration of Exam	Internal Assessment	Semester Exam	Total marks	Credits
1.	MCS101	Algebra	6	3	20	80	100	6
2.	MCS102	Real Analysis	6	3	20	80	100	6
3.	MCS103	Discrete Mathematics	6	3	20	80	100	6
4.	MCS104	Operating Systems	6	3	20	80	100	6
5.	MCS105	Oops through C++	6	3	20	80	100	6
6	MCS106	Practicals:Unix&C++	2+2	3			50	2
7	MCS199	Seminar	2					
		Total	36				**550**	**32**

SEMESTER –II

S.No	Sub. Code.	Subject	Instructions Hrs./ Week	Duration of Exam	Internal Assessment	Semester Exam	Total marks	Credits
1.	*MCS201*	Complex Analysis	6	3	20	80	100	6
2.	*MCS202*	*Computer Organization*	6	3	20	80	100	6
3.	*MCS203*	*Functional Analysis*	6	3	20	80	100	6
4.	*MCS204*	*Design &Analysis of Algorithms*	6	3	20	80	100	6
5.	*MCS205*	*Data Structure through C++*	6	3	20	80	100	6
6	*MCS206*	*Practicals:Data Structures*	4	3			50	2
7.	*MCS299*	*Seminar*	2					
		Total	36				**575**	**32**

M.Sc. Mathematics with Computer Science

Scheme of Instruction and Examination
(w.e.f. The Academic year 2011-2012)

SEMESTER-III

S. No.	Sub. Code.	Subject	Instructions Hrs./ Week	Duration of Exam	Internal Assessment	Semester Exam	Total marks	Credits
1.	MCS 301	Networks	6	3	20	80	100	6
2.	MCS302	Mathematical Methods	6	3	20	80	100	6

3.	MCS303	RDBMS with SQL	6	3	20	80	100	6
4.	MCS 304	Software Engineering	6	3	20	80	100	6
5		Elective	6	3	20	80	100	6
	MCS 305 A	Neural Networks& fuzzy logy						
	MCS 305B	Elementary Number theory						
	MCS 305C	Operation Research						
6	MCS306	Practicals :RDBMS & Networks	4	3			50	2
7.	MCS 399	Seminar	2				25	1
		Total	36				575	33

SEMESTER-IV

S. No.	Sub. Code.	Subject	Instructions Hrs./ Week	Duration of Exam	Internal Assessment	Semester Exam	Total marks	Credits
		THEORY						
1.	MCS 401	Networks Security	6	3	20	80	100	6
2.	MCS 402	Computer Graphics	6	3		80	100	6
3		Elective	6	3	20	80	100	6
	MCS 403A	Automata Language & Computation						
	MCS 403B	Image Processing						
	MCS 403C	AI & ES						
4		CB Paper	4	3	20	80	100	4
	CBMCS 404A	Elements of Information Technology						
	CBMCS404B	Applicable Mathematics						
5.	MCS405	Practicals on Computer Graphics	4	3			50	2
6.		Project	6	3			100	3
7.	MCS 499	Seminar	2				25	1
		Total	34				575	28

**** per batch***