PERIYAR UNIVERSITY
SALEM – 11

M.Sc., Mathematics Syllabus for candidates admitted from the academic year 2008 – 2009 and thereafter under Choice Based Credit System

(CBCS)

[Semester Pattern with Continuous Internal Assessment]

PERIYAR UNIVERSITY SALEM – 11
M.SC., DEGREE COURSE
(SEMESTER SYSTEM)
FACULTY OF SCIENCE
BRANCH - I: MATHEMATICS
(Choice Based Credit System)

REGULATONS AND SYLLABUS
(with effect from 2008-2009 onwards)

1. Objectives of the course

Mathematics to-day is penetrating all fields of human endeavor and therefore it is necessary to prepare the students to cope with the advanced developments in various fields of Mathematics. The objectives of this course are the following:

(a) To import knowledge in advanced concepts and applications in various fields of Mathematics.

(b) To provide wide choice of elective subjects with updated and new areas in various branches of Mathematics to meet the needs of all students.

2. Eligibility for Admission:

A candidate who has passed B.Sc., Mathematics / B.Sc., Mathematics (Computer Applications) degree of this University or any of the above degree of any other University accepted by the Syndicate equivalent thereto, subject to such condition as may be prescribed therefore shall be permitted to appear and qualify for the Master of Science (M.Sc.,) Degree Examination in Mathematics of this University after a course of study of two academic years.

3. Duration of the Course:

The course of study of Master of Science in Mathematics shall consist of two academic years divided into four semesters with 90 credits. Each Semester consists of 90 working days.

4. Course of Study:

The course of study shall comprise instruction in the following subjects according to the syllabus and books prescribed from time to time.

Sem	PaperCode	Course	Hrs	Credit	Marks		
					CIE	EA	Total
I		Algebra	6	5	25	75	100
		Real Analysis	6	5	25	75	100
		Mechanics	6	4	25	75	100
		Ordinary Differential Equations	6	4	25	75	100

		Elective I From Group A	6	4	25	75	100
II		Complex Analysis	6	5	25	75	100
		Advanced Algebra	6	4	25	75	100
		Partial Differential Equations	6	4	25	75	100
		Human Rights	2	2	-	100	100
		EDC- Optimization Techniques	4	4	25	75	100
		Elective II From Group B	6	4	25	75	100
III		Topology	6	5	25	75	100
		Measure Theory and Integration	6	5	25	75	100
		Graph Theory	6	4	25	75	100
		Calculus of Variations and Integral Equations	6	4	25	75	100
		Elective III From Group C	6	4	25	75	100
IV		Functional Analysis	6	5	25	75	100
		Differential Geometry	6	4	25	75	100
		C++ Programming	6	5	25	75	100
		Elective IV From Group D	6	4	25	75	100
		Project	6	5	-	100	100
		Total	90				2100

Sem	PaperCode	Course
I		**Elective - Group A**
		Numerical Analysis
		Difference Equations
II		**Elective - Group B**
		Discrete Mathematics
		Fluid Dynamics
III		**Elective - Group C**
		Number Theory
		Fuzzy sets and their applications
IV		**Elective - Group D**
		Control Theory
		Mathematical Statistics
		C++ Practical

5. Examinations:

The examination shall be of **three hours** duration for each paper at the end of each semester. The candidate failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examination.

Practical examinations for PG course should be conducted at the end of the even semester only.

At the end of fourth semester viva-voce will be conducted on the basis of the Dissertation/ Project report by one internal and one external examiner.

6. Question paper pattern:

Question paper pattern for Theory Examination

Time: Three Hours   Maximum marks: 75

Part – A (5 X 5 = 25 Marks)

Answer ALL Questions

Two Questions from each unit with internal choice

Part – B (5 X 10 = 50 Marks)

Answer ALL Questions

Two Questions from each unit with internal choice

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Question paper pattern for Practical Examination

Time: 3 Hours   Maximum marks: 100

Passing Minimum: 50 Marks   (Aggregate of Examination and Record)

Practical Examination: 60 Marks

CIA: 40 Marks

(No passing minimum for records)

There will be one question with or without subsections to be asked for the practical examination. Every question should be chosen from the question bank prepared by the examiner(s). Every fourth student get a new question i.e. each question may be used for at most three students.

7. Dissertation:

(a) Topic:

The topic of the dissertation shall be assigned to the candidate before the beginning of third semester and a copy of the same should be submitted to the University for approval

(b) No. of copies project / dissertation:

The students should prepare three copies of dissertation and submit the same for the evaluation by Examiners. After evaluation one copy is to be retained in the college library and one copy is to be submitted to the university (Registrar) and one copy can be held by the student.

Format to be followed:

The formats / certificate for project / dissertation to be submitted by the students is given below:

Format for the preparation of project work:

(a) Title page

(b) Bonafide Certificate

(c) Acknowledgement

(d) Table of contents

CONTENTS

Chapter No.	TITLE	Page No.
1.	Introduction	
2.	Title of the Chapters	
3.	Conclusion	
4.	References	

Format of the Title page:

TITLE OF THE PROJECT / DISSERTATION

Project / dissertation Submitted in partial fulfillment of the requirement for the Degree of Master of Science in

MATHEMATICS

to the Periyar University, Salem -635 001.

By

Student's Name :

Register Number :

College :

Year :

Format of the Certificate:

CERTIFICATE

This is to certify that the dissertation entitled ………………………… submitted in partial fulfillment of the requirement of the degree of Master of Science in MATHEMATICS to the Periyar University, Salem is a record of bonafide research work carried out by……………………..under my supervision and guidance and that no part of the dissertation has been submitted for the award of any degree, diploma, fellowship or other similar titles or prizes ands that the work has not been published in part or full in any scientific or popular journals or magazines

Date: Signature of the Guide

Place:

Signature of the Head of the Department

Guidelines for approval of PG guides for guiding students in their research for submitting project / dissertation:

A person seeking for recognition as guide should have:

(a) A Ph.D. degree or M.Phil / M.A. / M.Sc. degree with first class / second class and

(b) Should have 3 years of teaching / research experience

8. Passing Minimum

The candidate shall be declared to have passed the examination if the candidate secures not less than 50% marks (i.e. 38 marks) in the University examination in each paper and not less than 50% marks (i.e. 12 marks) in the Continuous Internal Assessment

For the Practical paper, a minimum of 50 marks out of 100 marks in the University examination and the record notebook taken together is necessary for a pass. There is no passing minimum for the record notebook. However submission of record notebook is a must.

For the Project work and viva-voce a candidate should secure 50% of the marks for pass. The candidate should attend viva-voce examination to secure a pass in that paper.

Candidate who does not obtain the required minimum marks for a pass in a paper / Practical Project Report shall be required to appear and pass the same at a subsequent appearance.

9. Classification of Successful Candidates

Candidates who secure not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in **First Class.**

All other successful candidate shall be declared to have passed in the **Second Class.**

Candidates who obtain 75%of the marks in the aggregate shall be deemed to have passed the examination in the **First Class with Distinction** provided they pass all the examinations prescribed for the course at the first appearance.

Candidates who pass all the examinations prescribed for the course in the first instance and within a period of two academic years from the year of admission to the course only are eligible for **University Ranking.**

10. Maximum Duration for the completion of the PG Programme:

The maximum duration for completion of the PG Programme shall not exceed eight semesters.

11. Commencement of this Regulation:

These regulations shall take effect from the academic year 2008-09, that is, for students who are admitted to the first year of the course during the academic year 2008-09 and thereafter.

12. Transitory Provision:

Candidates who were admitted to the PG course of study before 2008-2009 shall be permitted to appear for the examinations under those regulations for a period of three years, that is, up to end inclusive of the examination of April / May 2011. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.

Core Course – I
– Algebra

Unit I:

Another counting principle, Sylows theorem, Direct product of finite abelian groups(Chapter 2 Sections 2.11 to 2.14)

Unit II:

Ring theory: Polynomial rings – rings over rational field rings over commutative ring(Chapter 3 Sections3.9 to 3.11)

Unit III:

Vector spaces and modules: Vector spaces – Dual spaces – Inner product spaces modules. (Chapter 4 Sections 4.3 to 4.5)

Unit IV:

Field theory: Extension field – roots of polynomials - more about roots(Chapter 5 Sections 5.1, 5.3 and 5 .5)

Unit V:

Galois Theory: Elements of Galois theory – Solvability by radicals - Galois groups over the rational (Chapter 5 Section 5.6, 5.7 and 5.8)

Text book:

I.N Herstein : Topics in Algebra, 2nd Edition, John Wiley and Sons, Newyork, 2003.

Reference:

1.S.Lang Algebra, 3rd Edition, Addison Wesley, Mass 1993.

2. John B.Fraleigh – A first course in abstract Algebra, Addison Wesley, Mass 1982.

3. M.Artin, Algebra, Prentice Hall of India, NewDelhi, 1991.

Core Course – II
– Real Analysis

Unit I:

Functions of bounded variations: Introduction, Properties of monotonic functions, functions of bounded variation, Total Variation, Additive property of total variation, Total variation on [a,x], Functions of b.v. expressed as the difference of increasing functions. Continuous function of b.v(6.1 to 6.8)

Unit II:

The Riemann-Stieltjes Integral: Introduction, Notation, The definition of R.S Integral, Linear properties, Integration by points, change of variable in R.S Integral, Reduction of a R.I, Euler's Summation formula, Monotonically increasing integrations, upper and lower integrals, additive and linearity property of upper and lower integral, Riemarri's Condition (7.1 to 7.13)

Unit III:

Sequence of functions: Power series, Multiplication of power series, The substations theorem, The Taylor's series generated by a function, Bensteiri's Theorem, The binomial series, Abel's limit theorem, Tauber's Theorem (9.14 to 9.16; 9.19 to 9.23)

Unit IV:

The Lebesque Integral: Introduction, The integral of a step function, Monotonic sequence of step functions, Upper functions and their integrals, The class of L.I function on a general interval, Basic properties of L.I Lebesque Integration and sets of measure zero. The Levi motor convergence theorems, The Lebesque Dominated convergence Theorem (10.1 to 10.4 ; 10.6 to 10.10)

Unit V:

Fourier Series and Fourier Integrals: Introduction Orthogonal System of functions, The theorem on best approximation, The F.S of a fum relative to an orthonormal system. Properties of F.C, The Riesz Fircher theorem The Rieman-Lebesque lemma, The Dirichlet intergns, An integral representation for the partial sums of F.S Riemann's localization theorem, Ceraro summabiltity of F.S Consequences of Fejor's theorem, the Weiostrass approximation theorem (11.1 to 11.2 except 11.7, 11.12)

Text Book:

Tom M. Apastal, Mathematical Analysis, 2nd edition, Narason Publishing House Delhi, Bombay, Madras.

Reference Book:

R.Goldbelge, Methods of Real Analysis, Oxford & IBH Publishing Co. Pvt Ltd, New Delhi & Kolkata.

Core Course – III
– Mechanics

Unit I:

Mechanical Systems:

The Mechanical System – Generalized co–ordinates – Constraints – Virtual work – Energy and Momentum.(Chapter 1 Sections 1.1 to 1.5)

Unit II:

Lagrange's Equations:

Lagrange's Equation – Derivation of Lagrange's Equations – Examples – Integrals of motion.(Chapter 2 Sections 2.1 to 2.3)

Unit III:

Hamilton's Equation:

Hamilton's Equation – Hamiltons Principle – Hamilton's Equation – Other Variational Principle.(Chapter 4 Sections 4.1 to 4.3)

Unit IV:

Hamilton – Jacobi Theory:

Hamilton – Jacobi Theory – Hamilton Principle Function – Hamilton – Jacobi Equation – Separability.(Chapter 5 Sections 5.1 to 5.3)

Unit V:

Canonical Transformation:

Canonical Transformation – Differential forms and generating functions – Special Transformations – Lagrange and poisson brackets. (Chapter 6 Sections 6.1 to 6.3)

Text Book:

D. Greenwood, Classical Dynamics, Prentice Hall of India, New Delhi, 1985.

Reference :

1. H.Goldstein, Classical Mechanics, Narosa Publishing House, NewDelhi, 2001.
2. J.L. Synge and B.A. Griffth, Principles of Mechanics, McGraw Hill Book Co. New York,1970.
3. N.C. Rane and P.S.C. Joag, Classical Mechanics, Tata McGraw Hill, New Delhi, 1991.

Core Course – IV
– Ordinary Differential Equations

Unit I:

Linear Equations with Constant Coefficients:

Introduction – Second order homogeneous equations – Initial value problem – Linear dependence and independence – A formula for the Wornskian. (Chapter 2: Section 1 to 5)

Unit II:

Linear Equations with Constant Coefficients (Contd.):

Non-homogeneous equations of order two – Homogenous and non-homogeneous equations of order n – Initial value problem – Annihilater method to solve a non-homogeneous equation. (Chapter 2: Section 6 to 11)

Unit III:

Linear Equations with Variable Coefficients:

Initial value problems for homogeneous equations – solutions of homogeneous equations- Wronskian and linear independence – Reduction of the order of homogeneous equation. (Chapter 3: Section 1 to 5)

Unit IV:

Linear Equations with Regular Singular Points:

Linear equation with regular singular points – Euler equation – second order equations with regular singular points – solutions and properties of Legendre and Bessels equation. (Chapter 3: Section 8 & Chapter 4: Section 1 to 4 and 7 and 8)

Unit V:

First Order Equation – Existence and Uniqueness:

Introduction – Existence and uniqueness of solutions of first order equations – Equations with variable separated – Exact equations – Method of successive approximations – Lipschitz Condition – Convergence of the successive approximations. (Chapter 5: Section 1 to 6)

Text Book:

E.A.Codington, An Introduction to Ordinary Differential Equation, Prentice Hall of India, New Delhi, 1994.

Reference:

1. R.P Agarwal and Ramesh C.Gupta, Essentials of Ordinary Differential Equation. McGraw, Hill, New York, 1991.
2. D.Somasundram, Ordinary Differential Equations, Narosa Publ.House, Chennai – 2002.
3. D.Raj, D.P.Choudhury and H.I.Freedman, A Course in Ordinary Differential Equations, Narosa Publ. House, Chennai, 2004.

Elective – I (Group A)
– Numerical Analysis

Unit I :

Numerical Solutions to ordinary differential equation:

Numerical solutions to ordinary differential equation – Power series solution – Pointwise method – Solution by Taylor's series – Taylor's series method for simultaneous first order differential equations – Taylor's series method for Higher order Differential equations – Predictor – Corrector methods – Milne's method – Adam – Bashforth method (Chapter 11: Sections 11.1 to 11.6 and Sections 11.8 to 11.20)

Unit II :

Picard and Euler Methods:

Picard's Method of successive approximations – Picard's method for simultaneous first order differential equations – Picard's method for simultaneous second order differential equations – Euler's Method – Improved Euler's method – Modified Euler's Method. (Chapter 11: Sections 11.7 to 11.12)

Unit III :

Runge – Kutta Method:

Runge's method – Runge-Kutta methods – Higher order Runge-Kutta methods-Runge-Kutta methods for simultaneous first order differential equations – Runge-Kutta methods for simultaneous second order differential equations. (Chapter 11: Sections 11.13 to 11.17)

Unit IV :

Numerical solutions to partial differential equations:

Introduction Difference Quotients – Geometrical representation of partial differential quotients – Classifications of partial differential equations – Elliptic equation – Solution to Laplace's equation by Liebmann's iteration process. (Chapter 12: Sections 12.1 to 12.6)

Unit V :

Numerical Solutions to partial differential equations (contd.)

Poisson equation – its solution – Parabolic equations – Bender – Schmidt method – Crank – Nicholson method – Hyperbolic equation – Solution to partial differential equation by Relaxation method. (Chapter 12: Sections 12.7 to 12.10)

Text Book:

V.N Vedamurthy and Ch. S.N.Iyengar; Numerical Methods, Vikas Publishing House Pvt Ltd., 1998.

(OR) **[Continued on Next page]**

Elective – I (Group A)
– Difference Equations

Unit I:

Difference Calculus:

Difference operator – Summation – Generating function – Approximate summation. (Chapter 2 Sections 2.1 to 2.3)

Unit II:

Linear Difference Equations:

First order equations – General results for linear equations.(Chapter 3 Sections 3.1 to 3.2)

Unit III:

Linear Difference Equations(Contd.):

Equations with constant coefficients – Equations with variable coefficients – z – transform. (Chapter 3 Sections 3.3,3.5 AND 3.7)

Unit IV:

Initial value problems for linear systems – Stability of linear systems. (Chapter 4 Sections 4.1 to 4.3)

Unit V:

Asymptotic analysis of sums – Linear equations (Chapter 5 Sections 5.1 to 5.3)

Text Book:

W.G.Kelley and A.C.Peterson, Difference Equations, Academic press, New York,1991.

Reference:

1. S.N.Elaydi, An Introduction to Difference Equations, Springer – Verleg, NewYork,1990
2. R.Mickens, Difference Equations, Van Nostrand Reinhold, New York, 1990.
3. R.P.Agarwal, Difference Equations and Inequalities Marcelm Dekker, New York,1992.

Core Course – V
– Complex Analysis

Unit I :
Complex Functions

Spherical representation of complex numbers – Analytic function – Limits and continuity – Analytic Functions – Polynomials – Rational functions – Elementary theory of Power series – Sequences – Series – Uniform Convergence – Power series – Abel's limit theorem – Exponential and Trigonometric functions – Exponential - Trigonometric functions – Periodicity – The Logarithm.

(Chapter 1 : Sections 2.4 and Chapter 2 : Sections 1 to 3)

Unit II :

Analytical Functions as Mappings

Analytical Functions as Mappings – Conformality - Arcs and closed curves – Analytic functions in Regions – Conformal mapping – Length and area – Linear transformations –Linear group – Cross ratio – Symmetry –Oriented Circles –Families of circles –Elementary conformal mappings –Use of level curves – Survey of Elementary mappings – Elementary Riemann surfaces.

(Chapter 3 : Sections 2 to 4)

Unit III :

Complex Integration

Complex Integration – Fundamental Theorems – Line integrals –Rectifiable Arcs- Line Integrals as Arcs – Cauchy's Theorem for a Rectangle and in a disk – Cauchy's Integral Formula – Index of point with respect to a closed curve- The Integral formula – Higher order derivatives – Local properties of analytic functions – Taylor's Theorem – Zeros and Poles –Local mapping - Maximum Principle.

(Chapter 4 : Sections 1 to 3)

Unit IV :

Complex Integration (Conted)

The general form of Cauchy's Theorem – Chains and Cycles – Simple connectivity – Homology – General statement of cauchy's theorem – Proof of Cauchy's theorem – Locally exact differentials – Multiply connected regions – Calculus of residues – Residue Theorem – Argument Principle-Evaluation of Definite Integrals

(Chapter 4 : Sections 4 and 5)

Unit V :

Harmonic functions and Power series expansions

Harmonic Functions – Definition and basic properties- Mean-Value Property- Poisson's formula's –Schwarz's Theorem – Reflection Principle- Weierstrass's theorem- Taylor's series –Laurent series.

(Chapter 4 : Sections 6 and Chapter 5 : Sections 1)

Text Books

L.V Ahifors, Complex Analysis, 3rd edition, Mc Graw Hill Inter., Edition, New Delhi,1979.

Books for Supplementary Reading and Reference:

1. J.B Conway, Functions of one Complex variable, Narosa Publ. House, New Delhi,1980
2. S.Ponnusamy,Foundations of Complex Analysis, Narosa Publ. House, New Delhi,2004.
3. S.Lang,Comlex-Analysis, Addison – Wesley Mass,1977.

Core Course – VI
– Advanced Abstract Algebra

Unit I

Rings and ring homomorphism's – ideals – Extension and Contraction, modules and module homomorphism – exact sequences

Unit II

Tensor product of modules – Tensor product of algebra – Local properties – extended and contracted ideals in rings of fractions

Unit III

Primary Decomposition – Integral dependence – The going-up theorem – The going-down theorem – Valuation rings

Unit IV

Chain conditions – Primary decomposition in Noethorian rings

Unit V

Artin rings – Discrete valuation rings – Dedekind domains – Fractional ideals

Text Book

Introduction to Commutative Algebra, by M.F.Atiyah and I.G.Macdonald, Addison – Wesley Publication Company, Inc, 1969.

Chapter 1-9

Reference Books

1. N.S. Gopalakrishnan, Commutative Algebra, Oxonian Press Pvt. Ltd, New Delhi, 1988
2. F.W. Andeson and K.R. Fuller, Rings and Categories of Modules, 2nd Edition, Graduate Text in Mathematics Vol. 13, Springer-Verlag, New York, 1992
3. H.Matsumura, Commutative ring theory, Cambridge University Press, 1986.

Core Course – VII
– Partial Differential Equations

Unit I:

Second order Partial Differential Equations:

Origin of second order partial differential equations – Linear differential equations with constant coefficients – Method of solving partial (linear) differential equation – Classification of second order partial differential equations – Canonical forms – Adjoint operators – Riemann method. (Chapter 2 : Sections 2.1 to 2.5)

Unit II:

Elliptic Differential Equations: Elliptic differential equations – Occurrence of Laplace and Poisson equations – Boundary value problems – Separation of variables method – Laplace equation in cylindrical – Spherical co-ordinates, Dirichlet and Neumann problems for circle – Sphere.(Chapter 3 : Sections 3.1 to 3.9)

Unit III:

Parabolic Differential Equations:

Parabolic differential equations – Occurrence of the diffusion equation – Boundary condition – Separation of variable method – Diffusion equation in cylindrical – Spherical co-ordinates (Chapter 4: Sections 4.1 to 4.5)

Unit IV:

Hyperbolic Differential Equations:

Hyperbolic differential equations – Occurrence of wave equation – One dimensional wave equation – Reduction to canonical form – D'Alembertz solution – Separation of variable method – Periodic solutions – Cylindrical – Spherical co-ordinates – Duhamel principle for wave equations.(Chapter 5 : Sections 5.1 to 5.6 and 5.9)

Unit V:

Integral Transform:

Laplace transforms – Solution of partial differential equation – Diffusion equation – Wave equation – Fourier transform – Application to partial differential equation – Diffusion equation – Wave equation – Laplace equation. (Chapter 6 : Sections 6.2 to 6.4)

Text Book:

J.N. Sharma and K.Singh, Partial Differential Equation for Engineers and Scientist, Narosa publ. House, Chennai, 2001.

Reference:

1. I.N.Snedden, Elemetns of Partial Differeential Equations, McGraw Hill, New York 1964.
2. K.Sankar Rao, Introduction to partial Differential Equations, Prentice Hall of India, New Delhi,1995.
3. S.J. Farlow, Partial Differential Equations for Scientists and Engineers, John Wiley sons, New York, 1982.

Course – IX
EDC – Optimization Techniques

Unit I:

Integer linear programming:

Introduction – Illustrative applications integer programming solution algorithms: Branch and Bound (B & B) algorithm – zero – One implicit enumeration algorithm – Cutting plane Algorithm. (Sections 9.1,9.2,9.3.1.,9.3.2,9.3.3)

Unit II:

Deterministic dynamic programming:

Introduction – Recursive nature of computations in DP – Forward and backward recursion – Selected DP applications cargo – Loading model – Work force size model – Equipment replacement model – Investment model – Inventory models. (Sections 10.1,10.2,10.3,10.4.1,10.4.2,10.4.3,10.4.4,10.4.5)

Unit III:

Decision analysis and games:

Decision environment – Decision making under certainty (Analytical Hierarchy approach) Decision making under risk – Expected value criterion – Variations of the expected value criterion – Decision under uncertainty Game theory – optimal solution of two – Person Zero – Sum games – Solution of mixed strategy games (Sections 14.1,14.2,114.3.1,14.3.2,14.4,14.5.1,14.5.2)

Unit IV:

Simulation modeling:

What is simulation – Monte carlo simulation – Types of simulation – Elements of discrete event simulation – Generic definition of events – Sampling from probability distributions. Methods for gathering statistical observations – Sub interval method – Replication method – Regenerative (Cycle) method – Simulation languages (Sections 18.1,18.2,18.3,18.4.1,18.4.2,18.5,18.6,18.7.1,18.7.2,18.7.3,18.8)

Unit V:

Nonlinear programming algorithms:

Unconstrained non linear algorithms – Direct search method – Gradient method Constrained algorithms: Separable programming – Quadratic programming – Geometric programming – Stochastic programming – Linear combinations method – SUMT algorithm (Sections : 21.1.1, 21.1.2, 21.2.1, 21.2.2, 21.2.3, 21.2.4, 21.2.5, 21.2.6)

Text Book:

Operations Research An Introduction 6^{th} edison by Hamdy A. Taha, University of Arkansas Fayetteville.

Reference:

1. F.S. Hillier and G.J. Lieberman Introduction to Operation Research 4^{th} edition, Mc Graw Hill Book Company, New York, 1989.
2. Philips D.T.Ravindra A. and Solbery.J. Operations Research, Principles and Practice John Wiley and Sons, New York.
3. B.E.Gillett, Operations research – A Computer Oriented Algorithmic Approach,TMH Edition, New Delhi, 1976.

Elective – II (Group B)
– Discrete Mathematics

Unit I:

Theory of inference:

Consistency of premises validity using truth table – Consistency of premises – Predicates – 15e statement function, Variables and quantifiers – Predicate formulae – Free and bound variables – Theory of inference for the predicate calculus (Chapter 1: Sections 1- 4.1, 1 - 4.2, 1 - 5.1, 1 - 5.2,1 - 5.3, 1 - 5.4, 1 - 6.4)

Unit II:

Set Theory:

Functions – Definition and introduction – Composition of functions – Inverse functions – Binary and n-ary Operations – Characteristic function of a set – Hashing functions – Peuno axioms and mathematical induction – Cardinality. (Chapter 2: 2 - 4.1, 2 - 4.2, 2 – 4.3, 2 – 4.4,2 – 4.5, 2 – 4.6, 2 – 5.1, 2 – 5.2)

Unit III:

Algebraic Structures:

Groups: Definition and Examples – Subgroups and homomorphism - Cosets and Lagrange's Theorem – Normal subgroups – Algebraic systems with Two Binary Operations.(Chapter 3 : Sections 3 – 5.1, 3 – 5.2, 3 – 5.3, 3 – 5.4, 3 – 5.5)

Unit IV:

Lattices and Boolean algebra:

Lattices as Algebraic Systems – Sub lattices, direct product and homomorphism – Boolean Algebra Definition and examples – Sub Algebra. Direct Product and homomorphism – Boolean functions, Boolean forms and free Boolean Algebras – Values of Boolean expression and Boolean functions. (Chapter 4: Sections 4 – 1.3, 4 – 1.4, 4 – 2.2, 4 – 3.4, 4 – 3.2)

Unit V:

Graph Theory:

Basic definitions – Paths – Rechability and Connectedness – Matrix representation of Graphs – Trees – Finite state machine: Introductory special circuits – Equivalence of finite state machines (Chapter 5: 5 – 1.1, 5 - 1.2, 5 – 1.3, 5 – 1.4)(Chapter 4: Sections 4 – 6.1, 4 – 6.2)

Text Book:

1. J.P. Trembley and R.Manohar, Discrete Mathematical Structures applications to Computer Science, Tata McGraw Hills, New Delhi, 1997.

References:

1. James C.Abbott, Sets, Lattices and Boolean algebra, Allya and Bacon Boston, 1969.
2. H.G.Flegg Boolean Algebra and its applications, John Wiley and Sons, Inc, NewYork, 1974.

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Elective – II (Group B)

– Fluid Dynamics

Unit I:

Kinematics of Fluids in Motion:

Real fluids and ideal fluids – Velocity of a fluid at a point stream lines – path lines – Steady and unsteady flows – Velocity potential – The velocity vector – Local and particle rates of changes – Equations of continuity – Examples. (Chapter 2: Sections 2.1 to 2.8)

Unit II:

Equation of Motion of a fluid:

Pressure at a point in a fluid at rest – Pressure at a point in a moving fluid – Condition at a boundary of two invicid immersible fluids. Euler's equation of motion – Discussion of the case of steady motion under conservative body forces. (Chapter 3: Sections 3.1 to 3.7)

Unit III:

Some three dimensional flows:

Introduction – Sources – Sinks and doublets – Images in rigid infinite plane – Axis symmetric flows – Stokes stream function. (Chapter 4: Sections 4.1 to 4.3 and 4.5)

Unit IV:

Some two-dimensional flows:

Two dimensional flows – Meaning of two dimensional flow – Use of cylindrical polar co-ordinates – The stream function – Complex potential for two dimensional – Irrational incompressible flow – Complex velocity potential for standard two dimensional flows – Examples. (Chapter 5: Sections 5.1 to 5.6)

Unit V:

Viscous flows:

Viscous flows – Stress components in a real fluid – Relation between Cartesian components of stress – Translation motion of fluid elements – The rate of strain quadric and principle stresses – Further properties of the rate of strain quadric – Stress analysis in fluid motion – Relation between stress and rate of strain – The coefficients of viscosity and Laminar flow – The Navier – Stokes equations of motion of a viscous fluid. (Chapter 8: Sections 8.1 to 8.9)

Text Book:

F. Chorlton, Text Book of Fluid Dynamic, CBS Publication New Delhi, 1985.

References:

1. G.K. Batchaelor, An Introduction to Fluid Mechanics, Foundation Books, New Delhi,1994.
2. S.W. Yuan, Foundations of Fluid Mechanics, Prentice Hall of India Pvt.Ltd., New Delhi, 1976.
3. R.K. Rathy, An Introduction to Fluid Dynamics, IBH Publ. Comp. New Delhi, 1976.

Core Course – X
– Topology

Unit I:

Topological spaces:

Topological spaces - Basis for a topology – The order topology - The product topology on XxY – The subspace topology – Closed sets and limit points. (Chapter 2: sections 12 to 17)

Unit II:

Continuous functions :

Continuous functions – The product topology – The metric topology. (Chapter 2: Sections 18 to 21)

Unit III:

Connectedness:

Connected spaces – Connected subspaces of the real line – Components and local connectedness. (Chapter 3: Sections 23 to 25)

Unit IV:

Compactness: Compact spaces – Compact subspace of the real line –Limit point compactness – Local compactness. (Chapter 3: Sections 26 to 29)

Unit V:

Countability and Separation axioms:

The countability axioms – The separation axioms – Normal spaces – The Urysohn lemma – The Urysohn metrization theorem – The Tietze extension theorem. (Chapter 4: Sections 30 to 35)

Text Book:

James R.Munkres – Topology, 2nd edition, Prentice Hall of India Ltd., New Delhi, 2005

References:

1. J. Dugundji, Topology, Prentice Hall of India, New Delhi,1975.
2. G.F.Simmons, Introduction to Topology and Modern Analysis, McGraw Hill Book Co, New York, 1963.
3. S.T. Hu, Elements of General Topology, Holden Day, Inc. New York, 1965.

Core Course – XI
– Measure Theory and Integration

Unit I:

Lebesgue Measure:

Lebesgue Measure – Introduction – Outer measure – Measurable sets and Lebesgue measure – Measurable functions – Little Woods' Three Principle. (Chapter 3: Sections 1 to 3, 5 and 6)

Unit II:

Lebesgue integral :

Lebesgue integral – The Riemann integral – Lebesgue integral of bounded functions over a set of finite measure – The integral of a nonnegative function – The general Lebesgue integral.(Chapter 4: Sections 1 to 4)

Unit III:

Differentiation and Integration :

Differentiation and Integration – Differentiation of monotone functions – Functions of bounded variation – Differentiation of an integral – Absolute continuity. (Chapter 5: Sections 1 to 4)

Unit IV :

General Measure and Integration :

General Measure and Integration – Measure spaces – Measurable functions – integration – Signed Measure – The Radon – Nikodym theorem. (Chapter 11: Sections 1 to 3, 5 and 6)

Unit V:

Measure and Outer Measure

Measure and outer measure – outer measure and measurability – The Extension theorem – Product measures. (Chapter 12: Sections 1, 2 and 4)

Text Book:

1. H.L.Royden, Real Analysis, Mc Millian Publ. Co, New York, 1993.

Reference:

1. G. de Barra, Measure Theory and integration, Wiley Eastern Ltd, 1981.
2. P.K. Jain and V.P. Gupta, Lebesgue Measure and Integration, New Age Int. (P) Ltd., NewDelhi, 2000.
3. Walter Rudin, Real and Complex Analysis, Tata McGraw Hill Publ. Co. Ltd., New Delhi, 1966.

Core Course – XII
– Graph Theory

Unit I:

Graphs and Subgraphs:

Graphs and simple graphs – Graph isomorphism – Incidence and Adjacency Matrices – Subgraphs – Vertex degrees – Paths and connection – Cycles – Application – The shortest path problem.(Chapter 1 : Sections 1.1 to 1.8)

Unit II:

Trees and Connectivity:

Trees – Cut edges and bonds – Cut vertices – Cayley's formula - Application – Connector problem – Connectivity – Blocks – Application – Reliable Communication Networks. (Chapter 2: Sections 2.1 to 2.5 and Chapter 3: Sections 3.1 to 3.3)

Unit III:

Euler Tours and Matchings:

Euler Tours – Hamilton cycles – Application – Chinese Postman Problem – Traveling salesman problem - Matchings – Matching and coverings in Bipartite Graphs – Perfect Matchings – Applications – Personal Assignment Problem – Optimal Assignment Problem. (Chapter 4: Sections 4.1 to 4.4 and Chapter 5: Sections 5.1 to 5.5)

Unit IV:

Edge Colouring and Independent sets:

Edge Colouring – Edge Chromatic Number – Vizings Theorem – Application – Timetabling Problem – Independents sets – Ramsey's Theorem – Turan's Theorem. (Chapter 6: Sections 6.1 to 6.3 and Chapter 7: Sections 7.1 to 7.3)

Unit V:

Vertex Colourings:

Vertex Colourings – Chromatic Number – Brook Theorem – Hajos conjecture – Chromatic Polynomials – Girth and Chromatic Number – A storage problem.

(Chapter 8 : Sections 8.1 to 8.6)

Text Book:

J.A.Bondy and U.S.R. Murty, Graph Theory with Applications, North Holland, New York, 1982.

References:

1. Narasing Deo, Graph Theory with Application to Engineering and Computer Science, Prentice Hall of India, New Delhi. 2003.
2. F. Harary, Graph Theory, Addison – Wesely Pub. Co. The Mass. 1969.
3. L. R.. Foulds, Graph Theory Application, Narosa Publ. House, Chennai, 1933.

Core Course – XIII
– Calculus of Variations and Integral Equations

Unit I:

Variational problems with fixed boundaries:

The concept of variation and its properties – Euler's equation- Variational problems for Functionals – Functionals dependent on higher order derivatives – Functions of several independent variables – Some applications to problems of Mechanics (Chapter 1: Sections 1.1 to 1.7)

Unit II:

Variational problems with moving boundaries:

Movable boundary for a functional dependent on two functions – one-side variations – Reflection and Refraction of extermals – Diffraction of light rays.

(Chapter 2: Sections 2.1 to 2.5)

Unit III:

Integral Equation:

Introduction – Types of Kernels – Eigen Values and Eigen functions – Connection with differential equation – Solution of an integral equation – Initial value problems – Boundary value problems. (Chapter 1: Section 1.1 to 1.3 and 1.5 to 1.8)

Unit IV:

Solution of Fredholm integral equation:

Second kind with separable kernel – Orthogonality and reality eigen function – Fredholm Integral equation with separable kernel – Solution of Fredholm integral equation by successive substitution – Successive approximation – Volterra Integral equation – Solution by successive substitution.

(Chapter 2: Sections 2.1 to 2.3 and Chapter 4 Sections 4.1 to 4.5)

Unit V:

Hilbert – Schmidt Theory:

Complex Hilbert space – Orthogonal system of functions- Gram Schmit orthogonlization process – Hilbert – Schmit theorems – Solutions of Fredholm integral equation of first kind. (Chapter 3: Section 3.1 to 3.4 and 3.8 to 3.9)

Text Books:

1. A.S Gupta, Calculus of Variations with Application, Prentice Hall of India, New Delhi, 2005.
2. Sudir K.Pundir and Rimple Pundir, Integral Equations and Boundary Value Problems, Pragati Prakasam, Meerut, 2005.

References:

1. F.B. Hildebrand, Methods of Applied Mathematics, Prentice – Hall of India Pvt. New Delhi, 1968.
2. R. P. Kanwal, Linear Integral Equations, Theory and Techniques, Academic Press, New York, 1971.
3. L. Elsgolts, Differential Equations and Calculus of Variations, Mir Publishers, Moscow, 1973.

Elective – III (Group C)
– Number Theory

Unit I:

Divisibility and Congruence:

Divisibility – Primes - Congruence's – Solutions of Congruence's – Congruence's of Degree one. (Chapter 1: Sections 1.1 to 1.3 and Chapter 2: Sections: 2.1 to 2.3)

Unit II:

Congruence:

The function $\phi(n)$ – Congruence of higher degree – Prime power moduli – Prime modulus – Congruence's of degree two, prime modulus – power Residues.
(Chapter 2: Sections 2.4 to 2.9)

Unit III: Quadratic reciprocity:

Quadratic residues – Quadratic reciprocity – The Jacobi symbol – Greatest Integer function. (Chapter 3: Sections 3.1 to 3.3 and Chapter 4: Section 4.1)

Unit IV:Some Functions of Number Theory:

Arithmetic functions –The Mobius inverse formula – The multiplication of arithmetic functions. (Chapter 4: Sections 4.2 to 4.4)

Unit V:Some Diaphantine equations:

The equation ax + by= c – positive solutions – Other linear equations – The equation $x^2 + y^2 = z^2$- The equation $x^4 + y^4 = z^4$ Sums of four and five squares – Waring's problem – Sum of fourth powers – Sum of Two squares. (Chapter 5: Sections 5.1 to 5.10)

Text Book:

1. Ivan Niven and H.S Zuckerman, An Introduction to the Theory of Numbers, 3rd edition, Wiley Eastern Ltd., New Delhi, 1989.

References:

1. D.M. Burton, Elementary Number Theory, Universal Book Stall, New Delhi 2001.
2. K.Ireland and M.Rosen, A Classical Introduction to Modern Number Theory, Springer Verlag, New York, 1972.
3. T.M Apostol, Introduction to Analytic Number Theory, Narosa Publication, House, Chennai, 1980.

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Elective – III (Group C)
– Fuzzy Sets and Their Applications

Unit I:

Fuzzy sets:

Fuzzy sets – Basic types – Basic concepts - Characteristics – Significance of the paradigm shift – Additional properties of α - Cuts (Chapter 1: Sections 1.3 to 1.5 and Chapter 2: Sections 2.1)

Unit II:

Fuzzy Sets Versus CRISP Sets:

Representation of Fuzzy sets – Extension principle of Fuzzy sets – Operation on Fuzzy Sets – Types of Operation – Fuzzy complements. (Chapter 2: Sections 2.2 to 2.3 and Chapter 3: Sections 3.1 to 3.2)

Unit III:

Operations on Fuzzy Sets:

Fuzzy intersection – t-norms, Fuzzy unions – t conorms – Combinations of operations – Aggregation operations. (Chapter 3: Sections 3.3 to 3.6)

Unit IV:

Fuzzy Arithmetic:

Fuzzy numbers – Linguistic variables – Arithmetic operation on intervals – Lattice of Fuzzy numbers. (Chapter 4: Sections 4.1 to 4.4)

Unit V:

Constructing Fuzzy Sets:

Methods of construction: An overview – Direct methods with one expert – Direct method with multiple experts – indirect method with multiple experts and one expert – Construction from sample data. (Chapter 10: Sections 10.1 to 10.7)

Text Book:

G.J. Klir, and Bo Yuan, Fuzzy Sets and fuzzy Logic: Theory and Applications, Prentice Hall of India Ltd., New Delhi, 2005.

References:

1. H.J. Zimmermann, Fuzzy Set Theory and its Applications, Allied Publishers, Chennai, 1996.
2. A.Kaufman, Introduction to the Theory of Fuzzy Subsets, Academic Press, New York, 1975.
3. V.Novak, Fuzzy Sets and Their Applications, Adam Hilger, Bristol, 1969.

Core Course – XIV

– Functional Analysis

Unit I:

Banach Spaces:

Banach Spaces – Definition and examples – Continuous linear transformations – Hahn Banach theorem (Chapter 9 : Sections 46 to 48)

Unit II:

Banach Spaces and Hilbert Spaces:

The natural embedding of N in N** - Open mapping theorem – Conjugate of an operator – Hilbert space – Definition and properties. (Chapter 9 : Sections 49 to 51, Chapter 10 : Sections 52)

Unit III:

Hilbert Spaces:

Orthogonal complements – Orthonormal sets – Conjugate space H* - Adjust of an operator (Chapter 10 : Sections 53 to 56)

Unit IV:

Operations on Hilbert Spaces:

Self adjoint operator – Normal and Unitary operators – Projections.(Chapter 10: Sections 57 to 59)

Unit V:

Banach Algebras:

Banach Algebras – Definition and examples – Regular and simple elements – Topological divisors of zero – Spectrum – The formula for the spectral radius – The radical and semi simplicity. (Chapter 12 : Sections 64 to 69)

Text Book:

1. G.F.Simmons, Introduction to Topology and Modern Analysis, McGraw Hill Inter. Book Co, New York, 1963.

References:

1. W. Rudin, Functional Analysis, Tata McGraw Hill Publ. Co, New Delhi, 1973.
2. H.C. Goffman and G.Fedrick, First Course in Functional Analysis, Prentice Hall of India , New Delhi, 1987.
3. D. Somasundaram, Functional Analysis S. Viswanathan Pvt.Ltd., Chennai,1994.

Core Course – XV
– Differential Geometry

Unit I:

Theory of Space Curves:

Theory of space curves – Representation of space curves – Unique parametric representation of a space curve – Arc-length – Tangent and osculating plane – Principle normal and binormal – Curvature and torsion – Behaviour of a curve near one of its points – The curvature and torsion of a curve as the intersection of two surfaces. (Chapter 1 : Sections 1.1 to 1.9)

Unit II:

Theory of Space Curves (Contd.):

Contact between curves and surfaces – Osculating circle and osculating sphere – Locus of centre of spherical curvature – Tangent surfaces – Involutes and Evolutes – Intrinsic equations of space curves – Fundamental Existence Theorem – Helices.

(Chapter 1 : Sections 1.10 to 1.13 and 1.16 to 1.18)

Unit III:

Local Intrinsic properties of surface:

Definition of a surface – Nature of points on a surface – Representation of a surface – Curves on surfaces – Tangent plane and surface normal – The general surfaces of revolution – Helicoids – Metric on a surface – Direction coefficients on a surface

(Chapter 2 : Sections 2.1 to 2.10)

Unit IV:

Local Intrinsic properties of surface and geodesic on a surface:

Families of curves – Orthogonal trajectories – Double family of curves – Isometric correspondence – Intrinsic properties – Geodesics and their differential equations – Canonical geodesic equations – Geodesics on surface of revolution.

(Chapter 2: Sections 2.11 to 2.15 and Chapter 3: Sections 3.1 to 3.4)

Unit V:

Geodesic on a surface:

Normal property of Geodesics – Differential equations of geodesics using normal property – Existence theorems – Geodesic parallels – Geodesic curvature – Gauss Bonnet Theorems – Gaussian curvature – Surface of constant curvature

(Chapter 3: Sections 3.5 to 3.8 and Sections 3.10 to 3.13)

Text Book:

1. D. Somasundaram, Differential Geometry, Narosa Publ. House, Chennai, 2005

References:

1. T. Willmore, An Introduction to Differential Geometry, Clarendan Press, Oxford, 1959.

2. D.T Struik, Lectures on Classical Differential Geometry, Addison – Wesely, Mass. 1950.
3. J.A. Thorpe, Elementary Topics in Differential Geometry, Springer – Verlag, New York, 1979.

Core Course – XVI
– Programming with C++

Unit I:

Software Evolution – Procedure oriented Programming – Object oriented programming paradigm – Basic concepts of object oriented programming – Benefits of oops – Object oriented Languages – Application of OOP – Beginning with C++ - what is C++ - Application of C++ - A simple C++ Program – More C++ Statements – An Example with class – Structure of C++ Program.

Unit II:

Token, Expressions and control structures: Tokens – Keywords – Identifiers and Constants – Basic Data types – User defined Data types – Derived data types – Symbolic Constants in C++ - Scope resolution operator – Manipulators – Type cost operator – Expressions and their types – Special assignment expressions – Implicit Conversions – Operator Overloading – Operator precedence – Control Structure.

Unit – III:

Function in C++: Main Function – function prototyping – Call by reference – Return by reference – Inline functions – default arguments – Const arguments – Function overloading – Friend and Virtual functions – Math library function.

Class and Objects: Specifying a class – Defining member functions – A C++ program with class – Making an outside function inline – Nesting of member functions – Private member functions – Arrays within a class – Memory allocations for objects – Static data member – Static member functions – Array of the object – Object as function arguments – Friendly functions – Returning objects – Const member functions – Pointer to members – Local classes

Unit IV:

Constructors and Destructors: Constructors – Parameterized Constructors in a Constructor – Multiple constructors in a class – Constructors with default arguments – Dynamic Initialization of objects – Copy constructors – Dynamic Constructors – Constructing Two-dimensional arrays – Const objects – Destructors.

Operator overloading and type conversions: Defining operator overloading – overloading unary operators – overloading binary operators - overloading binary operators using friends – Manipulation of strings using operators – Rules for overloading operators – Type conversions.

Unit V:

Files: Introduction – Class for file stream operations – opening and closing a file – detecting End-of file – More about open () File modes – File pointer and their manipulations – Sequential input and output operations.

Exception Handling: Introduction – Basics of Exception Handling – Exception Handling Mechanism – Throwing Mechanism – Catching Mechanism – Rethrowing an Exception.

Text Book:

Object-Oriented Programming with C++ 2nd Edition, E.Balagrurusamy, Tata McGraw Hill Pub. 1999.

References:

1. Robert Lafore – “The Waite Group’s Object Oriented Programming In Turbo C++ - Galgotia Publication Pvt. Ltd. 1998.
2. Allan Neibaver – Office 2000.

Elective – IV (Group D)
– Control Theory

Unit I:

Observability:

Linear Systems – Observability Grammian – Constant coefficient systems – Reconstruction kernel – Nonlinear systems

Unit II:

Controllability:

Linear Systems – Controllability Grammian – Adjoint systems – Constant coefficient systems – Steering function – Nonlinear systems

Unit III:

Stability:

Stability – Uniform Stability – Asymptotic Stability of Linear Systems – Linear time varying systems – Perturbed linear systems – Nonlinear Systems.

Unit IV:

Stabilizability:

Stabilization via linear feedback control – Bass method – Controllable subspace – Stabilization with restricted feedback.

Unit V:

Optimal Control:

Linear time varying systems with quadratic performance criteria – Matrix Riccati equation – Linear time invariant systems – Nonlinear systems

Text Book:

K. Balachandran and J.P Dauer, Elements of Control Theory, Narosa Publ., New Delhi, 1999.

References:

1. R. Conti, Linear Differential Equations and Control, Academic Press, London, 1976.
2. R.F. Curtain and A.J. Pritchard, Functional Analysis and Modern Applied Mathematics, Academic Press, New York, 1977.
3. J. Klamka, Controllability of Dynamical systems, Kluwer Academic Publisher, Dordrecht, 1991.

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Elective – IV (Group D)
– Mathematical Statistics

Unit I:

Probability and Random Variables:

Probability – Axioms – Combinatorics, Probability on finite sample spaces – Conditional probability and Baye's theorem - Independence of events – Random variables – Probability distribution of a random variable – Discrete and continuous random variables – Function of a random variable. (Chapter 1: Sections 1.3 to 1.6 and Chapter 2: Sections 2.2 to 2.5)

Unit II: Moments and Generating Functions:

Moments of a distribution function – Generating functions – Some moment inequalities. (Chapter 3: Sections 3.2 to 3.4)

Unit III:

Multiple Random Variables:

Multiple random variables – Independent random variables – Functions of several random variables. (Chapter 4: Sections 4.2 to 4.4)

Unit IV: Multiple Random Variables (Contd.):

Covariance, Correlation and moments – Conditional expectation – Some discrete distributions – Some continuous distributions. (Chapter 4: Sections 4.5 and 4.6 and Chapter 5: Sections 5.2 to 5.3)

Unit V:

Limit Theorems:

Modes of convergence – Weak law of large numbers – Strong law of large numbers – Central limit theorems. (Chapter 6: Sections 6.2 to 6.4 and 6.6)

Text Book:

1. V.K. Rohatgi and Statistics, John Wiley Pvt, Singapore, 2001.

Reference:

1. G.G. Roussas, A First Course in Mathematical Statistics, Addition Wesley Publ. Co. Mass, 1973.
2. M. Fisz, Probability Theory and Mathematical Statistics, John Wiley, New York, 1963.
3. E.J. Dudewisg and S.N. Mishra, Modern Mathematical Statistics, John Wiley, New York, 1988.

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Elective – IV (Group D)
– C++ Programming Lab

1. Create two classes DM and DB, which store the value of distances. DM stores distances in meters and centimeters in DB in feet and inches. Write a program that can create the values for the class objects and add object DM with another object DB.
2. Create a class FLOAT that contains on float data member overload all the four arithmetic operators so that operates on the objects of FLOAT.
3. Design a class polar, which describes a part in a plane using polar coordinates radius and angle. A point in polar coordinates is as shown below. Use the overloads +operator to add two objects of polar. Note that we cannot add polar values of two points directly. The requires first the conversion points into rectangular coordinates and finally creating the result into polar coordinates.
   [Where rectangle co-ordinates: x = r* cos(a); y = r* sin(a);
   Polar co-ordinates: a = atan (x/y) r = Sqrt (x*x + y*y)]
4. Create a class MAT of size m*m. Define all possible matrix operations for MAT type objects verify the identity. (A-B)^2+B^2-2*A*B.
5. Area computation using derived class.
6. Define a class for vector containing scalar values. Apply overloading concepts for vector additions, multiplication of a vector by a scalar quantity, replace the values in a position vector.
7. Integrate a function using Simson’s 1/3 rule.
8. Solve the system of equations using Guass Sedel method.
9. Solve differential equations using Runge Kutta forth order method.

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