PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR

SALEM - 11

M.Sc. BRANCH-I: MATHEMATICS

(SEMESTER PATTERN)

(Under Choice Based Credit System)

REGULATIONS AND SYLLABUS

(For Candidates admitted in the Colleges affiliated to Periyar University from 2017-2018 onwards)

PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR

SALEM - 11

M.Sc. BRANCH-I: MATHEMATICS

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PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR

SALEM – 11

M.Sc. DEGREE PROGRAMME

(Semester System)

FACULTY OF SCIENCE BRANCH - I: MATHEMATICS

(Choice Based Credit System)

REGULATIONS AND SYLLABUS

(For Candidates admitted in the Colleges affiliated to Periyar University from 2017-2018 onwards)

1. Objectives of the Course:

In recent days Mathematics 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 impart 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. Commencement of this Regulation:

These regulations shall take effect from the academic year 2017-2018, that is, for students who are admitted to the first year of the course during the academic year 2017-2018 and thereafter.

3.Definitions:

Programme : Programme means a course of study leading to the award of the degree in a discipline.

Course : Course refers to the subject offered under the degree Programme.

4. 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 are eligible for admission to M.Sc., Degree Programme (consist of two academic years divided into four semester) and shall be permitted to appear and qualify for the Master of Science (M.Sc.) Degree Examination in Mathematics of this University.

5. Duration of the Course:

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

6. Syllabus:

The syllabus of the PG degree Programme has been divided into the following courses:

i. Core Courses,

ii. Elective Courses, and

iii. Extra Disciplinary Course (EDC).

i. Core Courses:

The core courses related to the programme concerned including practicals and project work offered under the programme.

ii. Elective Courses :

There are FOUR Elective Courses offered under the programme related to the major or non major but are to be selected by the students.

iii. Extra Disciplinary Course (EDC):

There is an **Extra Disciplinary Course** offered under the programme related to the non-major but are to be selected by the students.

7. Credits:

Weightage given to each course of study is termed as **credit.**

8. Credit System:

The weightage of credits are spread over to four different semester during the period of study and the cumulative credit point average shall be awarded based on the credits earned by the students. A total of 92 credits are prescribed for the Post Graduate programme.

9. Course of Study:

The course of study for the degree shall be in Branch I-Mathematics (under Choice Based Credit System) with internal assessment according to syllabi prescribed from time to time.

10. Structure of the Programme:

Sem.	Course Code	Title of the Course	Hours	Credit	Marks		
					CIA (Int.)	EA (Ext.)	Total
I	17PMA01	LINEAR ALGEBRA	6	5	25	75	100
	17PMA02	REAL ANALYSIS	6	5	25	75	100
	17PMA03	MECHANICS	6	4	25	75	100
	17PMA04	ORDINARY DIFFERENTIAL EQUATIONS	6	4	25	75	100
		ELECTIVE - I FROM **GROUP - A**	6	4	25	75	100
II	17PMA05	ALGEBRA	6	5	25	75	100
	17PMA06	FLUID DYNAMICS	6	5	25	75	100
	17PMA07	COMPLEX ANALYSIS	6	4	25	75	100
	17PHR01	HUMAN RIGHTS	2	2	-	100	100
		EDC FROM THE LIST	4	4	25	75	100
		ELECTIVE – II FROM **GROUP - B**	6	4	25	75	100
III	17PMA08	PARTIAL DIFFERENTIAL EQUATIONS	6	5	25	75	100
	17PMA09	TOPOLOGY	6	5	25	75	100
	17PMA10	MEASURE THEORY AND INTEGRATION	6	5	25	75	100
	17PMA11	CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS	6	4	25	75	100
		ELECTIVE – III FROM **GROUP - C**	6	4	25	75	100
IV	17PMA12	FUNCTIONAL ANALYSIS	6	5	25	75	100
	17PMA13	PROBABILITY THEORY	6	4	25	75	100
	17PMA14	GRAPH THEORY	6	5	25	75	100
		ELECTIVE – IV FROM **GROUP – D** ***(Theory Paper or Practical Paper)*** **T-*Theory Paper* ; P-*Practical Paper*.**	T-6 P-6	T-4 P-4	T-25 P-40	T-75 P-60	100
	17PMA15	PROJECT	6	5	-	100	100
		TOTAL	**120**	**92**	**--**	**--**	**2100**

(Ii) List of Elective Courses:

SEMESTER / ELECTIVE COURSE	PAPER CODE	PAPER TITLE
I	**GROUP A**	
	17PMAE01	Numerical Analysis
	17PMAE02	Difference Equations
II	**GROUP B**	
	17PMAE03	Discrete Mathematics
	17PMAE04	Combinatorial Mathematics
III	**GROUP C**	
	17PMAE05	Differential Geometry
	17PMAE06	Programming with C++
IV	**GROUP D**	
	17PMAE07	Number Theory (T)
	17PMAE08	Optimization techniques (T)
	17PMAE09	C++ Programming Lab (P)

(ii) **List of Extra Disciplinary Courses (EDC):**

Sl.No.	PAPER CODE	PAPER TITLE
1	17PMAED1	Numerical & Statistical Methods
2	17PMAED2	Statistics

11. 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.

12. Question Paper Pattern and Marks Distribution:

(i) Question Paper Pattern and Marks Distribution for Theory Examination:

TITLE OF THE PAPER

Time: Three Hours **Maximum Marks:** 75

Part – A (10 X 2 = 20 Marks)

Answer **ALL** Questions

(Two Questions from each unit)

Part – B (5 X 5 = 25 Marks)

Answer **ALL** Questions

(Two Questions from each unit with internal choice)

Part – C (3 X 10 = 30 Marks)

Answer any **Three** questions out of **Five** questions

(One question from each unit).

(ii) Question Paper Pattern and Marks Distribution for C++ Programming Lab :

Question Paper Pattern:

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.

The answer should contain i) Algorithm (A), ii) Flow Chart (F), iii) Program (P), iv) Execution of the Program with correct output (E & OP), and v) viva-voce (V).

Marks Distribution for C++ Programming Lab :

Maximum marks:100

Internal (CIA) : 40

External Assessment (EA- Practical Examination) : 60

(Practical Written Exam.: 50 Marks (The split up marks of this total marks 50 is, for A-05 , F-05, P-10, E -20 & OP-05 and V-05) and **Record:10 Marks).**

13. 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 (COE) and the student can have the rest.

(**c) Format to be followed:**

The format of the Project / Dissertation to be prepared and submitted by the students in Semester IV is given below:

Format for the preparation of Project work:

i) Title page:

TITLE OF THE PROJECT / DISSERTATION

Project / dissertation Submitted in partial fulfillment of the requirement for the award of the Degree of Master of Science in **MATHEMATICS (under Choice Base Credit System)** to the

Periyar University,

Periyar Palkalai Nagar,

Salem -636 011.

By

(Student's Name)

(Register Number)

Under the Guidance of

(Guide Name and Designation)

(College Logo)

(Name of the Department)

(College Address)

(Month and Year)

ii) Bonafide Certificate:

CERTIFICATE

This is to certify that the dissertation entitled ……submitted in partial fulfillment of the requirement of the award of the Degree of Master of Science in **MATHEMATICS (Under Choice Based Credit System)** 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 and that the work has not been published in part or full in any scientific or popular journals or magazines

Date:

Place: Signature of the Guide

Signature of the Head of the Department.

(iii) Acknowledgement:

(Drafted by the student)

(iv) Table of contents:

TABLE OF CONTENTS

14. Minimum Marks for Passing:

i) Theory Papers: The candidate shall be declared to have passed the examination if the candidate secures not less than 50 marks in total (CIA mark + Theory Exam mark) with minimum of 38 marks in the Theory Exam conducted by the University.

The **Continuous Internal Assessment (CIA) Mark** 25 is distributed to four components viz., **Tests, Assignment, Seminar** and **Attendance** as **10, 05, 05** and **05** marks, respectively.

ii) **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.

iii) **Project Work/Dissertation 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/Dissertation shall be declared Re-Appear* (RA) *and he / she has to appear and pass the same at a subsequent appearance.

15. 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.**

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

The maximum duration for completion of the PG Programme shall not exceed Four Years from the year of admission.

17. Transitory Provision:

Candidates who were admitted to the PG course of study before 2017-2018 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 2020. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.

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SYLLABUS - CORE COURSES

SEMESTER - I

CORE PAPER – I

LINEAR ALGEBRA

Paper Code : 17PMA01 **Max. Marks: 75**

Credit: 05

Unit I : Linear Transformation:

The algebra of linear transformations-Isomorphism of vector spaces-Representations of linear transformations by matrices - Linear functional-The double dual - The transpose of a linear transformation.

(Chapter 3: Sections: 3.1 - 3.7).

Unit II: Algebra of Polynomials:

The algebra of polynomials - Lagrange interpolation - Polynomial ideals - The prime factorization of a polynomial - Determinant functions.

(Chapter 4: Sections: 4.1 - 4.5, Chapter 5: Sections: 5.1 & 5.2).

Unit III: Determinants:

Permutations and the uniqueness of determinants-Classical adjoint of a (square) matrix - Inverse of an invertible matrix using determinants - Characteristic values - Annihilating polynomials.

(Chapter 5: Sections: 5.3 & 5.4, Chapter 6: Sections : 6.1 -6.3).

Unit IV: Diagonalization:

Invariant subspaces - Simultaneous triangulations - Simultaneous diagonalizations - Direct-sum decompositions - Invariant sums - Primary decomposition theorem.

(Chapter 6: Sections: 6.4 -6.8).

Unit V: The Rational and Jordan Forms:

Cyclic subspaces and annihilators-Cyclic decompositions and rational form-The Jordan form-Computation of invariant factors.(Chapter 7: Sections 7.1 - 7.4).

Text book:

1. **Kennath M. Hoffman and Ray Kunze,** Linear Algebra,2nd Edition, Pearson India Publishing, New Delhi, 2015.

Books for Reference:

1.M.Artin,Algebra, Prentice Hall of India Pvt. Ltd., New Delhi ,2005

2.S.H.Friedberg,A.J.Insel and L.E.Spence, Linear Algebra,4th Edition, Prentice Hall of India Pvt. Ltd., New Delhi,2009.

3. I.N Herstein : Topics in Algebra, 2nd Edition, Wiley Eastern Ltd. New Delhi, 2013.

4.J.J.Rotman,Advanced Modern Algebra,2nd Edition, Graduate Studies in Mathematics, Vol.114, AMS, Providence, Rhode Island,2010.

5. G.Strang, Introduction to Linear Algebra,2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi,2013.

SEMESTER - I

CORE PAPER –II

REAL ANALYSIS

Paper Code : 17PMA02/17PMACA02 **Max. Marks: 75**

Credit: 05

Unit I: Differentiation:

Differentiation - The derivative of a real function – Mean value Theorems – The continuity of the Derivative – L' Hospital's Rule – Derivatives of Higher order – Taylor's theorem – Differentiation of Vector–valued functions.

(Chapter 5: Page Number: 103 – 119).

Unit II: Riemann – Stieltjes Integral:

The Riemann - Stieltjes Integral – Definition and Existence of the Integral – Properties of the Integral – Integration and Differentiation – Integration of Vector–valued functions – Rectifiable curves.

(Chapter 6: Page Number: 120 – 142).

Unit III: Sequences and Series of Functions:

Sequences and Series of Functions – Discussion of main problem – Uniform Convergence - Uniform Convergence and Continuity - Uniform Convergence and Integration-Uniform Convergence and Differentiation, Equicontinuous families of functions – Stone Weierstrass Theorem.

(Chapter 7: Page Number: 143 – 171).

Unit IV: Some Special Functions:

Some Special Functions – Power Series – The Exponential and Logarithmic functions – The Trigonometric functions- The algebraic completeness of the complex field – Fourier series - The Gamma function. (Chapter 8: Page Number: 172 – 203).

Unit V:

Linear transformations, Differentiation, the contraction principle, the inverse function theorem, the implicit function theorem.(Chapter 9).

Text book:

1.Walter Rudin – Principles of Mathematical Analysis, 3rd edition, Mc Graw Hill Book Co., Kogaskusha, 1976.

Books for Reference:

1. T.M. Apostol, Mathematical Analysis, Narosa Publ. House, New Delhi, 1985.
2. H.L.Royden, Real Analysis, Macmillian Publn.Co.Inc.4th Edition, New York,1993
3. V.Ganapathy Iyer, Mathematical Analysis, Tata McGraw Hill, New Delhi,1970.

SEMESTER - I

CORE PAPER –III

MECHANICS

Paper Code : 17PMA03 **Max. Marks: 75**

Credit : 04

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:

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

Books for 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.

SEMESTER - I

CORE PAPER –IV

ORDINARY DIFFERENTIAL EQUATIONS

Paper Code: 17PMA04 **Max..Marks: 75**
Credit: 04

Unit I: Linear Equations with Constant Coefficients:

Introduction – Second order homogeneous equations – Initial value problem – Linear dependence and independence – A formula for the Wronskian.

(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 – Annihilator 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 Bessel 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:

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

Books for 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,2004.

SEMESTER -II

CORE PAPER –V

ALGEBRA

Paper Code : 17PMA05 / 17PMACA01 **Max.. Marks: 75**

Credits: 05

Unit I:

Another Counting Principle-Sylows Theorem.

(Chapter 2: Sections 2.11 & 2.12 in [1]).

Unit II:

Direct Product - Finite Abelian Groups.

(Chapter 2: Sections 2.13 & 2.14 in [1]).

Unit III:

Modules and homomorphisms-Classical isomorphism theorems-Direct sums and products – Finitely generated and free modules.

(Chapter 4 : Sections 4.4 and 4.5 in [2])

Unit IV:

Elements of Galois Theory-Solvability by Radicals-Galois Group over the Rationals.

(Chapter5 Sections 5.6, 5.7 and 5.8 in [1]).

Unit V:

Finite Fields-Wedderburn's Theorem on Finite Division Rings - A Theorem of Frobenius .

(Chapter 7: Sections 7.1, 7.2, and 7.3 in [1]).

Text book:

[1] I.N Herstein, Topics in Algebra, 2nd Edition, John Wiley and Sons, New York, 2003 (For Units I, II, IV and V).

[2] Michiel Hazewinkel, Nadiya Gubareni and V.V.Kirichenko, Algebras, Rings and Modules, Vol.1, Springer International Edition,2011(Indian Print).

Books for 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, New Delhi, 1991.

4. Bhupendra Singh, Advanced Abstract Algebra, Pragati Prakashan, Meerat, First Edition 2006.

SEMESTER -II

CORE PAPER –VI

FLUID DYNAMICS

Paper Code : 17PMA06 /17PMACAE04 **Max. Marks: 75**

Credits: 05

Unit I: Kinematics of Fluids in Motion:

Real fluids and Ideal fluids - Velocity of a fluid at a point –Stream lines and path lines - Steady and Unsteady flows - The Velocity Potential - The Vorticity Vector - Local and Particle Rates of Change - The Equation of Continuity - Worked Examples.

(Chapter 2: Sections 2.1 - 2.8).

Unit II: Equations of Motion of a Fluid:

Pressure at a point in a fluid at rest - Pressure at a point in a moving fluid - Euler's equations of Motion - Bernoulli's equation -Worked Examples - Discussion of the case of steady motion under Conservative Body Forces - Some flows involving axial symmetry(examples 1 and 2 only).

(Chapters 3: Sections 3.1, 3.2,3.4 - 3.7, 3.9).

Unit III: Some Three-Dimensional Flows:

Introduction - Sources, Sinks and Doublets-Images in rigid infinite plane - Images in solid spheres – Axis symmetric flows.

(Chapter 4: Sections 4.1 - 4.4).

Unit IV: Some Two-Dimensional Flows:

The Stream Function - The Complex Velocity Potential for Two Dimensional Irrotational, Incompressible Flow - Complex Velocity Potentials for Standard Two-Dimensional Flows - Some Worked Examples - Two Dimensional Image Systems - The Milne-Thomson Circle Theorem.

(Chapter 5: Sections 5.3 - 5.8).

Unit V: Viscous Fluid:

Stress components in a real fluid - Relation between Cartesian Components of Stress - Translational motion of fluid element – The Coefficient of Viscosity and Laminar flow - The Navier-Stokes equation of a viscous fluid - Some solvable problems in viscous flow - Steady motion between parallel planes only.

(Chapter 8: Sections 8.1 - 8.3, 8.8, 8.9 and 8.10.1).

Textbook

1. **Frank Chorlton**, Textbook of Fluid Dynamics, CBS Publishers & Distributors, 2004.

Books for References

1. L.M. Milne-Thomson, Theoretical Hydrodynamics, Macmillan, London, 1955.

2. G.K. Batchelor, An Introduction to Fluid Dynamics Cambridge Mathematical Library, 2000.

SEMESTER -II

CORE PAPER –VII

COMPLEX ANALYSIS

Paper Code : 17PMA07 **Max. Marks: 75**

Credits: 04

Unit I : 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 II : Complex Integration (Contd.):

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 III :Harmonic Functions and Power Series Expansions :

Harmonic Functions – Definition and basic properties- Mean-Value Property-Poisson's formula –Schwarz's Theorem – Reflection Principle- Weierstrass's theorem- Taylor's series –Laurent series. (Chapter 4 : Sections 6 and Chapter 5 : Sections 1).

Unit IV: Entire functions: Jenson's formula – Hadamards theorem.

Normal Families: Equicontinuity – Normality and compactness – Arzela's theorem – Families of analytic functions – The classical definition.

(Chapter 5: Sections 3 and 5).

Unit V:Conformal Mapping:

The Riemann Mappping Theorem, Conformal Mapping of Polygons. A closure look at harmonic functions.(Chapter 6 : Sections 1,2 and 3).

Text Books

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

Books for 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, Complex-Analysis, Addison – Wesley Mass,1977.

SEMESTER -III

CORE PAPER –VIII

PARTIAL DIFFERENTIAL EQUATIONS

Paper Code : 17PMA08 **Max. Marks: 75**

Credits: 05

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:

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

Books for Reference:

1. I.N.Snedden, Elements of Partial Differential 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

SEMESTER - III

CORE PAPER –IX

TOPOLOGY

Paper Code : 17PMA09 /17PMACA10 **Max. Marks: 75**

Credits: 05

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:

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

Books for Reference:

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.

SEMESTER - III

CORE PAPER –X

MEASURE THEORY AND INTEGRATION

Paper Code : 17PMA10 /17PMACA14 **Max. Marks: 75**

Credits: 05

Unit I: Lebesgue Measure:

Lebesgue Measure – Introduction – Outer measure – Measurable sets and Lebesgue measure – Measurable functions – Little Woods' Three Principles. (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.

Books for 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., New Delhi, 2000.

3. Walter Rudin, Real and Complex Analysis, Tata McGraw Hill Publ. Co. Ltd., New Delhi, 1966.

SEMESTER - III

CORE PAPER –XI

CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS

Paper Code : 17PMA11/17PMACAE01 **Max. Marks: 75**

Credits: 04

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 of [1]).

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 of [1]).

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 of [2]).

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 of [2]).

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 of [2]).

Text Books:

1. **A.S Gupta**, Calculus of Variations with Application, Prentice Hall of India, New Delhi, 2005.(For Units I and II),

2. **Sudir K.Pundir** and **Rimple Pundir**, Integral Equations and Boundary Value Problems, Pragati Prakasam, Meerut, 2005. (For Units III, IV and V)

Books for Reference:

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.

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SEMESTER - IV

CORE PAPER –XII

FUNCTIONAL ANALYSIS

Paper Code : 17PMA12/17PMACA15 **Max. Marks: 75**

Credits: 05

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* - Adjoint 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.

Books for Reference:

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.

SEMESTER -IV

CORE PAPER –XIII

PROBABILITY THEORY

Paper Code : 17PMA13 **Max. Marks: 75**

Credits: 04

Unit I:

Random Events and Random Variables - Random events – Probability axioms – Combinatorial formulae – conditional probability – Bayes Theorem – Independent events – Random Variables – Distribution Function – Joint Distribution – Marginal Distribution – Conditional Distribution – Independent random variables – Functions of random variables.

(Chapter 1: Sections 1.1 to 1.7, Chapter 2: Sections 2.1 to 2.9).

Unit II:

Parameters of the Distribution - Expectation- Moments – The Chebyshev Inequality – Absolute moments – Order parameters – Moments of random vectors – Regression of the first and second types.

(Chapter 3: Sections 3.1 to 3.8).

Unit III:

Characteristic functions - Properties of characteristic functions – Characteristic functions and moments – semi-invariants – characteristic function of the sum of the independent random variables – Determination of distribution function by the Characteristic function – Characteristic function of multidimensional random vectors – Probability generating functions.

(Chapter 4: Sections 4.1 to 4.7).

Unit IV:

Some probability distributions - One point , two point , Binomial – Polya – Hypergeometric – Poisson (discrete) distributions – Uniform – normal gamma – Beta – Cauchy and Laplace (continuous) distributions.

(Chapter 5: Section 5.1 to 5.10 (Omit Section 5.11).

Unit V:

Limit Theorems - Stochastic convergence – Bernoulli law of large numbers – Convergence of sequence of distribution functions – Levy-Cramer Theorems – De Moivre-Laplace Theorem – Poisson, Chebyshev, Khintchine Weak law of large numbers – Lindberg Theorem – Lyapunov Theroem – Borel-Cantelli Lemma - Kolmogorov Inequality and Kolmogorov Strong Law of large numbers.

(Chapter 6: Sections 6.1 to 6.4, 6.6 to 6.9, 6.11 and 6.12 only).

Text Book:

1. **M. Fisz**, Probability Theory and Mathematical Statistics, John Wiley and Sons, New York, 1963.

Books for Reference:

1. R.B. Ash, Real Analysis and Probability, Academic Press, New York, 1972

2. K.L.Chung, A course in Probability, Academic Press, New York, 1974.

3. Y.S.Chow and H.Teicher, Probability Theory, Springer Verlag. Berlin, 1988 (2nd Edition)

4. R.Durrett, Probability : Theory and Examples, (2nd Edition) Duxbury Press, New York, 1996.

5. V.K.Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Ltd., New Delhi, 1988(3rd Print).

6. S.I.Resnick, A Probability Path, Birhauser, Berlin, 1999.

7. B.R.Bhat, Modern Probability Theory (3rd Edition), New Age International (P)Ltd, New Delhi, 1999.

8. J.P. Romano and A.F. Siegel, Counter Examples in Probability and Statistics, Wadsworth and Brooks / Cole Advanced Books and Software, California, 1968.

SEMESTER -IV
CORE PAPER –XIV
GRAPH THEORY

Paper Code : 17PMA14 / 17PMACA13 **Max. Marks: 75**
Credits: 05

Unit I: Basic Results: Introduction-Basic Concepts-Subgraphs-Degrees of Vertices - Paths and Connectedness - Automorphism of a Simple Graph. (Chapter 1: Sections 1.1 - 1.6).

Directed Graphs: Introduction-Basic Concepts-Tournaments.(Chapter 2 : Sections 2.1 - 2.3).

Unit II: Connectivity and Trees:

Connectivity: Introduction-Vertex cut and Edge Cut-Connectivity and Edge Connectivity.(Chapter 3: Sections 3.1- 3.3).

Trees: Introduction-Definition, Characterization and Simple Properties-Centers and Centroids-Cutting the Number of Spanning Trees-Cayley's Formula. (Chapter 4: Sections 4.1- 4.5).

Unit III : Independent Sets, Matchings and Cycles:

Independent Sets and Matchings: Introduction-Vertex-Independent Sets and Vertex Coverings-Edge-Independent sets-Matchings and Factors-Matchings in Bipartite Graphs.
(Chapter 5: Sections 5.1- 5.5) .

Cycles: Introduction-Eulerian Graphs-Hamiltonian Graphs. (Chapter 6: Sections 6.1- 6.3) .

Unit IV: Graph Colorings:

Introduction-Vertex colorings-Critical Graphs-Edge colorings of Graphs-Kirkman's Schoolgirl-Problem-Chromatic Polynomials.(Chapter 7: Sections 7.1 ,7.2 ,7.3 (7.2.1 & 7.2.3 only) ,7.6, 7.8, and 7.9).

Unit V:Planarity:

Introduction- Planar and Nonplanar Graphs –Euler Formula and its Consequences-K_5 and $K_{3,3}$ are Nonplanar Graphs – Dual of a Plane Graph- The Four-Color Theorem and the Heawood Five-Color Theorem-Hamiltonian Plane Graphs-Tait Coloring.(Chapter 8: Sections 8.1 - 8.6 ,8.8 and 8.9).

Text Book:

1.R.Balakrishnan and K.Ranganathan, Text Book of Graph Theory, (2^{nd} Edition), Springer, New York,2012.

Books for Reference:

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

2.Narasing Deo, Graph Theory with Application to Engineering and Computer Science, Prentice Hall of India, New Delhi. 2003.

3. F. Harary, Graph Theory, Addison – Wesely Pub. Co. The Mass. 1969.

4. L. R.. Foulds, Graph Theory Application, Narosa Publ. House, Chennai, 1933.

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SYLLABUS - ELECTIVE COURSES

SEMESTER I

Elective I: Group- A

NUMERICAL ANALYSIS

Paper Code: 17PMAE01/17PMACA06 **Max. Marks: 75**

Credits: 04

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:

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

Books for Reference:

1. S.S. Sastry, Introductory methods of Numerical Analysis, Printice of India, 1995.

2. C.F. Gerald, and P.O. Wheathy, Applied Numerical Analysis, Fifth Edition, Addison Wesley, 1998.

3. M.K. Venkatraman, Numerical methods in Science and technology, National Publishers Company, 1992.

4. P. Kandasamy, K. Thilagavathy, K. Gunavathy, Numerical Methods, S. Chand & Company, 2003.

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SEMESTER - I
Elective I: Group-A
DIFFERENCE EQUATIONS

Paper Code: 17PMAE02 **Max. Marks : 75**
Credits: 04

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:

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

Books for 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 Marcel Dekker, New York,1992.

SEMESTER II

Elective II: Group-B

DISCRETE MATHEMATICS

Paper Code: 17PMAE03 /17PMACA04 **Max. Marks : 75**

Credits: 04

Unit I: The Foundations: Logic and Proofs :

Propositional - Applications of Propositional -Propositional Equivalences - Predicates and Quantifiers. (Chapter 1: Sections 1.1 - 1.3).

Algorithms: The Growth of Functions.

(Chapter 3: Section 3.2).

Unit II: Counting:

The Basics of Counting- The Pigeonhole Principle -Permutations and Combinations - Generalized Permutations and Combinations - Generating Permutations and Combinations .

(Chapter 5: Sections 5.1- 5.3, 5.5 and 5.6).

Unit III : Advanced Counting Techniques:

Applications of Recurrence Relations - Solving Linear Recurrence Relations-Generating Functions .

(Chapter 6: Sections 6.1, 6.2 and 6.4).

Unit IV: Boolean Algebra:

Boolean Functions- Representing Boolean Functions - Logic Gates - Minimization of Circuits.

(Chapter 10: Sections 10.1 -10.4).

Unit V: Modeling Computation:

Finite-State machines with Output- Finite-State machines with No Output-Turing Machines.

(Chapter 12: Sections 12.2, 12.3 and 12.5).

Text Book:

1. **Kenneth H.Rosen**, Discrete Mathematics and it's Applications,7th Edition, WCB / McGraw Hill Education ,New York,2008.

Books for Reference:

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

2.T.Veerarajan,Discrete Mathematics with Graph Theory and Combinatorics, Tata McGraw Hills Publishing Company Limited ,7th Reprint,2008.

SEMESTER II

Elective II: Group-B

COMBINATORIAL MATHEMATICS

Paper Code: 17PMAE04 **Max.. Marks : 75**

Credits: 04

Unit I: Permutations and combinations.

Unit II: Generating functions.

Unit III: Recurrence relations.

Unit IV: Principle of inclusion and exclusion.

Unit V: Polya's theory of counting.

Text Book:

1. **C.L.Liu,** Introduction to Combinatorial Mathematics, Tata McGraw Hill, Book Co., New York, 1968. (Chapters: 1 to 5.)

Books for Reference:

1. C.L. Liu, M. Eddberg, Solutions to problems in Introduction to Combinatorial Mathematics, MC Grow-Hill Book & Co., New York, 1968.

2. J.H. Van Lint, R.M. Wilson, A Course in Combinatorics, 2nd Edition, Cambridge University Press, Cambridge, 2001.

3. R.P. Stanley, Enumerative Combinatorics, Volume I, Cambridge Studies in Advanced Mathematics, Volume 49, Cambridge University Press, 1997. 4. P.J. Cameron, Combinatorics: Topics, Techniques, Algorithms, Cambridge University Press, Cambridge, 1998.

SEMESTER- III

Elective III: Group-C

DIFFERENTIAL GEOMETRY

Paper Code: 17PMAE05/17PMACA16 **Max. Marks : 75**

Credits: 04

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.

Books for Reference:

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.

3. J.A. Thorpe, Elementary Topics in Differential Geometry, Springer – Verlag, New York, 1979.

SEMESTER- III

Elective III: Group-C

PROGRAMMING WITH C++

Paper Code: 17PMAE06 **Max. Marks: 75**

Credits: 04

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:

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

Books for Reference:

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

SEMESTER IV

Elective IV: Group-D

NUMBER THEORY

Paper Code: 17PMAE07/17PMACAE02 **Max. Marks : 75**

Credits: 04

Unit I: Divisibility and Congruence:

Divisibility – Primes - Congruences – Solutions of Congruences – Congruences 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 φ(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 $x^4 + y^4 = z^2$ 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.

Books for Reference:

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.

SEMESTER IV

Elective IV: Group-D

OPTIMIZATION TECHNIQUES

Paper Code: 17PMAE08 / 17PMACA12 **Max. Marks: 75**

Credits: 04

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:

1.Hamdy A.Taha, Operations Research an Introduction, 6th Edison, University of Arkansas Fayetteville.

Books for Reference:

1. F.S. Hillier and G.J. Lieberman Introduction to Operation Research 4th 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.

SEMESTER- IV

Elective IV: Group-D

C++ PROGRAMMING LAB

Paper Code: 17PMAE09 **Max. Marks: 75**

Credits: 04

LIST OF PRACTICALS

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 Seidel method.

9. Solve differential equations using Runge Kutta forth order method.

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SYLLABUS - EXTRA DISCIPLINARY COURSE (EDC)

(For other PG Department Students)

SEMESTER II

1.NUMERICAL & STATISTICAL METHODS

Paper Code: 17PMAED1 **Max. Marks: 75**

Credits: 04

(Theorems and proof are not expected)

Unit I:

Algebraic and Transcendental Equations: Bisection Method – Iteration Method – The Method of False Position – Newton- Raphson – Method.

Unit II:

System of Linear Equation: Gauss Elimination, Gauss Jordon elimination – Triangularization method –Iterative Methods, Jacobi, Gauss-Seidel iteration, Iterative method for A-1.

Unit III:

Interpolation with equal intervals – Newton forward and backward formula - Central Difference Interpolation formula – Gauss forward and backward formula – Stirling's formula – Bessel's Formula - Numerical differentiation: Maximum and minimum values of a tabulated function. Numerical Integration: Trapezoidal Rule – Simpson's Rule – Numerical double Integration.

Unit IV:

Correlation Coefficient – Rank correlation coefficient of determination – Linear regression – Method of least squares – Fitting of the curve of the form $ax+b$, ax^2+bx+c, ab^x and ax^b – Multiple and partial correlation (3-variable only).

Unit V:

Binominal distribution – Poisson distribution – Normal distribution – Properties and Applications.

Text Book:

1. S.S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India, Pvt. Ltd., 1995.(For Units I, II and III).

2. S.C. Gupta and **V.K. Kapoor,** Fundamentals of Mathematical Statistics, Sultan Chand & Sons, (1994).(For Units IV and V).

Books for Reference:

1.S.Kalavathy, Numerical Methods, Vijay Nicole, Chennai, 2004.

2.Dr.Kandasamy, Numerical Methods, Sultan Chand, New Delhi.

2.STATISTICS

Paper Code: 17PMAED2 **Max.Marks: 75**

Credits: 04

Unit I:

Collection, classification and tabulation of data, graphical and diagrammatic representation – Bar diagrams, Pie diagram, Histogram, Frequency polygon, frequency curve and Ogives.

Unit II:

Measures of central tendency – Mean, Median and Mode in series of individual observations, Discrete series, Continuous series (inclusive), More than frequency, Less than frequency, Mid-value and open-end class.

Unit III:

Measures of dispersion – Range, Quartile deviation, Mean deviation about an average, Standard deviation and co-efficient of variation for individual, discrete and continuous type data.

Unit IV:

Correlation – Different types of correlation – Positive, Negative, Simple, Partial Multiple, Linear and non-Linear correlation. Methods of correlation – Karl-Pearson's coefficient of correlation-Spearman's rank correlations and Concurrent deviation.

Unit V:

Regression types and method of analysis, Regression line, Regression equations, Deviation taken from arithmetic mean of X and Y, Deviation taken from assumed mean, Partial and multiple regression coefficients – Applications.

Text Book:

1.S.C.Gupta and **V.K. Kapoor**, Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi, 1994.

Books for Reference:

1. Freund J.E. (2001); Mathematical Statistics, Prentice Hall of India.

2. Goon, A.M., Gupta M.K., Dos Gupta, B, (1991), Fundamentals of Statistics, Vol. I, World Press, Calcutta.

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