MASTER OF SCIENCE - MATHEMATICS

REGULATIONS

ELIGIBILITY

A candidate who has passed the Degree Examination in B.Sc. (Mathematics) or B.Sc (Mathematics with Computer Applications) of Bharathiar University and as per the norms set by the Government of Tamilnadu or an Examination accepted as equivalent thereto by the Academic Council, subject to such conditions as may be prescribed thereto are permitted to appear and qualify for the **Master of Science – Mathematics Degree Examination** of this college after a course of study of two academic years.

OBJECTIVE OF THE COURSE

- To meet the demand for well trained Post Graduates in Mathematics students with academic excellence.
- To demonstrate an understanding of the theoretical concepts and axiomatic underpinnings of Mathematics and an ability to construct proofs at the appropriate level.
- To demonstrate competency in Mathematical modeling of complex phenomena, problem solving and decision making.
- To demonstrate a level of proficiency in quantitative and computing skills sufficient to meet the growing demands of society upon modern education.

COURSE SCHEME OF EXAMINATIONS

Subject Code	Subject	Hrs of Instruction	Exam Duration (Hrs)	Max Marks			Credit Points
				CA	CE	Total	
First Semester							
16PMA13A	CORE- I: Algebra	7	3	25	75	100	4
15PMA13B	CORE- II: Real Analysis	7	3	25	75	100	4
16PMA13C	CORE- III: Ordinary Differential Equations	6	3	25	75	100	4
16PMA13D	CORE- IV: Numerical Methods	6	3	25	75	100	4
	ELECTIVE –I:	4	3	25	75	100	4
		30				**500**	**20**
Second Semester							
16PMA23A	CORE -V Complex Analysis	6	3	25	75	100	4
16PMA23B	CORE- VI: Partial Differential Equations	7	3	25	75	100	4
15PMA23C	CORE –VII: Mechanics	7	3	25	75	100	4
16PMA23D	CORE- VIII: Operations Research	6	3	25	75	100	4
	ELECTIVE- II:	4	3	25	75	100	4
		30				**500**	**20**

BoS Chairman/HoD
Department of Mathematics
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Third Semester							
16PMA33A	CORE- IX: Topology	6	3	25	75	100	4
15PMA33B	CORE- X: Fluid Dynamics	5	3	25	75	100	4
15PMA33C	CORE- XI: Mathematical Statistics	6	3	25	75	100	4
16PMA33D	CORE –XII: Graph theory	5	3	25	75	100	4
16PMA33E	CORE –XIII: Number Theory	4	3	25	75	100	4
	ELECTIVE- III:	4	3	25	75	100	4
		30				**600**	**24**
Fourth Semester							
15PMA43A	CORE –XIV: Functional Analysis	7	3	25	75	100	4
16PMA43B	CORE- XV: Mathematical Methods	7	3	25	75	100	4
15PMA43C	CORE- XVI: Computer Programming in C++	4	3	25	75	100	4
16PMA43P	CORE LAB –I: Computer Programming in C++	4	3	40	60	100	4
16PMA43V	Project Work	4	3	60	90	150	6
	ELECTIVE- IV:	4	3	25	75	100	4
		30				**650**	**26**
	TOTAL					**2250**	**90**

ELECTIVE – I

(Student shall select any one of the following subject as Elective-I in first semester)

S.No	Subject Code	Name of the Subject
1	16PMA1EA	Solid Geometry
2	16PMA1EB	Differential Geometry
3	15PMA1EC	Fuzzy Logic and Fuzzy Sets

ELECTIVE - II

(Student shall select any one of the following subject as Elective-II in second semester)

S.No	Subject Code	Name of the Subject
1.	16PMA2EA	Mathematical Software
2.	16PMA2EB	Mathematical Modeling
3.	16PMA2EC	Introduction to Special Functions

ELECTIVE - III

(Student shall select any one of the following subject as Elective-III in third semester)

S.No	Subject Code	Name of the Subject
1.	16PMA3EA/15PMA1EA	Discrete Mathematics
2.	15PMA3EB	Magneto Hydro Dynamics
3.	15PMA3EC	Stochastic Differential Equations

ELECTIVE - IV

(Student shall select any one of the following subject as Elective-IV in fourth semester)

S.No	Subject Code	Name of the Subject
1.	15PMA4EA	Control Theory
2.	15PMA4EB	Neural Networks
3.	15PMA4EC	Cryptography

Total Credit Distribution

Subjects	Credits	Total		Credits	Cumulative Total
Core	4	16 x 100 =	1600	64	74
Core Lab	4	1 x 100 =	100	04	
Project	6	1 x 150 =	150	06	
Elective	4	4 x 100 =	400	16	16
Total			**2250**	90	**90**

FOR COURSE COMPLETION

Students has to complete the following Subjects:

- Core papers in I, II, III and IV Semesters.
- Elective papers in the I, II , III and IV Semesters.
- Core practical in IV Semester.
- Project and Viva - Voce in IV Semester.

Earning extra credits is not mandatory for course completion

Extra Credits

Subject	Credit	Total credits
Publication with ISSN Journal	**1**	**1**
Hindi /Other Foreign language	**1**	**1**
Paper Presented in Sponsored National/ International Seminar/conference/ workshop	**1**	**1**
Online Courses Prescribed By Department / Self study paper	**1**	**1**
Representation – Academic/Sports /Social Activities/ Extra Curricular Activities at University/ District/ State/ National/ International	**1**	**1**
Total		**5**

Rules:

The students can earn extra credits only if they complete the above before the third semester and the proof of Completion must be submitted in the office of the Controller of Examinations before the commencement of the IV Semester. (Earning extra credits are not mandatory for Course completion)

1. Publication with ISSN Journal by a student and co-authored by staff member will be given one credit extra.
2. Student can opt Hindi/ French/ Other foreign Language approved by certified Institutions to earn one extra credit. The certificate (Hindi) must be obtained from Dakshina Bharat Hindi Prachar Sabha and He/She has to enroll and complete before the third semester.
3. Award winners in paper presented in sponsored Seminar/conference or participation in short term workshop (minimum 5 days) will be given one credit extra.
4. Student can earn one credit, if they complete any one Online certification courses / Self study paper prescribed by the concerned department.

Self study paper offered by the Mathematics department

S. No.	Semester	Course Code	Course Title
1.	**Semester I to III**	**16PMASS1**	**Modern Analysis – I**
2.		**16PMASS2**	**Modern Analysis – II**

List of online courses prescribed by the department

1. Differential Equations in action
2. Visualizing Algebra
3. Integration Applications
4. Sampling people, Networks and Records
5. Performance modeling and simulation

5. Award Winners in / Social Activities / Extra Curricular / Co-Curricular Activities / Representation in Sports at University / District / State / National / International level can earn one extra credit.

16PMA13A	CORE- I: ALGEBRA	SEMESTER - I

Total Credits: 4
Hours Per Week: 7

OBJECTIVES:

1. To introduce the general concepts in Abstract Algebra.
2. To give a foundation about algebraic structures and transformations

CONTENTS

UNIT-I

GROUP THEORY**:** Another counting principle - Sylow's theorem - Direct products.

UNIT-II

RING THEORY**:** Euclidean rings – A particular Euclidean ring – Polynomial rings – Polynomials over the rational field.

UNIT-III

FIELDS: Extension Fields – Roots of polynomials – More about roots.

UNIT-IV

FIELDS: The Elements of Galois theory – Selected Topics: Finite Fields.

UNIT-V

LINEAR TRANSFORMATIONS: Canonical forms: Triangular form – Trace and Transpose – Hermitian , unitary and normal Transformations.

TEXT BOOKS:

1. *Herstein, I.N.2002.* **Topics in Algebra** (II Edition)**.** Narosa Publishing House, New Delhi.

UNIT I : Chapter 2 - Sections 2.11 to 2.13.

UNIT II : Chapter 3 - Sections 3.7 to 3.10.

UNIT III : Chapter 5 - Sections 5.1,5.3 and 5.5.

UNIT IV : Chapter 5 - Section 5.6.
Chapter 7 - Section 7.1.

UNIT V : Chapter 6 - Sections: 6.4,6.8 and 6.10

REFERENCE BOOKS:

1. *Fraleigh, J.B.* 1988. **A First Course in Abstract Algebra.** Narosa Publishing House, New Delhi.
2. *Hungerfor, T.W.* 1974. **Algebra.** Springer.New York.

15PMA13B	CORE- II: REAL ANALYSIS	SEMESTER - I

Total Credits: 4
Hours Per Week: 7

OBJECTIVES:

1. To give a systematic study of Riemann Stieltjes Integral and the calculus on R^n .
2. To gain knowledge about the convergence of sequences and series, Power series, Fouries series and polynomials.

CONTENTS

UNIT - I

RIEMANN STILTJES INTEGRAL: Definition and Existence of the Integral – properties of the integral – Integration and differentiation – Integration of vector valued function – rectifiable curves.

UNIT - II

SEQUENCE AND SERIES OF A FUNCTION : Uniform convergence - Uniform convergence and continuity – uniform convergence and integration – uniform convergence and differentiation – equicontinuous families of functions – The Stone Weirstrass theorem

UNIT - III

FUNCTIONS OF SEVERAL VARIABLES: Linear transformation – The contraction principle – The Inverse function theorem – The Implicit function theorem.

UNIT – IV

LEBESGUE MEASURE: Introduction - Outer measure – Measurable sets and Lebesgue measure – Measurable functions – Littlewood's Three principles.

UNIT - V

LEBESGUE INTEGRAL: The Lebesgue integral of bounded functions over a set of finite measure – Integral of a non negative function – The General Lebesgue Integral – Convergence in measure

TEXT BOOKS:

1. *Rudin,W.* **Principles of Mathematical Analysis**. 1976. McGraw Hill, New York.

   Unit I & II : Chapter 6 & 7.
   Unit III : Chapter 9

2. *Roydon, H.L.* **Real Analysis** .2005.Third Edition. Prentice Hall of India.

   Unit IV : Chapter 3 (except Section – 4)
   Unit V : Chapter 4 (Sections 2, 3 & 4 only)

REFERENCE BOOKS:

1. *Bartle, R.G.* 2005. **Introduction to Real Analysis**.3rd Edition. John Wiley and Sons Inc. New York.
2. *Rudin,W,* 1987. **Real and Complex Analysis.** 3rd Edition. McGraw-Hill. New York.

16PMA13C	CORE -III: ORDINARY DIFFERENTIAL EQUATIONS	SEMESTER - I

Total Credits: 4
Hours Per Week: 6

OBJECTIVES:

1. To learn differentical methods to solve higher order differential equations
2. To introduce dynamical systems and its applications

CONTENTS

UNIT - I

Solutions in power series : Second order linear equations with ordinary points – Legendre equation and Legendre polynomials – Second order equation with regular singular point – Bessel equation (First kind only), Properties of Bessel functions.

UNIT - II

Systems of Linear Differential Equations: Systems of first order equations – Existence and Uniqueness theorem – Fundamental matrix.

UNIT - III

Non-homogeneous linear systems – linear systems with constant coefficients – linear systems with periodic co-efficients.

UNIT - IV

Existence and Uniqueness of Solutions: Preliminaries - Successive approximations – Picard's theorem – Some examples.

UNIT - V

Oscillations of second order Equations: Fundamental results – Sturm's comparison theorem – Elementary linear oscillations. Comparison theorem of Hille-Winter – oscillations of $x'' + a(t)\, x = 0$.

TEXT BOOKS:

1. *Deo, S.G., Lakshmikandham, V., and Raghavendra,V*. **Text book of Ordinary Differential Equations,** Twelfth Reprint (2007), Tata McGraw Hill Publishing company Limited, New Delhi.

   Unit I : Chapter 3 : Section 3.2 to 3.5

   Unit II : Chapter 4 : Section 4.2, 4.4 to 4.5

   Unit III : Chapter 4 : Section 4.6 to 4.8

   Unit IV : Chapter 5 : Section 5.2 to 5.5

   Unit V : Chapter 8 : Section 8.1 to 8.5

REFERENCE BOOK:

1. *Coddington .E.A and Levinson.N*, **Theory Of Ordinary Differential Equations,** McGraw Hill Publishing company Limited, New Delhi,(1955).

16PMA13D	CORE -IV: NUMERICAL METHODS	SEMESTER - I

Total Credits: 4
Hours Per Week: 6

OBJECTIVES:

1. To expose the students to various tools in solving numerical problems.
2. To enable the students to apply these methods in a computer environment.

CONTENTS

UNIT - I

SOLUTION OF NONLINEAR EQUATIONS: Newton's method – Convergence of Newton's method – Bairstow"s Method for quadratic factors NUMERICAL DIFFERENTIATION AND INTEGRATION: Derivatives from Differences tables – Higher order derivatives – Divided difference, Central-Difference formulas – Composite formula of Trapezoidal rule – Romberg integration – Simpson's rules.

UNIT - II

SOLUTION OF SYSTEM OF EQUATIONS: The Elimination method – Gauss and Gauss Jordan methods – LU Decomposition method – Matrix inversion by Gauss-Jordan method – Methods of Iteration – Jacobi and Gauss Seidal Iteration – Relaxation method – Systems of Nonlinear equations.

UNIT - III

SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS: Taylor series method – Euler and Modified Euler methods – Rungekutta methods – Multistep methods – Milne's method – Adams Moulton method.

UNIT - IV

BOUNDARY VALUE PROBLEMS AND CHARACTERISTIC VALUE PROBLEMS: The shooting method – solution through a set of equations – Derivative boundary conditions – Characteristic value problems – Eigen values of a matrix by Iteration – The power method.

UNIT - V

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS: (Solutions of Elliptic, Parabolic and Hyperbolic partial differential equations) Representation as a difference equation – Laplace's equation on a rectangular region – Iterative methods for Laplace equation – The Poisson equation – Derivative boundary conditions – Solving the equation for time-dependent heat flow (i) The Explicit method (ii) The Crank Nicolson method – solving the wave equation by Finite Differences.

TEXT BOOK:

1. Kandasamy P, Thilagavathy k and Gunavathy K 2007. **Numerical Methods,** S.CHAND & COMPANY, New Delhi.

REFERENCE BOOK:

1. *Gerald , C.F and Wheatley, P.O*. 1998. **APPLIED NUMERICAL ANALYSIS**. Fifth Edition. Addison Wesley.

16PMA23A	CORE -VI: COMPLEX ANALYSIS	SEMESTER – II

Total Credits: 4
Hours Per Week: 6

OBJECTIVES:

1. To lay the foundation for advanced complex analysis.
2. To develop clear thinking and analyzing capacity for research.

CONTENTS

UNIT - I

Introduction to the concept of analytic function: Limits and continuity – Analytic functions – Polynomials – Rational functions – Conformality: Arcs and closed curves – Analytic functions in regions – Conformal Mapping – Length and Area – Linear Transformations: The Linear group – The Cross ratio.

UNIT - II

Complex Integration: Line Integrals Rectifiable Arcs – Line Integrals as Functions of Arcs – Cauchy's theorem for a rectangle - Cauchy's theorem in a disk, Cauchy's Integral formula: The Index of a point with respect to a closed curve – The Integral formula – Higher derivatives Removable singularities, Taylor's Theorem – Zeros and Poles – The Local Mapping – The Maximum principle.

UNIT - III

The Calculus of Residues: The Residue theorem – The Argument principle – Evaluation of definite integrals. Harmonic functions: The Definitions and basic Properties – Mean value property – Poisson's Formula.

UNIT - IV

Series and Product Developments: Weierstrass Theorem – The Taylor Series – The Laurent Series – Partial fractions and Factorization: Partial Fractions – Infinite Products – Canonical Products.

UNIT - V

The Riemann Mapping Theorem – Statement and Proof – Boundary Behaviour – Use of the reflection principle – Analytic arcs – Conformal mapping of Polygons: The Behaviour at an angle – The Schwarz – Christoffel Formula – Mapping on a rectangle.

TEXT BOOK:

1. *Ahlfors, L.V.* 1979. **Complex Analysis.** Mc Graw Hill. New York.

Unit I	: Chapter – 2 Sections 1.1 – 1.4
	Chapter – 3 Sections 2.1 – 2.4, 3.1, 3.2
Unit II	: Chapter – 4 Sections 1.1 – 1.5, 2.1 – 2.3, 3.1 - 3.4
Unit III	: Chapter – 4 Sections 5.1 – 5.3, 6.1 – 6.3
Unit IV	: Chapter – 5 Sections 1.1 – 1.3, 2.1 – 2.3
Unit V	: Chapter – 6 Sections 1.1 – 1.4, 2.1 – 2.3

REFERENCE BOOK:

1. *Venkatachalapathi, G.* Complex Analysis for M.Sc Mathematics.

16PMA23B	CORE- VI : PARTIAL DIFFERENTIAL EQUATIONS	SEMESTER - II

Total Credits: 4
Hours Per Week: 7

OBJECTIVES:

1. To give an introduction about Mathematical techniques that analyzes of the behaviour of a Partial Differential Equations.
2. To study the applications of boundary value problems

CONTENTS

UNIT - I

Mathematical Models: The Classical equations – The vibrating string – The vibrating membrane – Conduction of Heat in solids. Classification of second order equations: Second order equations in two independent variables – Cannonical forms – Equations with constant coefficients.

UNIT - II

The Cauchy problem: The Cauchy problem – Cauchy – Kowlalewsky theorem – Homogeneous wave equation – Initial – Boundary value problems – Equations with non-homogeneous boundary conditions – Non-homogeneous wave equation.

UNIT - III

Method of separation of variables: Seperation of variables – The vibrating string problem – Existence and Uniqueness of solution of the vibrating string problem. The heat conduction problem – Existence and Uniqueness of solution of the heat conduction problem – The Laplace and beam equations.

UNIT - IV

Boundary value problems: Boundary value problems – Maximum and minimum principles – Uniqueness and continuity theorems – Dirichlet problems for a circle – Neumann problem for a circle - Drirchlet problem for a rectangle – Neumann problem for a rectangle.

UNIT - V

Green's function: The Dirac delta function – Properties of Green's functions – method of Green's function – Dirichlet's problem for the Laplace operator.

TEXT BOOKS:

1. *Tyn Myin-U and Lokenath Debnath, 2007.* **Linear Partial Differential Equations for Scientists and Engineers,** 4th Edition. Rajkamal Electric press, Delhi.

   Unit I : Chapter 3: Section 3.1 to 3.3, 3.5, 4.1 to 4.3

   Unit II : Chapter 5: Section 5.1 to 5.5, 5.7

   Unit III : Chapter 7: Section 7.2 -7.7

   Unit IV : Chapter 9: Section 9.1 to 9.4, 9.6 to 9.7, 9.9

   Unit V : Chapter 11: Section 11.2 to 11.5

REFERENCE BOOK:

1. *Sneedon.I.N,* **Elements Of Partial Differential Equations**, Mc Graw Hill. London, 1957.

15PMA23C	CORE- VII: MECHANICS	SEMESTER – II

Total Credits: 4
Hours Per Week: 7

OBJECTIVES:

1. The students should understood the concepts of: Lagrange's Equations,
2. The students should understood the concepts of: Hamilton's Equations.

CONTENTS

UNIT-I

INTRODUCTORY CONCEPTS: The Mechanical system – Equations of motion - Generalized Coordinates – Constraints – Virtual Work – Principle of virtual work – Generalized force - Energy and Momentum – Potential energy – Work and Kinetic Energy – Conservation of energy – Equilibrium and Stability - Problems.

UNIT-II

LAGRANGE'S EQUATIONS: Derivations of Lagrange's Equations - A nonholonomic rheonomic system -– Conservative Systems – Natural Systems – holonomic conservative systems - Examples – Integrals of Motion.

UNIT-III

HAMILTON'S EQUATIONS: Hamilton's Principle – Euler Lagrange equation - Hamilton's Equations – Hamilton's equations using Legendre transformation.

UNIT-IV

HAMILTON – JACOBI THEORY: Hamilton's Principle functions –Jacobi theorem – Hamilton Jacobi Equation – Seperability – Stackel's theorem.

UNIT-V

CANONICAL TRANSFORMATIONS: Canonical Transformations - Differential forms and Generating Functions – Lagrange and Poisson Brackets – Bilinear covarient.

TEXT BOOKS:

1. *Greenwood, D.T.* 1977. **Classical Dynamics.** Dover Publication, New York.

   Unit-I : Chapter 1: Sections 1.1 – 1.5

   Unit-II : Chapter 2: Sections 2.1 – 2.3

   Unit-III : Chapter 4: Sections 4.1 – 4.2

   Unit-IV : Chapter 5: Sections 5.1 – 5.3

   Unit-V : Chapter 6: Sections 6.1, 6.3

REFERENCE BOOK:

1. *Herbert Goldstein 2000*, **Classical Mechanics.** Narosa Publishing house.

16PMA23D	CORE- VIII: OPERATIONS RESEARCH	SEMESTER–II

Total Credits: 4
Hours Per Week: 6

OBJECTIVES:

1. The students should gain knowledge about the Simplex and Dual Simplex method.
2. To understand the concept of CPM / PERT.

CONTENTS

UNIT - I

Introduction to Operations Research – Operations Research Techniques– Simulation Modeling – Art of Modeling the Simplex method- Standard LPP form – and its basic solutions –Artificial starting solution – Special cases in the Simplex method - Applications.

UNIT - II

Duality – Definition – Primal –Dual relationship – Dual simplex method – Transportation model – Transportation Algorithm – The North West Corner Rule – Least Cost Method – Vogel's Approximation Method – Modi Method - Assignment model – Hungarian Method.

UNIT - III

Network models – A Scope of network applications – Definitions – Network representations - Minimal spanning tree algorithm – Shortest root algorithm (Dijkstra's algorithm only) – CPM and PERT.

UNIT - IV

Advanced linear programming – Introduction – Vector and bases– Standard LPP in Matrix Form – Vector Representation – Basic Solution - Simplex method – Fundamentals – Revised simplex method – Bounded Variables Algorithm – Decomposition Algorithm.

UNIT - V

Queuing System – Elements of Queuing Model – Role of exponential Distribution – Pure Birth and Death Models-Generalized Poisson Queuing model- Specialized Poisson Queues.

TEXT BOOKS:

1. *Taha, H.A.* 2006. **Operations Research: An Introduction.** Eighth Edition. Prentice Hall of India Private Limited, New Delhi.

Unit I : Chapter 1: 1
Chapter 2: 2.1, 2.2.1, 2.2.2
Chapter 3: 3.1.1, 3.1.2, 3.3.1, 3.3.2, 3.4.1, 4.2, 3.5.1 – 3.5.4
Unit-II : Chapter 4: 4.1, 4.2.1, 4.2.2, 4.2.3, 4.2.4, 4.4.1
Chapter 5: 5.1, 5.2, 5.3.1, 5.3.2, 5.4.1, 5.4.2
Unit-III : Chapter 6: 6.1, 6.2, 6.3.1, 6.3.3, 6.5.1 – 6.5.5
Unit-IV : Chapter 7: 7.1.1, 7.1.2, 7.2.1, 7.2.2
Unit-V : Chapter 15: 15.1, 15.2, 15.3, 15.4, 15.5, 15.6

REFERENCE BOOKS:

1. *Dantzig, G.*1963.**Linear Programming and Extension.** Princeton University Press. Princeton.
2. *Kandiswarup, P. K. Gupta. Man Mohan*.1998.**Operations Research** . S. Chand & Sons Education Publications, New Delhi.

16PMA33A	CORE- IX: TOPOLOGY	SEMESTER–III

Total Credits: 4
Hours Per Week: 6

OBJECTIVES:

1. To give an insight into Topological space.
2. To understand the concept of countability and matric spaces.

CONTENTS

UNIT - I

Topological Spaces and Continuous Functions : Topological spaces – Basis for a Topology – The Order Topology – The Product Topology on X x Y- Closed sets and Limit Points – Continuous Functions –The Product Topology – The Metric Topology.

UNIT - II

Connectedness and Compactness: Connected Spaces – Connected subspace of the real line R – Components and Local connectedness – Compact Spaces – Compact subspaces of the real line R- Limit Point Compactness.

UNIT - III

Countability and Separation Axioms: The Countability Axioms – The Separation Axioms Normal spaces – The Urysohn's Lemma – The Urysohn Metrization Theorem.

UNIT - IV

The Tychonoff Theorem: The stone-Cech Compactification.

UNIT - V

Complete Metric spaces and Function Spaces : Complete Metric Spaces – Compactness in Metric Spaces – Pointwise and Compact Convergences Ascoil's Theorem.

TEXT BOOKS:

1. *James R.Munkres*. 2007 . **Topology**. 2nd Edition Prentice Hall of India Private Limited, New Delhi.

   Unit-I : Chapter 2: Sections 12 to 15,17 to 20.

   Unit-II : Chapter 3: Sections 23 to 28

   Unit-III : Chapter 4: Sections 30 to 34

   Unit-IV : Chapter 5: Sections 37 to 38

   Unit-V : Chapter 7: Sections 43,45 to 47

REFERENCE BOOKS:

1. *George F. Simmons*. 2006. **Introduction to Topology and Modern Analysis**, McGraw Hill Book Company.
2. *Joshi,K.D*. 1993. **Introduction to General Topology**. New age International Private Limited.
3. *Kelley, J.L*. 2007. **General Topology.** Springer International Edition.

15PMA33B	CORE- X: FLUID DYNAMICS	SEMESTER–III

Total Credits: 4
Hours Per Week: 5

OBJECTIVES:

1. To understand the concepts of the fluid.
2. To give an insight into viscous flows

CONTENTS

UNIT - I

Introductory Notions – Velocity – Stream Lines and Path Lines – Stream Tubes and Filaments – Fluid Body – Density – Pressure. Differentiation following the Fluid – Equation of continuity – Boundary conditions – Kinematical and physical – Rate of change of linear momentum – Equation of motion of an inviscid fluid.

UNIT – II

Euler's momentum Theorem – Conservative forces – Bernoulli's theorem in steady motion – energy equation for inviscid fluid – circulation – Kelvin's theorem – vortex motion – Helmholtz equation.

UNIT – III

Two Dimensional Motion – Two Dimensional Functions – Complex Potential – basic singularities – source – sink – Vortex – doublet – Circle theorem. Flow past a circular cylinder with circulation – Blasius Theorem – Lift force. (Magnus effect)

UNIT - IV

Viscous flows – Navier-Stokes equations – Vorticity and circulation in a viscous fluid – Steady flow through an arbitrary cylinder under pressure – Staedy Couettc flow between cylinders in relative motion – Steady flow between parallel planes.

UNIT - V

Laminar Boundary Layer in incompressible flow: Boundary Layer concept – Boundary Layer equations – Displacement thickness, Momentum thickness, Kinetic energy thickness – integral equation of boundary layer – flow parallel to semi infinite flat plate – Blasius equation and its solution in series.

TEXT BOOKS:

1. *Milne Thomson, L.M. 1968*. **Theoretical Hydro Dynamics** by McMillan Company. 5th Edition. (Unit I & II)

   Chapter I : Sections 1.0 – 1.3., 3.10-3.41 (omit 3.32)

   Chapter III : Sections 3.42 – 3.53 (omit 3.44)

2. *Curle , N and Davies, H.J*. 1968. **Modern Fluid Dynamics (Volume I).**

   D Van Nostrand Company Limited., London .(Unit III, IV & V)

   Chapter III : Sections 3.1 – 3.7.5 (omit 3.3.4, 3.4, 3.5.2,3.6)

   Chapter V : Sections 5.1 – 5.3.3

   Chapter VI : Sections 6.1 – 6.3.1 (omit 6.2.2., 6.2.5)

15PMA33C	CORE - XI: MATHEMATICAL STATISTICS	SEMESTER–III

Total Credits: 4
Hours Per Week: 6

OBJECTIVES:

1. On successful completion of this course the students should gain knowledge about the Probability and moment generating functions.
2. To understand the concept of test of significance.

CONTENTS

UNIT - I

Probability : Basic terminology-Some theorems on probability- addition and multiplication theorems on probability- Boole's Inequality-Conditional probability – Independent Events – Pair wise independent events- Bayes theorem –Geometric probability-Random variables – Distribution function – random variables of the discrete and continuous – Independent random variables –Two dimensional random variables: Marginal distribution functions-Joint density functions distributions-Conditional distributions function and Conditional probability density functions– Stochastic independence.

UNIT - II

Moment Generating Functions - Characteristic functions and their Properties – Multivariate Moment generating functions and Characteristic function. Some important theorems: Levy theorem – Uniqueness theorems of characteristic function-Hall- Bray theorem-Chebycbev's Inequality-Convergence in Probability- Bernoulli law of large numbers- The DeMoivre Laplace theorem – the Lindeberg-Levy theorem.

UNIT - III

Discrete Probability distribution: Binomial distribution – Probability generating functions of Binomial distribution. Poisson distribution – Probability generating functions of Poisson distribution -Geometric distribution-Power series Distribution and their properties.

UNIT - IV

Continuous probability distributions: Normal distribution –Gamma distribution –Rectangular distribution- Exponential distribution. Exact sampling distributions: Chi-square distribution- Students t- distribution- F-distribution –Fiszer's Z-distribution-Fisher's Z-Transformation-Applications of Z-Transformation.

UNIT - V

Test of significance – Procedure for Testing of hypothesis – Test of significance for large samples and small samples test - simple problems. Non-parametric methods: Wald-Wolfowitz Run Test- Test for randomness- Median Test-Sign test – Mann-Whitney-Wilcoxon U –test-Simple problems.

TEXT BOOKS:

1. *Gupta, S.C. Kapoor, V.K.*2007. **Fundamentals of Mathematical Statistics.** S.**C**hand and Co New Delhi.

REFERENCE BOOKS :

1. *Vittal***,** *P.R***.** 2015. **Mathematical Statistics.** Margham Publications, Chennai
2. *Kapur, J.*M and Saxena, H.C. 2001 . **Mathematical Statistics.** S.Chand & Co, New Delhi
3. *John E.* Freund's,2007, **Mathematical statistics with Applications**, Prentics – Hall India, New Delhi.
4. *Hogg and Craig,* **Introduction To Mathematical Statistics**, Pearson Education.

16PMA33D	CORE – XII: GRAPH THEORY	SEMESTER–III

Total Credits: 4
Hours Per Week: 5

Note: Simple problems in the exercise of all units can also be included.

OBJECTIVES:

1. To give an insight into Graphs and connectivity.
2. To understand the concept of matching and edge colourings.

CONTENTS

UNIT - I

GRAPHS AND SUB GRAPHS: Graphs and Simple Graphs – Graph Isomorphism – The Incidence and Adjacency matrices – Sub graphs – Vertex Degrees – paths and Connection – Cycles. Trees: Trees – Cut edges and Bonds – cut vertices – Cayley's formula

UNIT – II

CONNECTIVITY, EULER TOURS AND HAMILTON CYCLES: Connectivity – Blocks - Euler tours - Hamilton Cycle.

UNIT - III

MATCHINGS: Matchings coverings in Bipartite Graphs – Perfect Matchings. Edge colourings: Edge chromatic number – Vizing's theorem.

UNIT - IV

INDEPENDENT SETS, CLIQUES: Independent sets – Ramsey's theorem. Vertex Colourings: Chromatic Number – Brook's Theorem – Hajos Conjecture – Chromatic Polynomials – Girth and Chromatic number.

UNIT - V

PLANAR GRAPHS: Plane and planar Graphs – Dual Graphs – Euler's formula – Bridges – Kuratowski's theorem (Proof omitted) – The Five Colour Theorem and the Four Colour Conjecture – Nonhamiltonian planar Graphs.

TEXT BOOKS:

1. *Bondy, J.A and Murty, U.S.R.* 1976.**Graph Theory with Applications.** American Elsevier Publishing Company Inc., New York.

   Unit-I : Sections: 1.1 – 1.7 and 2.1 – 2.4.

   Unit-II : Sections: 3.1 – 3.2 and 4.1 – 4.2

   Unit-III : Sections: 5.1 – 5.3 and 6.1 – 6.2

   Unit-IV : Sections: 7.1 -7.2 and 8.1 – 8.5

   Unit-V : Sections: 9.1 – 9.7

REFERENCE BOOK:

1. *Balakrishnan, V.K*, **Schaum's outline of theory and problems of Graph Theory**, McGraw Hill Education Pvt.Ltd, New Delhi.

16PMA33E	CORE- XIII: NUMBER THEORY	SEMESTER–III

Total Credits: 4
Hours Per Week: 4

OBJECTIVES:

1. To give an insight into arithmetic functions.
2. To understand the concept of number theory.

CONTENTS

UNIT - I

Divisibility: Introduction- Divisibility-Division Algorithm-Euclid Lemma and algorithm - Primes- The Fundamental theorem of arithmetic functions (or) the unique factorization theorem-Euclid theorem.

UNIT - II

Congruences: Introduction – Residue Classes- Euler's theorem (or) Euler's Generalization of Fermat's theorem- Fermat's theorem- Wilson's theorem- Solutions of congruence- Degree of Congruences- Chinese Remainder theorem.

UNIT - III

Primitive roots and Power Residues - Congruences of degree 2, prime modulus - Number theory from an algebraic view point - Groups, Rings and Fields.

UNIT – IV

Quadratic reciprocity and Quadratic Forms: Quadratic residues - Quadratic reciprocity – The Jacobi Symbol

UNIT – V

Some functions of Number Theory: Greatest Integer Function - Arithmetic functions – The Möbius Inversion formula – Recurrence functions.

TEXT BOOKS:

1. *Ivan Nivan and Herberts Zucherman*.1991. **An Introduction to Theory of Numbers**. Fifth Edition, Wiley Eastern Limited, New Delhi.

   Unit-I : Chapter I: Sections 1.1 – 1.3

   Unit-II : Chapter II: Sections: 2.1 – 2.3

   Unit-III : Chapter II: Sections: 2.8 – 2.11

   Unit-IV : Chapter III: Sections: 3.1 to 3.3

   Unit-V : Chapter IV: Sections: 4.1 – 4.4

REFERENCE BOOKS:

1. *Kennath and Rosan,* 1968.***Elementary Number Theory and its Applications.*** Addison Wesley Publishing Company.

15PMA43A	CORE –XIV: FUNCTIONAL ANALYSIS	SEMESTER–IV

Total Credits: 4
Hours Per Week: 7

OBJECTIVES:

1. The students should gain knowledge about the normed spaces.
2. To understand the concept of operators and spectrum.

CONTENTS

UNIT - I

Banach spaces – The definition and some examples – Continuous linear transformations – The Hahn-Banach theorem – The natural imbedding of N in N** - The open mapping problem.

UNIT - II

The conjugate of an operator – Hilbert spaces – The definition and some simple properties – Orthogonal complements - Orthonormal sets.

UNIT - III

The Conjugate space H* - The adjoint of an operator – Self-adjoint operators – Normal and unitary operators – Projections.

UNIT - IV

Matrices – Determinants and the spectrum of an operator – The spectral theorem.

UNIT - V

The definition and some examples of Banach algebra – Regular and singular elements – Topological divisors of zero – The spectrum – The formula for the spectral radius.

TEXT BOOKS:

1. *Simmons, G.F.* 1963. **Introduction to Topology and Modern Analysis.** McGraw – Hill Book Company, London.

   Unit I : Sections: 46 – 50.

   Unit II : Sections: 51 – 54.

   Unit III : Sections: 55 – 59.

   Unit IV : Sections: 60 – 63.

   Unit V : Sections: 64 – 68.

REFERENCE BOOK:

1. *Somasundaram. D* 2006. **A First course in Functinal Analysis.** Narosa Publishing house**.** Pvt. Ltd.

2. *Vasishtha A. R and Sharma.J.N 1975,* **Functional Analysis***, Krishna Prakashan media (p) ltd.*

16PMA43B	CORE –XV: MATHEMATICAL METHODS	SEMESTER–IV

Total Credits: 4
Hours Per Week: 7

OBJECTIVES:

1. The students should gain knowledge about the Fourier Transforms.
2. To understand the concept of application of Integral equation.

CONTENTS

UNIT - I

FOURIER TRANSFORMS: Fourier sine and cosine transforms – Fourier transforms of derivatives - Fourier transforms of simple functions - convolution integral – Parseval's Theorem.

UNIT - II

SOLUTION OF PDE BY FOURIER TRANSFORM : Laplace equation in half plane in infinite strips; in semi infinite strip. The Linear diffusion equation on a semi infinite line – the two dimensional diffusion equation.

UNIT - III

HANKEL TRANSFORMS: Properties of Hankel Transforms – Hankel inversion theorem of derivatives of functions (proof deleted)- The Parseval's relation – relation between Fourier and Hankel transforms - Axisymmetric Dirichlet problem for a half space - Axisymmetric Dirichlet problem for a thick plate.

UNIT- IV

INTEGRAL EQUATIONS: Types of Integral equations – Integral Fredholm Alternative - Approximate method – Equation with separable Kernel - Volterra integral equations.

UNIT - V

Application of Integral equation to ordinary differential equation – initial value problems – Boundary value problems – singular integral equations – Abel Integral equation.

TEXT BOOKS:

1. *Sneddon, I.N.* 1974.**The Use of Integral Transforms.** Tata Mc Graw Hill, New Delhi.

   Unit I : Chapter 2: 2.4 - 2.7, 2.9 – 2.10,

   Unit II : Chapter 2: 2.16 – 2-(a).(b).(c) 2.16.

   Unit III : Chapter 5: 5.2 – 5.4, 5.6 – 5.7, 5.10 – 5.12.

2. *Kanwal, R.P*. 1971.**Linear Integral Equations Theory and Technique,** Academic Press, New York.

   Unit IV : Chapter 2: 2.3 - 2.5, Chapter 3: 3.3 - 3.4.

   Unit V : Chapter 5: 5.1 – 5.2, Chapter 8: 8.1 – 8.2.

15PMA43C	CORE-XVI: COMPUTER PROGRAMMING IN C++	SEMESTER–IV

Total Credits: 4
Hours Per Week: 4

OBJECTIVES:

1. The students should gain knowledge about the OOPS.
2. To understand the concept of functions, operator overloading, classes and objects.

CONTENTS

UNIT - I

Principles of object-Oriented Programming: Software crisis – Software evolution – A look at procedure-oriented Programming – Object-oriented Programming Paradigm – Basic Concept of Object-Oriented Programming – Benefits of OOP – Object-Oriented languages – Applications of OOP.

UNIT – II

Tokens, Expressions and Control structure: Introduction – Tokens – Keywords – Identifiers and constants – basic data types – User defined data types - Derived data types – Symbolic constants – type compactability – Declaration of variables – Dynamic insulation of variables – Reference variables – operations in C++ - Scope resolution operator – member Dereferencing operators – memory management operators – Manipulators – typr cast operator – expressions and their types – Special assignment expressions – implicit conversions – operator over loading – operator precedence – Control structures.

UNIT – III

Functions in C++: Introduction – The main function – Function prototyping – call by reference – return by reference inline functions – default arguments – constant arguments – function over loading – friend and virtual functions – Math library functions – Managing Console I/O operations: Introduction – C++ streams – C++ stream classes – Unformatted I/O operations - Formatted I/O operations – Managing output with manipulators.

UNIT - IV

Classes and Objects: Introduction – C Structures Revisited – 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 Allocation for Objects – Static Data Members – Static Member Functions – Arrays of Objects – Objects as Function Arguments – Friendly functions – Returning Objects – Constant Member Functions. Constructors and Destructors: Introduction – Constructors – Parameterized Constructors – Multiple Constructors in a class – Constructors with Default Arguments – Dynamic Initializations of Objects – Copy Constructor – Constructing Two dimensional arrays – Constant Objects – Destructors.

UNIT - V

Operators overloading and Type Conversions: Introduction – Defining Operator Overloading – Overloading Unary Operators – Overloading Binary Operators – Overloading Binary Operators Using Friends – manipulating of strings Using Operators – Rules of Overloading Operators.
Inheritance: Extending Classes: Introduction – Defining Derived Classes – Single inheritance – Making a Private Member Inheritable – Multilevel Inheritance – Multiple Inheritance – Hierachial Inheritance – Hybrid Inheritance – Virtual Base Classes – Abstract Classes – Constructors in Derived Classes – Member Classes: Nesting of Classes.

TEXT BOOK:

1. *Balaguruswamy, E*. 2009, fourth edition. **Object Oriented Programming with C++** . Tata McGraw- Hill Publishing Company limited.

REFERENCE BOOKS:

1. *Venugopal,Rajkumar,T.Ravishankar , K.R* 1997. **Mastering C++,** Tata McGraw- Hill Education Pvt. limited.
2. *Herbert Schildt.* 2003. **C++: The Complete reference**.,fourth edition , Tata McGraw- Hill Education Pvt. limited.
3. *Ravichandran,D.* 2013. **Programming with C++,** Third edition , Tata McGraw- Hill Education Pvt. limited.

16PMA43P	CORE LAB- I: COMPUTER PROGRAMMING IN C++	SEMESTER–IV

Total Credits: 4
Hours Per Week: 4

CONTENTS

1. DISTANCE CONVERSION PROBLEM:

Creating two classes DM and DB which store the value of distances. The display may be in the order of meter and centimeter and feet or inches depending on the order of display.

2. OVERLOADING OBJECTS:

Creating a class FLOAT that contains one float data member overload all the four arithmetic operators so that operate on the objects of FLOAT.

3. OVERLOADING CONVERSIONS:

Designing a class polar which describes a point in a plane using polar Co-ordinates radius and angle. Points into rectangular Co-ordinates and finally converting the result into polar Coordinates.

4. POLAR CONVERSION:

Creating two classes polar and rectangular. By Using conversion routines convert from one system to another.

5. OVRELOADING MATRIX:

Creating a class MAT of size M*N. Define matrix Addition, Subtraction and Multiplication operations for MAT type objects.

6. AREA COMPUTATION USING DERIVED CLASS:

Area of rectangle = $X*Y$, Area of triangle = $\frac{1}{2} * X * Y$

7. VEXTOR PROBLEM:

Defining a class for vector containing scalar values. Apply overloading concepts for vector addition, Multiplication of a vector by a scalar quantity.

16PMA1EA	ELECTIVE- I : SOLID GEOMETRY	SEMESTER–I

Total Credits: 4
Hours Per Week: 4

OBJECTIVES:

1. To give an insight into solid shapes.
2. To understand the concept conicoids.

CONTENTS

UNIT - I

CONICOIDS : General equation of the second degree - shapes of some surfaces – intersection of a line with conicoids – plane of contacts - the polar plane of a point.

UNIT - II

The enveloping cone – the enveloping cylinder – conjugate diameters and diametral planes – paraboloids.

UNIT - III

PLANE SECTIONS OF CONICOIDS : Introduction – Nature of the plane section of a central conicoid – Axes of non-central plane sections.

UNIT - IV

Circular sections – Section of paraboloids – circular sections of paraboloids.

UNIT – V

GENERATING LINES OF CONICOIDS: Ruled surfaces – Generating lines of a hyperboloid of one sheet – central point line of striction - parameter of distribution of generator.

TEXT BOOKS:

1. Shanthi Narayanan , Dr.P.K.Mittal , 2013. **Analytical Solid Geometry ,** S.Chand and company pvt ltd, Ramnagar, New Delhi.

   UNIT I : Chapter 8 - Sections 8.1 to 8.5.

   UNIT II : Chapter 8 - Sections 8.6.1 to 8.9

   UNIT III : Chapter 9 - Sections 9.1 to 9.3

   UNIT IV : Chapter 9 - Section 9.4 to 9.6

   UNIT V : Chapter 10 - Sections: 10.1 to 10.6

16PMA1EB	ELECTIVE- I : DIFFERENTIAL GEOMETRY	SEMESTER – I

Total Credits: 4
Hours Per Week: 4

OBJECTIVES:

1. The students should gain knowledge about the curves and arcs.
2. To understand the concept of elementary theory of surface.

CONTENTS

UNIT - I

Space Curves: Introduction – Definitions - Arc length-tangent, normal and binormal – Serret – Frenet formula – curvature and torsion of a curve given as intersection of two surfaces.

UNIT - II

Contact between curves and surfaces – Locus of the centre of spherical curvarure – tangent surface – involutes and evolutes – Intrinsic equations – Fundamental existence theorem for space curve – Helices.

UNIT - III

Surface: Definition of a surface – curves on a surface – surface of revolution Helicoids – Metric – familes of curves.

UNIT – IV

Geodesics: Geodesics – canonical geodesic equations – Normal property of Geodesics – Existence theorem – Geodesic parallels.

UNIT -V

Geodesic curvature – Liouville's formula for K_G – Gauss – Bonnet theorem – Gaussian curvature – Geodesic polar form – Minding's theorem.

TEXT BOOK:

1. *S.G. Venkatachalam, S.G.* 2012, Differential Geometry (for M.Sc Mathematics), Margham publications.

   UNIT I : Chapter 1 - Pages 1.1 to 1.37.

   UNIT II : Chapter 1 - Pages 1.39 to 1.77

   UNIT III : Chapter 2 –Pages 2.1 to 2.12 & 2.18 to 2.21

   UNIT IV : Chapter 3 – Pages 3.1 to 3.24

   UNIT V : Chapter 3 – Pages 3.25 to 3.48

15PMA1EC	ELECTIVE- I: FUZZY LOGIC AND FUZZY SETS	SEMESTER–I

Total Credits: 4
Hours Per Week: 4

OBJECTIVES:

1. To give an insight into crisp sets and fuzzy sets.
2. To understand the concept of fuzzy relations and fuzzy measure.

CONTENTS

UNIT - I

CRISP SETS AND FUZZY SETS: The Notion of Fuzzy Sets-basic concepts of Fuzzy sets –Fuzzy complement-Fuzzy Union-Fuzzy intersection – Combination of operations – general aggregation of operations.

UNIT-II

FUZZY RELATIONS: Crisp and Fuzzy relations – Binary relations – Binary relations on a single set – Equivalence and similarity relations – Compatibility on Tolerance Relations-Orderings – Morphism – Fuzzy relations Equations.

UNIT - III

FUZZY MEASURES: Belief and plausibility Measures –Probability measures – Possibility and Necessity measures.

UNIT-IV

UNCERTAINTY AND INFORMATION: Types of Uncertainty – Measures of Fuzziness-Classical Measures of Uncertainty-Hartley information – Shannon entropy– Measures of Dissonance- Measures of Non-Specificity.

UNIT – V

APPLICATIONS: Natural, life and Social Sciences - Engineering - Medicine - Management and decision making.

TEXT BOOK:

1. *George J. Klir and Tina, A. Folger*.1995. **Fuzzy Sets Uncertainty and Information.** Prentice Hall of India Private Limited. Fourth printing.

   Unit I : Chapter 1,2 Sec 1.3,1.4,2.2-2.6
   Unit II : Chapter 3 Sec 3.1-3.8
   Unit III : Chapter 4 Sec 4.2-4.5
   Unit IV : Chapter 5 Sec 5.1-5.4, 5.6
   Unit V : Chapter 6 Sec 6.2-6.5

REFERENCE BOOK:

1. *George J. Klir and Boyuan*. **Fuzzy Sets and Fuzzy Logic Theory and Applications.** Prentice Hall of India Private Limited.

16PMA2EA	ELECTIVE –II: MATHEMATICAL SOFTWARE	SEMESTER – II

Total Credits: 4
Hours Per Week:4

Note: * Instruction hours -4 hours (Theory- 2 hours, Practical lab-2 hours)

OBJECTIVES:

1. To give an insight into Theoretical Computer Science.
2. To understand the structures of various interconnection networks.

CONTENTS

UNIT - I

LATEX: Text formatting – TEX and its offspring – Whats different in LATEX 2ε - Distinguishing LATEX 2ε - Basics of a LATEX file. Commands and Environments – Command names and arguments – Environments – Declarations – Lengths – Special Characters – Fragile Commands.

UNIT - II

Tables – Printing literal text – Footnotes and marginal notes. Mathematical formulas – Mathematical environments – Main elements of math mode – Mathematical symbols – Additional Elements – Finetuning mathematics.

UNIT - III

MATLAB: Introduction – Basics of MATLAB – Input – Output – File types – Platform dependence – General commands – Creating a script file – Creating and Executing a function file – Working with files and directories.

UNIT - IV

Interactive Computation : Matrices and Vectors Matrix and Array operations Using Built-in Functions and ON-line Help – Command line functions – Saving and loading data – Ploting simple graphs.

UNIT - V

MATHEMATICA : Running Mathematica – Numerical Calculations – Building Up calculations – Using the Mathematica system – Algebraic Calculations – Symbolic Mathematics – Numerical Mathematics.

Note: Instruction hours -4 hours (theory- 2 hours, practical lab-2 hours)

TEXT BOOKS:

1. *Kopka ,H and Daly ,P.W.* 1999. **A Guide to LATEX**. Thrid Edition. Addison Wesley, London.
2. *Rudra Pratap.* 2003. **Getting started with MATLAB A Quick Introduction for Scientists and Engineers.** Oxford University Press.
3. *Stephen Wolfram.* 2003. **The Mathematical Book.** Fifth Edition. Cambridge University Press.

REFERENCE BOOKS:

1. *Delores M.Etter and David C Kunciciky with Hally Moore*. 2009. **Introduction to MATLAB 7**. Dorling Kindersley Pvt Ltd.
2. *Brian R Hunt, Ronald L Lipsman, Jonathan M Rosenberg with Kevin ,R Coombes, John, E, Osborn and Garrett J Stuck. 2006.* ***A Guide to MATLAB FOR BEGINNERS AND EXPERIENCED USERS.*** Replika Press Pvt Ltd.

LIST OF PROGRAMS

LATEX

1. Creating a document with paragraph alignment.
2. Creating a document using tables.
3. Inserting a graph or picture in a document.
4. Creating a document and type mathematical formulas.

MATLAB

1. Generating Fibonacci numbers.
2. Solving a first/second order nonlinear ODE.
3. Finding Addition, Multiplication and determinant of matrices.
4. Designing a Simple Plot.
5. Solving nonlinear algebraic equations.

MATHEMATICA

1. Performing Matrix Operations.
2. Solving Quadratic Equations.
3. Solving a First / Second order Differential Equations.

16PMA2EB	ELECTIVE –II: MATHEMATICAL MODELLING	SEMESTER–II

Total Credits: 4
Hours Per Week: 4

OBJECTIVES:

1. To give an insight into mathematical modelling.
2. To understand the concept of dynamic programming techniques.

CONTENTS

UNIT - I

Mathematical modeling through system of ordinary differential equation of first order Mathematical modeling in population dynamics, Mathematical modeling of epidemics through system ordinary differential equations of first order - Mathematical modeling in medicine, arms race, battle and international trading in terms of system of ordinary differential equations of first order

UNIT - II

Mathematical modeling through differential equations The need of mathematical modeling through differential equations – some simple models – basic theorem of linear differential equations with constant coefficient - Mathematical modeling through differential equations in economics and finance

UNIT - III

Mathematical modeling through difference equations (contd.) Mathematical modeling through difference equations in population dynamics and genetics Mathematical modeling through difference equations in probability theory .miscellaneous examples of Mathematical modeling through difference equations

UNIT - IV

Mathematical modeling through graphs Situations that can be modeled through graphs - Mathematical models in terms of directed graphs - Mathematical models in terms weighted graphs.

UNIT - V

Mathematical modeling through calculus variations and dynamic programming Optimization principles and techniques - Mathematical modeling through calculus of variation - Mathematical modeling through dynamic programming.

TEXT BOOKS:

1. *Kapur, J.N.* 2000. **Mathematical Modeling.** Willey Eastern limited. reprint.
2. *James, D.J.G. and Macdonald,* J.J. 2005. C**ase Studies in Mathematical Modeling.** Stanly Thames. Cheltenham.

REFERENCE BOOKS:

1. *Kapur, J.N. 1976.* **Mathematical entropy models**.
2. *Crossand, M. and Moscrcadini, A.O.* 1976. **The Art of Mathematical Modeling,** Ellis Harwood and john Wiley.

16PMA2EC	ELECTIVE- II: INTRODUCTION TO SPECIAL FUNCTIONS	SEMESTER–II

Total Credits: 4
Hours Per Week: 4

OBJECTIVES:

1. The students should gain knowledge about the special function.
2. To understand the concept of types and axiom.

CONTENTS

UNIT – I
Gamma function and related functions

UNIT – II
Hyper geometric functions

UNIT - III
Generalized Hyper geometric functions

UNIT - IV
Chebyshev polynomials

UNIT - V
Some advanced special functions

TEXT BOOKS:

1. *N. Saran, Dr. S.D. Sharma and Dr. T.N. Trivedi,* 2015. **Special Functions(seventeenth edition), Pragari Prakashan Educational publishers,**

Unit I : Chapter 2: Section 2.1 to 2.10

Unit II : Chapter 3: Section 3.1 to 3.5

Unit III : Chapter 4: Section 4.1 to 4.7

Unit IV : Chapter 9: Section 9.1 to 9.7

Unit V : Chapter 13: Section 13.1 to 13.7

16PMA3EA/ 15PMA1EA	ELECTIVE –III: DISCRETE MATHEMATICS	SEMESTER–III

Total Credits: 4
Hours Per Week: 4

OBJECTIVES:

1. **To give an insight into lattices and finite fields**
2. **To understand the concept coding theory.**

CONTENTS

UNIT-I

LATTICES: Properties and examples of Lattices -Distributive lattices - Boolean algebras-Boolean polynomials-Minimal Forms of Boolean Polynomials.

UNIT-II

APPLICATIONS OF LATTICES : Switching Circuits-Applications of Switching Circuits

UNIT-III

FINITE FIELDS : Finite fields

UNIT-IV

FINITE FIELDS AND POLYNOMIALS: Irreducible Polynomials over Finite fields -Factorization of Polynomials over Finite fields.

UNIT-V

CODING THEORY : Introduction to Coding -Linear Codes.

RECOMMENDED TEXT:

Rudolf Lidl& Gunter Pilz. APPLIED ABSTRACT ALGEBRA, Second Indian Reprint 2006, Springer Verlag, NewYork.

Unit – I : Chapters - 1 to 4 and 6.
Unit – II : Chapters - 7 and 8.
Unit – III : Chapter - 13.
Unit – IV : Chapters - 14 and 15.
Unit – V : Chapters - 16 and 17.

REFERENCE BOOKS:

1. A.Gill, Applied Algebra for Computer Science, Prentice Hall Inc., New Jersey.
2. J.L.Gersting, Mathematical Structures for Computer Science (3rdEdn.), Computer Science Press, New York.
2. S.Wiitala,Discrete Mathematics-A Unified Approach, McGraw Hill Book Co.

15PMA3EB	ELECTIVE –III: MAGNETO HYDRO DYNAMICS	SEMESTER–III

Total Credits: 4
Hours Per Week: 4

OBJECTIVES:

1. The students should gain knowledge about the hydro dynamics.
2. To understand the concept of stability.

CONTENTS

UNIT - I

Electromagnetism – Fundamental Laws – Electrostatic Energy – Electrodynamics – Ampere's Law – Lorentz force on a moving charge – Magnetostatic Energy – Faraday's Law of Induction – Poynting stresses – Electromagnetic Equations with respect to moving axes – boundary conditions of electric and magnetic fields.

UNIT – II

Kinematics of fluid motion – equation of continuity – Stress tensor – Navier-stokes equations – boundary condition – Velocity Magneto fluid dynamic equations – MHD approximation – equation of Magnetic diffusion in a moving conducting medium – Magnetic Reynolds number.

UNIT - III

Alfven's theorem Law of isorotation - Magneto hydrostatics – Force-free field – Alfven waves in incompressible MHD.

UNIT - IV

Incompressible viscous flows in the presence of magnetic field – Hartmann Flow – unsteady Hartmann flow – Magnetofluid dynamic pipe flow.

UNIT – V

Stability – Instability of linear pinch – Sausage and flute types – Method of small oscillations – gravitational instability.

TEXT BOOKS:

1. *Crammer ,K.R. and Pai ,S.I.*1973.***Magneto Fluid Dynamics for Engineers and Applied Physicists.*** McGraw Hill.
2. *Ferraro,V.C.A. and Plumpton*.1966. ***Introduction to Magneto Fluid Dynamics***.Oxford.

15PMA3EC	ELECTIVE- III: STOCHASTIC DIFFERENTIAL EQUATIONS	SEMESTER–III

Total Credits: 4
Hours Per Week: 4

OBJECTIVES:

1. To give an insight into Diffusions.
2. To understand the concept of Stochastic Analogs of Classical Differential Equations.

CONTENTS

UNIT – I

Introduction: Stochastic Analogs of Classical Differential Equations, Filtering Problems, Stochastic Approach to Deterministic Boundary Value Problems, Optimal Stopping, Stochastic Control and Mathematical Finance. Some mathematical preliminaries: Probability Spaces, Random Variables and Stochastic Processes and an Important Example: Brownian motion.

UNIT – II

Ito Integrals: Construction of the Ito integral, Some Properties of the Ito Integral and Extensions of the Ito Integral.

UNIT - III

The Ito formula and the Martingale Representation Theorem: The 1- dimensional Ito Formula, the Multi dimensional Ito Formula and the Martingale Reprsentation Theorem. Stochastic Differential Equations: Examples and Some Solution Methods, An Existence and Uniqueness Result and Weak and Strong Solutions.

UNIT - IV

The Filtering problem: Introduction, The 1- dimensional Linear Filtering Problem and the Multi- dimensional Linear Filtering Problem.

UNIT - V

Diffusions: Basic Properties: The Markov Property, the Strong Markov Property, the Generator of an Ito Diffusion, the Dynkin Formula, the Characteristic Operator.

TEXT BOOKS:

1. *Bernt Oksendal*. 2003.**Stochastic Differential Equations - An Introduction with Applications.** (Sixth Edition). Springer-Verlag, Heidelberg.

15PMA4EA	ELECTIVE- IV: CONTROL THEORY	SEMESTER–IV

Total Credits: 4
Hours Per Week: 4

OBJECTIVES:

1. The students should gain knowledge about the observability Grammian.
2. To understand the concept of optimal control.

CONTENTS

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 -

UNIT - IV

Linear time varying systems – Perturbed linear systems – Nonlinear systems

UNIT – V

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

TEXT BOOKS:

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

   Unit I : Chapter 2: 2.1 - 2.2.

   Unit II : Chapter 3: 3.1 – 3.2.

   Unit III : Chapter 4: 4.1

   Unit IV : Chapter 4: 4.2,4.3

   Unit V : Chapter 5: 5.1 -5.3

15PMA4EB	ELECTIVE- IV: NEURAL NETWORKS	SEMESTER–IV

Total Credits: 4
Hours Per Week: 4

OBJECTIVES:

1. To give an insight into Mathematical Neuron model.
2. To understand the concept of neural networks.

CONTENTS

UNIT - I

Mathematical Neuron Model- Network Architectures- Perceptron-Hamming Network- Hopfield Network-Learning Rules-Perceptron Architectures and Learning Rule with Proof of Convergence.

UNIT - II

Supervised Hebbian Learning-Linear Associator-The Hebb Rule-Pseudo inverse Rule- Variations of Hebbian Learning-Back Propagation-Multilayer Perceptrons-Back propagation Algorithm-Convergence and Generalization.

UNIT – III

Performances Surfaces and Optimum Points-Taylor series-Directional Derivatives- Minima-Necessary Conditions for Optimality-Quadratic Functions-Performance Optimizations- Steepest Descent-Newton's Method-Conjugate Gradient.

UNIT - IV

Associative Learning-Simple Associative Network-Unsupervised Hebb rule-Simple Recognition Network-Instar Rule-Simple Recall Network-Outatar Rule-Competitive Networks- Hamming Network- Competitive Layer-Self Organizing Feature maps- Learning Vector Quantization.

UNIT - V

Adaptative Resonance Theory-Overview of Adaptative Resonance Theory-Orienting Sub System- Learning Law L I-L2 and L2-L1. ART I Algorithm-Other ART Architectures-Stability- Recurrent Networks-Stability Concepts-Lyapunov Stability Theorem-Pendulum Example-Lasalle's Invariance Theorem.

TEXT BOOKS:

1. *Martin T.Hagan. Howard ,B.* Demuth and Mark Beale. 2003. **Neural Network Design.** Vikas Publishing House, New Delhi.
2. *James A. Freeman and* David *M.* Skapura. 2003.**Neural Networks Algorithms, Applications and Programming Techniques.** Pearson Education.

REFERENCE BOOK:

1. *Robert J. Schalkoff.* 1997. **Artificial Neural Network.** McGraw-Hill International Edition.

15PMA4EC	ELECTIVE –IV: CRYPTOGRAPHY	SEMESTER–IV

Total Credits: 4
Hours Per Week: 4

OBJECTIVES:

1. To give an insight into cryptography.
2. To understand the concept of Encryption and secrecy.

CONTENTS

UNIT – I

Introduction – Encryption and Secrecy – The objective of Cryptography – Cryptographic protocols. Mathematical background – Number Theory – Introduction – Modular Arithmetic – Integer factorization problem – Pollard's rho factoring – Elliptic curve factoring – Discreate logarithm problem

UNIT – II

Finite fields – Groups, Rings, Fields - Basic properties – Modular Arithmetic – The Euclidean Algorithm – Finite field of the form GF(P) and GF(2^n)Arithmetic of polynomials –Factoring polynomials over finite fields – Square free factorization

UNIT – III

Block Ciphers principles – The data Encryption standard – The strength of DES – Block cipher design principles –Block cipher mode operation – Stream ciphers - Symmetric key encryption.

UNIT – IV

Public key cryptography – Concepts of public key cryptography – Modular arithmetic – RSA – Description of the algorithm – Computational aspects – Security of RSA- Discrete logarithm – Elliptic curve cryptography

UNIT - V

Protocols and mechanisms - Key establishment, management and certification – Pseudorandom numbers and sequences – classes of attacks and security models – Authentication methods – Kerberos – Security Applications.

TEXT BOOKS:

1. *Hans Delfs and Helmut Knebl*. 2002. **Introduction to Cryptography.** Springer Verlag.
2. *Alfred J.* Menezes. Paul Van *Oorschot and Scott A. Vanstone,C.*2000. **Handbook of Applied Cryptography.** CRC Press.
3. *William Stallings*.2000. **Cryptography and Network Security.** Prentice Hall of India.

REFERENCE BOOK:

1. *Pachghare, V.K.* 2009. **Cryptography and Information Security**. PHI Learning Private Ltd.

16PMASS1	SELF STUDY PAPER – I: MODERN ANALYSIS – I	SEMESTER - I To III

Total Credits: 1

UNIT – I

Preliminaries: Sets and functions – countable sets – uncountable sets – Inequalities of Holder and Minkowski

UNIT – II

Metric Spaces: Definition and Examples – Bounded sets in a metric space – open ball in a metric spaceopen sets – subspaces

UNIT – III

Interior of a set – closed sets – closure – limit point – sense sets.

UNIT – IV

Complete metric space: Introduction – completeness – Baire's category theorem.

UNIT – V

Continuity: Introduction – continuity – Homeomorphism – Uniform continuity – Discontinuous functions on R.

TEXT BOOK:

Arumugam, S and Thangapandi. A,2002, **Modern Analysis, ISAAC,** New Gamma Publishing house, palayamkottai

UNIT – I : Chapter 1 Section 1.1 to 1.4

UNIT – II : Chapter 2 Section 2.1 to 2.5

UNIT – III : Chapter 2 Section 2.6 to 2.10

UNIT – IV : Chapter 3 Section 3.0 to 3.2

UNIT – V : Chapter 4 Section 4.0 to 4.4

16PMASS2	SELF STUDY PAPER – II: MODERN ANALYSIS – II	SEMESTER- I To III

Total Credits: 1

UNIT – I

Connectedness: Introduction – Definition and Examples – connected subsets of R –m connectedness and contuinity.

UNIT – II

Compactness: Introduction – compact space – compact subset of R – Equivalent characterization for compactness – compactness and continuity.

UNIT – III

Metric space C[a, b]: Introduction – pointwise convergence – uniform convergence – Test for uniform convergence – the metric space C[a, b].

UNIT – IV

Contraction mapping and its applications: Introduction – contraction mapping theorem.
Completion of a metric space: Introduction – completeness.

UNIT – V

Theory of matrices: Introduction – Algebra of matrices – Types of matrices – Inverse of matrix – Elementary transformations – Rank of a matrix – Simultanneous linear equations – The characteristic polynomial of a matrix.

TEXT BOOK:

1. Arumugam, S and Thangapandi. A,2002, **Modern Analysis, ISAAC,** New Gamma Publishing house, palayamkottai

   UNIT – I : Chapter 5 Section 5.0 to 5.3
   UNIT – II : Chapter 6 Section 6.0 to 6.4
   UNIT – III : Chapter 7 Section 7.0 to 7.4
   UNIT – IV : Chapter 8 Section 8.0 to 3.2
   Chapter 9, Section 9.0 to 9.1

2. Arumugam, S and Thangapandi. A,2002, **Modern Analysis, ISAAC,** New Gamma Publishing house, palayamkottai

   UNIT – V : Chapter 7 Section 7.0 to 7.7

24/6/2016

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