ALAGAPPA UNIVERSITY, KARAIKUDI
NEW SYLLABUS UNDER CBCS PATTERN (w.e.f.2017-18)

M.Sc., MATHEMATICS – PROGRAMME STRUCTURE

Sem.	Course Code	Name of the Course	Cr.	Hrs./ Week	Max. Marks		
					Int.	Ext.	Total
I	7MMA1C1	**Core–I**– Algebra – I	5	6	25	75	100
	7MMA1C2	**Core–II**– Analysis – I	5	6	25	75	100
	7MMA1C3	**Core – III**–Differential Geometry	5	6	25	75	100
	7MMA1C4	**Core –IV**–Ordinary Differential Equations	5	6	25	75	100
	7MMA1E1 7MMA1E2 7MMA1E3	**Elective–I: (Choose One out of Three)** **A)** Number Theory **(or)** **B)** Calculus of Variations and Special Functions **(or)** **C)** Data Structures and Algorithms Theory and Practical	4	6	25	75	100
		Total	**24**	**30**	**--**	**--**	**500**
II	7MMA2C1	**Core –V**–Algebra – II	5	6	25	75	100
	7MMA2C2	**Core –VI**–Analysis – II	5	6	25	75	100
	7MMA2C3	**Core–VII**–Partial Differential Equations	5	6	25	75	100
	7MMA2C4	**Core –VIII–**Mechanics	5	6	25	75	100
	7MMA2E1 7MMA2E2 7MMA2E3	**Elective–II:(Choose One out of Three)** **A)** Graph Theory **B)** Applied Algebra **C)** Difference Equations	4	6	25	75	100
		Total	**24**	**30**	**--**	**--**	**500**
III	7MMA3C1	**Core–IX**–Complex Analysis	5	6	25	75	100
	7MMA3C2	**Core–X**–Topology – I	5	6	25	75	100
	7MMA3C3	**Core–XI**–Probability and Statistics	5	6	25	75	100
	7MMA3E1 7MMA3E2 7MMA3E3	**Elective–III:(Choose One out of Three)** **A)** Discrete Mathematics **(or)** **B)** Fluid Dynamics **(or)** **C)** Automata Theory	4	6	25	75	100
	7MMA3E4 7MMA3E5 7MMA3E6	**Elective–IV:(Choose One out of Three)** **A)** Fuzzy Mathematics **(or)** **B)** Stochastic Processes **(or)** **C)** Combinatorial Mathematics	4	6	25	75	100
		Total	**23**	**30**	**--**	**--**	**500**
IV	7MMA4C1	**Core – XII**–Functional Analysis	5	8	25	75	100
	7MMA4C2	**Core – XIII**–Operations Research	5	8	25	75	100
	7MMA4C3	**Core – XIV**–Topology II	5	7	25	75	100
	7MMA4E1 7MMA4E2 7MMA4E3	**Elective–V:(Choose One out of Three)** **A)** Advanced Statistics **B)** Stochastic Differential Equations **C)** Numerical Methods	4	7	25	75	100
		Total	**19**	**30**	**--**	**--**	**400**
		Grand Total	**90**	**120**	**--**	**--**	**1900**

M.Sc. MATHEMATICS

I YEAR – I SEMESTER
COURSE CODE: 7MMA1C1

CORE COURSE-I –ALGEBRA– I

Unit I

Group Theory: Definition of a group – Some examples of groups – Some preliminary Lemmas – Subgroups – A counting principle – Normal subgroups and Quotient groups – Homomorphisms – Automorphisms – Cayley's Theorem – Permutation Groups.

Unit II

Another counting Principle – Sylow's Theorem – Direct products

Unit III

Ring Theory: Definition and examples of rings – some special classes of Rings – Homomorphisms.

Unit IV

Ideals and Quotient Rings – More ideals and Quotient Rings – The field of quotients of an Integral Domain

Unit V

Enclidean Rings – A Particular Euclidean Ring – Polynomial Rings – Polynomials over the Rational Field – Polynomial Rings over commutative Rings.

Text Book(s)

I.N.Herstein, Topics in Algebra (2nd Edition) Wiley Eastern Limited, New Delhi, 1975.

Chapter II – 2.1 to 2.13 & Chapter III

Books for Supplementary Reading and Reference:

1. M.Artin, Algebra, Prentice Hall of India, 1991.
2. John B.Fraleigh, A First Course in Abstract Algebra, Addison Wesley, Mass, 1982.
3. D.S.Malik, J.N.Mordeson and M.K.Sen, Fundamentals of Abstract Algebra, McGraw Hill (International Edition), New York, 1997.

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I YEAR – I SEMESTER
COURSE CODE: 7MMA1C2

CORE COURSE-II – ANALYSIS – I

Unit I

Basic Topology: Metric Spaces – Compact sets – Perfect sets – Connected sets.

Unit II

Numerical sequences and series; Convergent sequences, Subsequences, Cauchy sequences, Upper and Lower limits – Special sequences, Series, Series of non–negative terms. The number e – The root and ratio tests.

Unit III

Power series – Summation by parts – Absolute convergence – Addition and Multiplication of series – Rearrangements

Unit IV

Continuity: Limits of functions – Continuous functions, Continuity and Compactness, Continuity and Connectedness – Discontinuities – Monotonic functions – infinite limits and limits at infinity.

Unit V

Differentiation: The derivative of a real function – Mean value theorems – the continuity of derivatives – L'Hospital's rule – Derivatives of Higher order – Taylor's theorem Differentiation of vector – valued functions.

Text Book

Walter Rudin, Principles of Mathematical Analysis, III Edition (Relevant portions of chapters II, III, IV & V), McGraw-Hill Book Company, 1976.

Books for Supplementary Reading and Reference:

1. H.L.Royden, Real Analysis, Macmillan Publ.co., Inc. 4th edition, New York, 1993.
2. V.Ganapathy Iyer, Mathematical Analysis, Tata McGraw Hill, New Delhi, 1970.
3. T.M.Apostal, Mathematical Analysis, Narosa Publ. House, New Delhi, 1985.

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I YEAR – I SEMESTER
COURSE CODE: 7MMA1C3

CORE COURSE-III – DIFFERENTIAL GEOMETRY

Unit I

Space Curves – Definition of a space Curve – Arc length – tangent – normal and binormal – Curvature and Torsion – Contact between Curves and Surfaces – tangent surface – Involutes and evolutes – Intrinsic equations – Fundamental Existence Theorem for space Curves - Helices.

Unit II

Intrinsic Properties of a Surface – Definition of a Surface – Curves on a Surface – Surface of revolution – Helicoids – Metric – Direction Coefficients – families of Curves – Isometric Correspondence – Intrinsic properties.

Unit III

Geodesics – Canonical geodesic equations – Normal property of geodesics – Existence Theorems – Geodesic parallels.

Unit IV

Geodesic Curvature – Gaurs – Bonnet Theorem – Gaussian Curvature – Surface of Constant Curvature.

Unit V

Non-Intrinsic Properties of a Surface – The second fundamental form – Principal Curvature – Lines of Curvature – Developable – Developable associated with space curves and with curves on surfaces.

Text Book

T.J.Willmore, An Introduction to Differential Geometry, Oxford University Press (17^{th} Impression) New Delhi 2002 (Indian Print)

Chapter I	:	Sections 1 to 9
Chapter II	:	Sections 1 to 9
Chapter II	:	Sections 10 to 14
Chapter II	:	Sections 15 to 18
Chapter III	:	Sections 1 to 6

Books for Supplementary Reading and Reference:

1. D.Somasundaram, Differential Geometry, A First Course, Narosa Publishing House, Chennai, 2005.
2. D.J.Struik, Classical Differential Geometry, Addison Wesley Publishing Company INC, Massachusetts, 1961.

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I YEAR – I SEMESTER
COURSE CODE: 7MMA1C4

CORE COURSE-IV – ORDINARY DIFFERENTIAL EQUATIONS

Unit I

Linear equations with constant coefficients – Linear dependence and Independence – a formula for the Wronskian – non-homogenous equation – homogeneous equation of order n-initial value problems for n^{th} order equations – equations with real constants – non-homogeneous equations of order n.

Unit II

Linear equations with variable coefficients : Reduction of the order of a homogeneous equation – non-homogeneous equation-homogeneous equations with analytic coefficients – Legendre equation.

Unit III

Linear equations with regular singular points – Euler equations – second order equations with regular singular points – an example – second order equations with regular singular points – general case – exceptional cases – Bessel equation – Bessel equation (continued) – regular points at infinity.

Unit IV

Existence and uniqueness of solutions to first order equations : Equations with variables separated – exact equations – method of successive approximations – Lipchitz condition – convergence of the successive approximations.

Unit V

Nonlocal existence of solutions-approximations to solutions and uniqueness of solutions – Existence and uniqueness of solutions to systems and n^{th} order equations – existence and uniqueness of solutions to system.

Text Book

Earl A.Coddington, An Introduction to Ordinary Differential Equations – Prentice Hall of India, 1987.

Unit – I	Chapter - 2 sections 2.4 to 2.10
Unit – II	Chapter - 3 sections 3.5 to 3.8
Unit – III	Chapter - 4 sections 4.1 to 4.4 and 4.6 to 4.9
Unit – IV	Chapter - 5 sections 5.2 to 5.6
Unit – V	Chapter 5 & 6 sections 5.7 to 5.8 and 6.6

Books for Supplementary Reading and Reference:

1. D.Somasundaram, Ordinary Differential Equations, Narosa Publishing House, Chennai, 2002.
2. M.D.Raisinghania, Advanced Differential Equations, S.Chand and Company Ltd, New Delhi, 2001.

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I YEAR – I SEMESTER
COURSE CODE: 7MMA1E1

ELECTIVE COURSE-I (A) – NUMBER THEORY

Unit I

The fundamental Theorem of Arithmetic: Introduction – divisibility – greatest common divisor – Prime Numbers – The Fundamental theorem of arithmetic – The series of reciprocals of the primes the Euclidean Algorithm – the greatest common divisors of more than two numbers.

Unit II

Arithmetical functions and Dirichlet Multiplication: Introduction; the Mobius function $\mu(n)$ – θ and μ – product formula for $\theta(n)$ the Dirichlet product of arithmetical functions Dirichlet inverses and the mobius inversion formula the Mangoldt function Λ (n) – Multiplicative functions – Multiplicative functions; and Dirichlet multiplication – the inverse of a Completely multiplicative function – Liouville's fn λ (n) – the division functions $\sigma\alpha$ (n) – Generalized Convolutions – Formal Power Series – the Bell series of an arithmetical function Bell series and Dirichlet Multiplication – Derivatives of arithmetical functions the selberg identity.

Unit III

Averages of Arithmetical Functions: Introduction The big on notation Asymptotic equality of functions – euler's summation formula some elementary asymptotic formulas – the average order of d (n) – the average order of the division functions σ £(n) – the average order of Ψ (n) an application to the distribution of lattice points. Visible from the origin the average order μ (n) and of Λ (n) the partial sums of a Dirichlet product – Applications to $\mu(n)$ and Λ (n) Another identity for the partial sums of a Dirichlet product.

Unit IV

Congruences: Definition and Basic properties of congruences Residue classes and complete residue systems linear congruences – reduced residue systems and the Euler – Fermat theorem– Polynomial congruences modulo Lagrange's theorem – Applications of Lagrange's theorem Simultaneous linear congruences the Chinese remainder theorem – Application of the Chinese remainder theorem – polynomial congruences with prime power moduli the principle of cross classification a decomposition property of reduced residue systems.

Unit V

Quadratic residuces and the Quadratic Reciprocity Law: Lagrange's symbol and its properties– evaluation of (-1/p) and (2/P) – Gauss's Lemma – the quadratic reciprocity law applications of the reciprocity law the Jacobi symbol applications to Diophantine Equations.

Text Book

Tom M. Apostal, Introduction to Analytic Number theory, Springer Verlag.

Chapters : I, II, III, V & IX (upto Diophantine equations)

Books for Supplementary Reading and Reference:

1. Niven and H.S.Zuckerman, An Introduction to the Theory of Numbers, 3rd Edition, Wiley Eastern Ltd., New Delhi, 1989.
2. D.M.Burton, Elementary Number Theory, Universal Book Stall, New Delhi, 2001.

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I YEAR – I SEMESTER

COURSE CODE: 7MMA1E2

ELECTIVE COURSE-I (B) – CALCULUS OF VARIATIONS AND SPECIAL FUNCTIONS

Unit I

Functional – The fundamental lemma – Euler's equation – minimum surface of revolution – Brachistochrone problem – Problems on geodesics – isoperimetric problems.

Unit II

Several dependent variables – Functional dependent on Higher order Derivative – Functionals dependent variables – Variational problems – Parametric form

Unit III

Hamiltous' Principle – Lagrange's equations – Problems on vibrations – Direct methods in variational problems – Euler's finite difference method – Ritz method and Kantorovich's method problems.

Unit IV

Legendre functions – Legendre Polynomials – Recurrence formula – Rodrigue's formula – properties – Bessel functions – Gamma function– recurrence formula– generating function – properties of Bessel functions.

Unit V

Hermite, Legendre and chebyshev functions and polynomials – Generating functions – Properties.

Text Books

1) L.Elsgolts, Differential Equations & Calculus of Variations, Mir Publishers(Units I, II & III)
2) G.F.Simmons, Differential Equations with Applications and Historical Notes, Tata McGraw Hill, New Delhi, (Units IV & V)

Books for Supplementary Reading and Reference:

1) Advanced Mathematics for Engineering and Science by M.K. Venkataraman, National Publishing Company Pvt. Ltd.
2) Methods of Applied Mathematics by F.B.Hildebrand, PHI.
3) Advanced Engineering Mathematics by Erwin Kreyzig, Wiley Eastern.
4) Differential Equations with Special Functions by Sharma and Gupta, Krishna Prakasan Mandir.
5) Higher Engineering Mathematics by B.S.Grewal, Kanna Publishers.

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I YEAR – I SEMESTER

COURSE CODE: 7MMA1E3

ELECTIVE COURSE-I (C) – DATA STRUCTURES AND ALGORITHMS THEORY AND PRACTICAL

Unit I

Preliminaries in C++**:** Functions and Parameters Dynamic Memory Allocation – Classes – Testing and Debugging Programming Performances**:** Space Complexity – Time Complexity – Asymptotic Notation (O,Ω, θ, o) Practical Complexity – Performance Measurements.

Unit II

Data Representation**:** Linear Lists – Formula based representation – Linked representation – Indirect Addressing – Simulating Pointers – Applications. Arrays Matrices**:** Arrays – Matrices – Special Matrices – Sparse Matrices. Stacks and Queues: The Abstract Data Type – Derived Classes and Inheritance – Formula based Representation – Linked Representation – Applications – Hashing.

Unit III

Binary and other Trees**:** Trees – Binary Trees – Properties of binary trees – Representation of Binary Trees – Common Binary tree operations – Binary Tree traversal – The ADT Binary tree – Applications – Priority Queues: Linear Lists – Hash – Leftist Trees – Applications – Search Trees – AVL Trees – B-Trees – Applications – Graphs.

Unit IV

The Greedy Method**:** Optimization Problems – Greedy Method – Applications Divide and Conquer**:** The Method – Applications – Lower Bounds on Complexity.

Unit V

Dynamic Programming**:** The Method – Applications – Backtracking – The Method – Applications – Branch and Bound: The Method – Applications.

Text Book

SAHNI, Data structures, Algorithms and Applications in C++ – International Edition 1998, Tata McGraw Hill.

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DATA STRUCTURES AND ALGORITHMS IN C++ LAB

1. Stack implementation using Arrays and Linked List
2. Queue implementation using Arrays and Linked List
3. Binary Search Tree
4. Single Linked List, Doubly Linked and Circular Linked List
5. Different Types of Sorting (Quick, Bubble, Merge etc)
6. String Operations
7. Number Generation (Prime Number, Fibonacci, Armstrong, Perfect Numbers)
8. Searching (Linear and Binary)
9. SPARSE Matrix
10. Polynomial Addition
11. Tree Traversal
12. Sum of Alternate Digits
13. Student File (Mark Processing)
14. Matrix Multiplication
15. Employee Details

I YEAR–II SEMESTER
COURSE CODE: 7MMA2C1

CORE COURSE-V–ALGEBRA–II

Unit I

Vector Space: Elementary basic concepts – Linear Independence and Basis.

Unit II

Dual spaces – Inner product spaces.

Unit III

Field: Extension fields – Roots of polynomials – More about roots.

Unit IV

The Elements of Galois theory.

Unit V

Linear Transformations: The Algebra of linear transformations – Characteristic roots – Matrices – Canonical forms Triangular Form – Hermitian, Unitary, and Normal transformations.

Text Book

I.N.Herstein, Topics in Algebra (2nd edition) John Wiley and Sons, New York.

Chapter IV	:	(Sections 4.1 to 4.4)
Chapter V	:	(Sections 5.1, 5.3, 5.5, 5.6)
Chapter VI	:	(Sections 6.1, 6.2, 6.3, 6.4, and 6.10)

Books for Supplementary Reading and Reference:

1. P.B.Bhattacharya, S.K.Jain and S.R.Nagpaul, Basic Abstract Algebra (2nd edition) Cambridge University Press, 1997 (Indian Edition)
2. S.Lang, Algebra 3rd edition, Addison-Wesley, Mass, 1993.
3. N.Jacobson, Basic Algebra, Vol. I & II W.H.Freeman, also Published by Hindustan Publishing Company, New Delhi, 1980.

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I YEAR – II SEMESTER
COURSE CODE: 7MMA2C2

CORE COURSE-VI–ANALYSIS–II

Unit I

Riemann-Stieltjes Integral: Definition and Existence of the Integral – Properties of the Integral, Integration and Differentiation , Integration of vector – valued functions – Rectifiable curves.

Unit II

Sequences and Series of functions: Discussion of main problem, Uniform convergence – continuity- Integration and Differentiation, Equicontinuous families of functions – the Stone Weierstrass theorem.

Unit III

Some special functions: Power series, the Exponential, Logarithmic and Trigonometric functions – the Algebraic completeness of the Complex field – Fourier Series – The Gamma function.

Unit IV

Lebesgue measure: Algebra of sets – Measurable space – Lebesgue outer measure – Lebesgue measure and Lebesgue measurable sets – non-measurable sets – Lebesgue measurable functions – Little wood's three principles.

Unit V

Lebesgue Integral: Riemann integral – Lebesgue Integral of a bounded function over a set of finite measure – Lebesgue Integral of nonnegative measurable function – general Lebesgue integral – Convergence theorems on measurable functions.

Text Book(s)

1. Walter Rudin, Principles of Mathematics Analysis (3rd edition), McGraw Hill 1976. (For Analysis part Chapters VI, VII and VIII)
2. H.L. Royden, Real Analysis (3rd edition) Macmillan Publishing Company, New York, 1988.(For Measure Theory chapters III and IV)

Books for Supplementary Reading and Reference:

1. G.De Barra, Measure Theory and Integration, Wiley Easten Ltd., New Delhi, 1987.
2. Malik S.C. and Savita Arora, Mathematical Analysis, Wiley Eastern Limited, New Delhi, 1991.

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I YEAR –II SEMESTER
COURSE CODE: 7MMA2C3

CORE COURSE-VII – PARTIAL DIFFERENTIAL EQUATIONS

Unit I

Ordinary differential equations in more than two variables : Surfaces and curves in three dimensions-simultaneous differential equations of the first order and the first degree in three variables-methods of solution of dx/P=dy/Q=dz/R orthogonal trajectories of a system of curves on a surface-pfaffian differential forms and equations – solution of Pfaffian differential equations the three variables.

Unit II

Partial differential equations of the first order : Partial differential equations – origins of first order partial differential equations – Cauchy's problem for first order equations – linear equations of the first order-integral surfaces passing through a given curve-surfaces orthogonal to a given system of surfaces-nonlinear partial differential equations of the first order-Cauchy's method of characteristics.

Unit III

Compatible systems of first order equations – Charpits method-special types of first order equations – solutions satisfying given conditions – Jacobi's method.

Unit IV

Partial differential equations of the second order : Origin of second order equations – linear partial differential equations with constant coefficients. Equations with variable coefficients – separation of variables – method of integral transforms (exercise problems are excluded)

Unit V

Laplace's equation : Elementary solutions of Laplace's equation – boundary value problems – The Wave equation – Elementary solutions of the one dimensional wave equation – The Diffusion equation : Elementary solutions of the diffusion equation – separation of variables.

Text Book(s)

1. I.N.Sneddon,Elements of Partial Differential Equations,McGraw Hill Book Company, 1986.
   - Unit I : Chapter 1 : Sections 1.1 to 1.6
   - Unit II : Chapter 2 : Sections 2.1 to 2.8
   - Unit III: Chapter 2 : Sections 2.9 to 2.13
   - Unit IV: Chapter 3 : Sections 3.1, 3.4, 3.5, 3.9 and 3.10
   - Unit V : Chapter 4, 5 & 6 : Sections 4.2, 4.4, 5.2, 6.3 and 6.4

Books for Supplementary Reading and Reference:

1. M.D.Raisinghania, Advanced Differential Equations, S.Chand&Company Ltd.,New Delhi, 2001.
2. K.Sankara Rao, Introduction to Partial Differential Equations, Second Edition, Prentice – Hall of India, New Delhi, 2006.
3. J.N.Sharma and K.Singh, Partial Differential Equations for Engineers and Scientists, Narosa Publishing House, Chennai, 2001.

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I YEAR – II SEMESTER
COURSE CODE: 7MMA2C4

CORE COURSE-VIII – MECHANICS

Unit I

The mechanical system – generalized coordinates – constraints – virtual work – energy and momentum.

Unit II

Derivation of Lagrange's equations – examples – integrals of motion.

Unit III

Hamilton's principle – Hamilton's equations – other variations principle.

Unit IV

Hamilton principle function – Hamilton – Jacobi equations – separability.

Unit V

Differential forms and generation functions – special transformations – Lagrange and Poisson brackets.

Text Book(s)

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

Unit I :	Chapters 1 sections 1.1 to 1.5
Unit II :	Chapters 2 sections 2.1 to 2.3
Unit III:	Chapters 4 sections 4.1 to 4.3
Unit IV:	Chapters 5 sections 5.1 to 5.3
Unit V :	Chapters 6 sections 6.1 to 6.3

Books for Supplementary Reading and Reference:

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

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I YEAR – II SEMESTER
COURSE CODE: 7MMA2E1

ELECTIVE COURSE-II (A) – GRAPH THEORY

Unit I

Graphs – Subgraphs – Trees.

Unit II

Connectivity – Euler Tours and Hamiltonian cycles.

Unit III

Matchings – Edge colouring.

Unit IV

Independent sets and cliques – vertex colourings.

Unit V

Planar graphs.

Text Book

J.A.Bondy and V.S.R.Murty, Graph Theory and applications, Macmillan, London, 1976.

Chapter I	:	(Sections 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7)
Chapter II	:	(Sections 2.1, 2.2, 2.3, 2.4)
Chapter III	:	(Sections 3.1, 3.2)
Chapter IV	:	(Sections 4.1, 4.2)
Chapter V	:	(Sections 5.1, 5.2)
Chapter VI	:	(Sections 6.1, 6.2)
Chapter VII	:	(Sections 7.1, 7.2)
Chapter VIII	:	(Sections 8.1, 8.2)
Chapter IX	:	(Sections 9.1, 9.2, 9.3, 9.4 & 9.6)

Books for Supplementary Reading and Reference:

1. S.A.Choudum, A First Course in Graph Theory, Macmillan, India Ltd., 1987.
2. R.Balakrishnan and K.Renganathan, A Text Book of Graph Theory, Springer Verlag, New York, 1999.

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I YEAR – II SEMESTER
COURSE CODE: 7MMA2E2

ELECTIVE COURSE-II (B) – APPLIED ALGEBRA

Unit I

Finite State Machines: Introduction – Binary Devices and States – Finite state Machines – Covering and equivalence – Equivalent States – A minimization procedures – Turing machines – Incompletely specified machines – Relations between states – a minimization procedure.

Unit II

Programming Languages: Introduction – Arithmetic expressions – Identifies: assignment statements – Arrays – FOR statements – Block structures in ALGOL – The ALGOL grammer– Evaluating arithmetic statements – compiling arithmetic expressions.

Unit III

Boolean Algebras: Introduction – Order – Boolean polynomials – Block diagrams for gating networks – connections with logic – logical capabilities of ALGOL – Boolean Applications – Boolean subalgebras – Disjunctive normal form – Direct Products; morphisms.

Unit IV

Optimization and computer Design: Introduction – optimization – Computerizing optimization – Logic design – NAND gates and NOR gates – The minimization problem – procedure for deriving prime implicants – consensus taking – Flip – Flops – Sequential machine design.

Unit V

Binary Group Codes: Introduction – Encoding and Decoding – Block codes Matrix encoding techniques – Group codes – Decoding tables – Hamming codes.

Text Book

Modern Applied Algebra by Garret Birkhoff and Thomas C.Bartee, McGraw Hill International Student Edition.

Chapters : III, IV, V, VI & VIII

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I YEAR – II SEMESTER
COURSE CODE: 7MMA2E3

ELECTIVE COURSE-II (C) – DIFFERENCE EQUATIONS

Unit I

Difference calculus – Difference Operator – Summation Generating function and Approximate Summation.

Unit II

Linear Difference Equations – First order equations – General results for linear equations – Solving Linear Equations.

Unit III

Equations with variable coefficients – The Z-Transform.

Unit IV

Stability Theory – Initial Value Problems for linear Systems – Stability of linear systems.

Unit V

Asymptotic Methods – Introduction – Asymptotic analysis of sums – linear equations.

Text Book

W.G.Kelley and A.C.Peterson, Difference Equations, 2nd edition, Academic Press, New York, 1991.

Chapter 2: Sections 2.1 - 2.3
Chapter 3: Sections 3.1, 3.3, 3.5 and 3.7
Chapter 4: Sections 4.1 and 4.2
Chapter 5: Sections 5.1 to 5.3

Books for Supplementary Reading and Reference:

1. S.N.Elaydi, An Introduction to Difference Equations, Springer Verlag, New York, 1995.
2. R.P.Agarwal, Difference Equations and Inequalities, Marcel Dekkar, New York, 1992.

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II YEAR–III SEMESTER
COURSE CODE: 7MMA3C1

CORE COURSE-IX–COMPLEX ANALYSIS

Unit I

Concept of analytic function – Elementary theory of power series – Conformability – Linear transformations.

Unit II

Complex integration – Cauchy integral formula.

Unit III

Local properties of analytic functions.

Unit IV

Calculus of residues.

Unit V

Power series expansions – canonical products – Jensen's formula.

Text Book

Lars V.Ahlfors, Complex Analysis, 3rd edition, McGraw Hill International Book Company, 1979.

Chapter II : (Sections 1, 2)
Chapter III : (Sections 2, 3)
Chapter IV : (Sections 1, 2, 3, & 5)
Chapter V : (Sections 1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 3.3).

Books for Supplementary Reading and Reference:

1. S.Ponnusamy, Foundations of Complex Analysis, Narosa Publication House, New Delhi, 2004.
2. John B.Conway, Functions of One Complex Variable, 2nd edition, Springer-Verlag, International Student Edition, Narosa Publishing Company.

II YEAR – III SEMESTER
COURSE CODE: 7MMA3C2

CORE COURSE-X–TOPOLOGY – I

Unit I

Topological Spaces – Basis of a topology – the order topology – the product topology on XxY– the subspace topology – closed sets and limit points.

Unit II

Continuous functions – the product topology – the metric topology – the quotient topology.

Unit III

Connected spaces – connected sets in the real line – components and path components – local connectedness.

Unit IV

Compact spaces – compact sets in the real line – limit point compactness.

Unit V

The countability axioms – the separation axioms – the Urysohn's lemma – the Uryshon's metrization theorem.

Text Book

James R.Munkres, Topology a first course, Prentice Hall of India Pvt. Ltd.,New Delhi (1987)

Chapter II	:	(Sections 2.1 to 2.10)
Chapter III	:	(Sections 3.1 to 3.4)
Chapter IV	:	(Sections 3.5 to 3.7)
Chapter V	:	(Sections 4.1 to 4.4)

Books for Supplementary Reading and Reference:

1. James Dugundji, Topology, Prentice Hall of India, New Delhi, 1975.
2. George F.Simmons, Introduction to Topology and Modern Analysis, McGraw Hill Book Co., 1963.

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II YEAR–III SEMESTER
COURSE CODE: 7MMA3C3

CORE COURSE-XI – PROBABILITY AND STATISTICS

Unit I

Probability and Distribution: Introduction – Set theory – The probability set function – Conditional probability and independence – Random variables of the discrete type – Random variables of the continuous type – properties of the distribution function – expectation of random variable – some special expectations – Chebyshev's Inequality.

Unit II

Multivariate Distributions: Distributions of two random variables – Conditional Distributions and Expectations – the correlation coefficient – Independent random variables – extension to several Random variables.

Unit III

Some special Distributions: The Binomial and Related Distributions – The Poisson Distribution– The Gamma and Chi-square Distributions – The Normal Distribution – The Bivariate Normal Distribution.

Unit IV

Distributions of functions of Random variables: Sampling Theory – Transformations of variables of the discrete type – Transformations of variables of the continuous type – the Beta, t and F distributions – Extensions of the change – of – variable Technique –Distributions of order statistics – The Moment generating – Function, Techniques – The distributions of $\bar{X}$ and ns^2/σ^2 – Expectations of functions of Random variables

Unit V

Limiting Distributions : Convergence in distribution – convergence in probability – Limiting Moment Generating Functions – The Central Limit Theorem – Some theorems on Limiting Distributions.

Text Book:

1. Introduction to Mathematical Statistics, (Fifth edition) by Robert V.Hogg and AllenT. Craig Pearson Education Asia.

Chapters I, II, III, IV (Omit 4.10) & V.

Books for Supplementary Reading and Reference:

1. M.Fisz, Probability, Theory and Mathematical Statistics, John Wiley and Sons, New York. 1963.
2. V.K.Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Ltd., New Delhi, 1988 (3rd Print)

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II YEAR – III SEMESTER
COURSE CODE: 7MMA3E1

ELECTIVE COURSE-III (A) – DISCRETE MATHEMATICS

Unit I

Algebraic Systems : Binary Operation – Algebraic Systems – Semigroups and Monoids – Homorphism and Isomophism of Semigroups and Monoids – Properties of Homomorphism – Subsemi groups and Submonoids.

Unit II

Mathematical Induction – Techniques of Proof – Mathematical Induction – Recurrence Relations and Generating Functions – Recurrence – an introduction – Polynomials and their Evaluations Recurrence Relations – Solution of Finite order Homogeneous (Linear) Relations.

Unit III

Solution of Non-homogeneous Relations – Generations Functions – Some Common Recurrence Relations – Primitive Recursive Functions – Recursive and Partial Recursive Fnctions.

Unit IV

Lattices – Lattices – Some Properties of Lattices – New Lattices – Modular and Distributive Lattices.

Unit V

Boolean Algebra – Boolean Algebras – Boolean Polynomials – Karnaugh Map – Switching Circuits

Text Book:

1. Dr. M.K.Venkataraman, Dr. N.Sridharan and Dr. N.Chandra Sekaran, The National Publishing Company, Chennai.

   Chapter IV; Chapter V -Sections 1 to 9
   Chapter VII -Sections 7.1 to 7.6; Chapter X

Books for Supplementary Reading and Reference:

1. Rudolf Lidl and Gunter Pilz, Applied Abstract Algebra, 2nd Indian Reprint 2006, Springer Verlag, New York.
2. Kenneth H. Rosen, Discrete Mathematics and its Applications, Fourth edition, McGraw Hill Publications.
3. A.Gill, Applied Algebra for Computer Science, Prentice Hall Inc., New Jersey.

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II YEAR–III SEMESTER
COURSE CODE: 7MMA3E2

ELECTIVE COURSE-III (B) – FLUID DYNAMICS

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 - Acceleration of a Fluid.

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.

Unit III Some Three-Dimensional Flows

Introduction - Sources, Sinks and Doublets Images in rigid infinite plane - Images in solid spheres - Axis symmetric flows - Stoke's Stream Function.

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.

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.

Text Book

1. Frank Chorlton, Textbook of Fluid Dynamics, CBS Publishers & Distributors, 2004.
   Chapter 2: Sections 2. - 2.9
   Chapter 3: Sections 3.1, 3.2, 3.4 - 3.7, 3.9
   Chapter 4: Sections 4.1 - 4.5
   Chapter 5: Sections 5.3-5.8
   Chapter 8: Sections 8.1-8.3, 8.8, 8.9, 8.10.1

Books for Supplementary Reading and Reference:

1. E.Karuse, Fluid Mechanics with Problems and Solutions, Springer, 2005.
2. R.W.Fox and A.T.McDonald, Introduction to Fluid Mechanics, Wiley, 1985.

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II YEAR – III SEMESTER
COURSE CODE: 7MMA3E3

ELECTIVE COURSE-III (C) – AUTOMATA THEORY

Unit I

Definition of automata – transition system – acceptability of a string by finite automation –Non – deterministic finite state machines – the equivalence of DFA and NDFA.

Unit II

Formal languages – Chomsky classification of languages – Languages and their relations.

Unit III

Recursive and Recursively Enumerable sets – Operation on languages – Languages and Automata.

Unit IV

Regular expressions – finite Automata and regular expansions – Pumping Lemma for regular sub–closure properties of regular sets.

Unit V

Context – Free languages – simplication of context free Grammar – Normal forms for context free languages.

Text Book

K.L.P.Mishra and N. Chandrasekaran, Theory of Computer Science, (Automata, Languages and Computation) III Edition, Prentice Hall of India (2007).

Chapter III : (Sections 3.1 to 3.7)
Chapter IV : (Sections 4.1 to 4.6)
Chapter V : (Sections 5.1 to 5.5)
Chapter VI : (Sections 6.1 to 6.4)

Books for Supplementary Reading and Reference:

1. John E.Hopcroft, Rajeev Motwanl, Jeffrey D.Ullmon, Introduction to Automata Theory, Langauges and Computation, 3rd edition, Pearson Addison Wesley.
2. Harry R.Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, 2nd edition, Prentice Hall, 1997.

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II YEAR – III SEMESTER
COURSE CODE: 7MMA3E4

ELECTIVE COURSE- IV- (A) – FUZZY MATHEMATICS

Unit I

Crisp sets and fuzzy sets.

Unit II

Operation on fuzzy sets.

Unit III

Fuzzy relations.

Unit IV

Fuzzy measures.

Unit V

Uncertainty and Information.

Text Books

1. J.Klir and Tina A Folger, Fizzy Sets, Uncertainty and Information, Prentice Hall of India Private Ltd., New Delhi, 2006

   Chapters : I, II, III, IV and V upto section 5.5.

Books for Supplementary Reading and Reference:

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

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II YEAR – III SEMESTER
COURSE CODE: 7MMA3E5

ELECTIVE COURSE IV (B) – STOCHASTIC PROCESSES

Unit I

Stochastic Processes: Basic concepts – Markov chains.

Unit II

Definition, Transition Matrix, order of Markov chain, Higher Transition probabilities – classifications of states and chains, Determinations of Higher transition probabilities.

Unit III

Stability of a Markov chain, Limiting behaviour Markov process and related distributions.

Unit IV

Generalizations of Poisson process. Birth and death process, Markov processes.

Unit V

Renewal processes: Renewal Equations, Renewal Theorems, delayed and equilibrium renewal processes, residual and excess life times.

Text Book

J. Medhi, Stochastic Processes, 2nd edition, Wiley Eastern, June 1987

Chapter II	:	Full
Chapter III	:	(Sections 3.1, 3.2, 3.3, 3.4, 3.5)
Chapter IV	:	(Sections 4.1, 4.2, 4.3, 4.4, 4.5)
Chapter VI	:	(Sections 6.1, 6.2, 6.3, 6.4, 6.5)

Books for Supplementary Reading and Reference:

1. S.K.Srinivasan and A.Vijayakumar, Stochastic Processes, Narosa, 2003.
2. E.Cinlar, Introduction to Stochastic Processes, Prentice Hall of India, 1975.

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II YEAR – III SEMESTER
COURSE CODE: 7MMA3E6

ELECTIVE COURSE-IV (C) – COMBINATORIAL MATHEMATICS

Unit I

Generating function.

Unit II

Recurrence relation.

Unit III

The principle of inclusion and exclusion.

Unit IV

Polya theory of counting.

Unit V

Block Designs.

Text Book

CL.Liu, Introduction to Combinatorial Mathematics, Tata McGraw Hill.

Chapters : II III, IV, V & XIV.

Books for Supplementary Reading and Reference:

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

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II YEAR – IV SEMESTER
COURSE CODE: 7MMA4C1

CORE COURSE-XII –FUNCTIONAL ANALYSIS

Unit I

Normed spaces, continuity of linear Maps.

Unit II

Hahn – Banach theorems, Banach limits, Banach spaces.

Unit III

Uniform boundedness Principle – Closed graph and open mapping theorems

Unit IV

Duals and Transposes, Duals of L^p ([a, b]) and C ([a, b]) (excluding moment sequences)

Unit V

Inner product spaces, orthonormal sets, projection and Reisz Representation theorems.

Text Book

Functional Analysis by B.V Limaye, Second Edition, New Age International Pvt. Ltd., Publishers.

Chapter II	:	(Section 5, 6, 7, 8)
Chapter III	:	Section 9 (Subsections 9.1, 9.2, & 9.3 only) & Sections 10
Chapter IV	:	(Sections 13, 14) (excluding Moment Sequences Subsections 14.6 & 14.7)
Chapter VI	:	(Sections 21, 22, and 24.1, 24.2, 24.3 & 24.4)

Books for Supplementary Reading and Reference:

1. G.F.Simmons, Introduction to Topology and Modern Analysis, Tata McGraw Hill Publishing Company, New Delhi, 2004.
2. H.C.Goffman and G.Fedrick, First Course in Functional Analysis, Prentice Hall of India, New Delhi, 1987.
3. Walter Rudin, Functional Analysis, Tata McGraw Hill Publishing Company, New Delhi, 1973.

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II YEAR – IV SEMESTER
COURSE CODE: 7MMA4C2

CORE COURSE XIII – OPERATIONS RESEARCH

Unit I

Network Models: Scope and definition of network models – Minimal spanning tree algorithm– Shortest – Route Problem: Examples of the shortest route applications, Shortest route algorithms, linear programming formulation of the shortest route problem – maximal flow model – Enumeration of cuts, maximal flow algorithm, linear programming formulation of maximal flow mode – CPM and PERT: Network representation, CPM Computations, construction of the time schedule, Linear programming formulation of CPM, PERT calculations.

Unit II

Deterministic inventory Models: General inventory Model – role of demand in the development of inventory models – static Economic – Order – Quantity models – Classic EOQ model, EOQ with price breaks, Multi item EOQ with storage limitation – Dynamic EOQ models: No setup Model, Setup Model.

Unit III

Queing systems: Elements of a queuing model – Role of exponential distribution – Pure birth and Death Models (relationship between the Exponential and Poisson distributions) Pure birth Model, Pure death model.

Unit IV

Generalized poisson queuing model Specialized poisson Queues: Steady State measures of performance, Single Server Models, multiple server models, Machine Servicing Model (M/M/R): (GD/K/K), R>K – (M/G/1): (GD/∞/∞) – Pollaczek – Khintchine (P-K) formula – other queuing Models, Queuing Decision Models.

Unit V

Non Linear Programming Algorithms: Unconstrained algorithms: Direct search Method, Gradient Method – Constrained Algorithms separable programming.

Text Book

Hamdy A.Taha, Operations Research, An Introduction (8^{th} edition), Prentice – Hall of India Pvt. Ltd., New Delhi.

Chapters : VI, XI, XV and XIX (upto 19.2.1)

Books for Supplementary Reading and Reference:

1. J.K.Sharma, Operations Research, Theory and Applications, 3^{rd} edition, Macmillan India Ltd, 2007.
2. F.S.Hillier and G.J.Lieberman, Introduction to Operations Research (8^{th} edition) Tata McGraw Hill Publishing Company, New Delhi, 2006.

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II YEAR – IV SEMESTER
COURSE CODE: 7MMA4C3

CORE COURSE-XIV– TOPOLOGY – II

Unit I

Connectedness and Compactness: Local Compactness – The Tychonoff Theorem: The Tychonoff theorem.

Unit II

Completely Regular Spaces , The Stone – Cech Compactification.

Unit III

Metrization theorems and Paracompactness: Local Finiteness, The Nagata – Smirnov Metrization Theorem (Sufficiency) – The Nagata – Smirnov Theorem (necessity).

Unit IV

Complete Metric Spaces and Function Spaces: Complete metric spaces – A Space – Filling Curve – Compactness in Metric spaces – Point wise and compact convergence.

Unit V

The Compact – Open Topology – Ascoli's theorem – Baire Spaces – A Nowhere differentiable functions.

Text Book

James R Munkres, Topology, A First Course, Prentice Hall of India, New Delhi (1984)

Chapter III	:	(Section 3.8)
Chapter V	:	(Sections 5.1, 5.2, 5.3)
Chapter VI	:	(Sections 6.1, 6.2, 6.3)
Chapter VII	:	(Sections 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8)

Books for Supplementary Reading and Reference:

1. JL.Kelley, General Topology, Van Nostrnad, Reinhold Co., New York.
2. K.D.Joshi, Introduction to General Topology, Wiley Eastern Ltd., 1983.

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II YEAR – IV SEMESTER
COURSE CODE: 7MMA4E1

ELECTIVE COURSE-V (A) – ADVANCED STATISTICS

Unit I

Introduction to statistical Inference: Point estimation – confidence intervals for means – confidence intervals for differences of means – test of statistical hypothesis – Additional comments about statistical tests – Chi-Square tests.

Unit II

Sufficient Statistics: Measures of Quality of Estimators – a sufficient statistic for a parameter– properties of a sufficient statistic – completiness and uniqueness the exponential class of probability density – functions of a parameter.

Unit III

More about estimation: Bayesian Estimation – Fisher Information and the Rao – Cramer inequality Limiting Distributions of Maximum Likelihood estimators.

Unit IV

Theory of statistical tests: Certain Best tests – Uniformly most powerful tests – Likelihood Ratio Tests – the sequential probability Ratio Test.

Unit V

Inferences about Normal Models: The distributions of certain Quadratic forms – A test of the equality of several means – Noncentral χ^2 and noncentral F – multiple comparisons – The analysis of variance – A regression problem – A test of independence.

Text Book

Robert V. Hogg and Allen T.Craig, Introduction to Mathematical Statistics (Fifth Edition) by Pearson Education, Asia.

Chapter	:	VI
Chapter	:	VII (Omit 7.7, 7.8 and 7.9)
Chapter	:	VIII (Omit 8.4)
Chapter	:	IX (Omit 9.5)
Chapter	:	X (Omit 10.8 and 10.9)

Books for Supplementary Reading and Reference:

1. V.K.Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Ltd., New Delhi, 1998 (3rd Print)
2. M.Fisz, Probability Theory and Mathematical Statistics, John Wiley and Sons, New York, 1963.

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II YEAR – IV SEMESTER
COURSE CODE: 7MMA4E2

ELECTIVE COURSE –V-(B) – STOCHASTIC DIFFERENTIAL EQUATIONS

Unit I

Probability spaces – Random variable and stochastic Processes – An Important Example – Brownian motion – Construction of the Ito Integral – Some properties of the Ito Integral – Extenstions of the Ito Integral.

Unit II

The 1 – Dimensional Ito Formula – The Multi – Dimensional Ito Formula – The Martingale Representation Theorem.

Unit III

Stochastic Differential Equations – Examples and Some Solution Methods – An Existence and Uniqueness Result – Weak and Strong Solutions.

Unit IV

The Filtering Problem – Introduction – The 1 – Dimensional Linear Filtering Problem – The Multidimensional Linear Filtering Problem.

Unit V

Diffusions – Basic properties – The Markov Property – The Strong Morkov Property – The Generator of an Ito Diffusion – The Dynkin Formula – The characteristic operator.

Text Book

B.Oksendal, Stochastic Differential Equations : An Introduction with Applications, Sixth Edition, Springer – Verlag, Heidelberg, 2003.

Chapter 2 : Sections 2.1,2.2
Chapter 3 : Sections 3.1 - 3.3
Chapter 4 : Sections 4.1 - 4.3
Chapter 5 : Sections 5.1 - 5.3
Chapter 6 : Sections 6.1 - 6.3
Chapter 7 : Sections 7.1 - 7.5

Books for Supplementary Reading and Reference:

1. Avner Friedman, Stochastic Differential Equations and Applications, Dover Publications, 2006.
2. Ludwig Arnold, Stochastic Differential Equations, Theory and Applications, Dover Publications, 2011.

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II YEAR – IV SEMESTER
COURSE CODE: 7MMA4E3

ELECTIVE COURSE-V (C)–NUMERICAL METHODS

Unit I

Transcendental and polynomial equations : Rate of convergence of iterative methods – Methods for finding complex roots – Polynomial equations – Birge – Vieta method, Bairstow's method, Graeffe's root squaring method.

Unit II

System of Linear Algebraic equations and Eigen Value Problems : Error Analysis of direct and iteration methods – Finding eigen values and eigen vectors – Jacobi and Power methods.

Unit III

Interpolation and Approximation : Hermite Interpolations – Piecewise and Spline Interpolation – Bivariate Interpolation – Approximation – Least square approximation and best approximations.

Unit IV

Differentiation and Integration : Numerical Differentiation – Optimum choice of Step – length – Extrapolation methods – Partial Differentiation – Methods based on undetermined coefficient – Gauss methods.

Unit V

Ordinary differential equations : Local truncation error – Euler, Backward Euler, Midpoint, Taylor's Method and second order Runge – Kutta method – Stability analysis.

Text Book

M.K.Jain, S.R.K.Iyengar and R.K.Jain, Numerical Methods for Scientific and Engineering Computation, III Edn. Wiley Eastern Ltd., 993.

Unit I - Chapter 2, 2.5 to 2.8
Unit II - Chapter 3, 3.3, 3.4, 3.5
Unit III - Chapter 4, 4.5 to 4.9
Unit IV - Chapter 5, 5.2, 5.3, 5.4, 5.5, 5.8
Unit V - Chapter 6, 6.2, 6.3, 6.6

Books for Supplementary Reading and Reference:

1. Kendall E.Atkinson, An Introduction to Numerical Analysis, II Edn., John Wiley & Sons, 1983.
2. M.K.Jain, Numerical Solution of Differential Equations, II Edn., New Age International Pvt Ltd., 1983.
3. Samuel, D. Conte, Carl. De Boor, Elementary Numerical Analysis, McGraw Hill International Edn., 1983.

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