ARUMUGAM PILLAI SEETHAI AMMAL COLLEGE

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TIRUPPATTUR

DEPARTMENT OF MATHEMATICS

SYLLABUS (2018-2019 to 2023 - 2024)

M. Sc MATHEMATICS

CONTENTS

ALAGAPPA UNIVERSITY, KARAIKUDI
NEW SYLLABUS UNDER CBCS PATTERN (w.e.f.2017-2018)

M.Sc., MATHEMATICS – PROGRAMME STRUCTURE
(2018 – 19 to 2021 – 22)

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	**Elective–I:** Number Theory	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	**Elective–II** Graph Theory	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	**Elective–III** Discrete Mathematics	4	6	25	75	100
	7MMA3E6	**Elective–IV** Combinatorial Mathematics	4	6	25	75	100
		Total	**23**	**30**	**--**	**--**	**500**
	7MMA4C1	**Core – XII**–Functional Analysis	5	8	25	75	100

IV	7MMA4C2	**Core – XIII**–Operations Research	5	8	25	75	100
	7MMA4C3	**Core – XIV**–Topology II	5	7	25	75	100
	7MMA4E1	**Elective–V** Advanced Statistics	4	7	25	75	100
		Total	**19**	**30**	**--**	**--**	**400**
		Grand Total	**90**	**120**	**--**	**--**	**1900**

SEMESTER -1

S.No	Class	Semester	Subject name	Subject Code
I	I M.Sc	I Semester	ALGEBRA –I	7MMA1C1
			ANALYSIS- I	7MMA1C2
			DIFFERENTIALGEOMENTY	7MMA1C3
			ORDINARY DIFFERENTIAL EQUATION	7MMA1C4
			NUMBER THEORY	7MMA1E1

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 (2^{nd} 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
(17th 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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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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SEMESTER-II

S.No	Class	Semester	Subject name	Subject Code
1	I MSc.	II Semester	Algebra –II	7MMA2C1
			Analysis-II	7MMA2C2
			Partial Differential Equations	7MMA2C3
			Mechanics	7MMA2C4
			Graph theory	7MMA2E1

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 (2^{nd} 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 (2^{nd} edition) Cambridge University Press, 1997 (Indian Edition)
2. S.Lang, Algebra 3^{rd} 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.

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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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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SEMESTER-III

S.No	Class	Semester	Subject name	Subject Code
1	II M.Sc	III Semester	COMPLEX ANALYSIS	7MMA3C1
			TOPOLOGY-I	7MMA3C2
			PROBABILITY AND STATISTICS	7MMA3C3
			DISCRETE MATHEMATICS	7MMA3E1
			COMBINATORIAL MATHEMATICS	7MMA3E6

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:

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

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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:

- James Dugundji, Topology, Prentice Hall of India, New Delhi, 1975.
- 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:

- M.Fisz, Probability, Theory and Mathematical Statistics, John Wiley and Sons, New York. 1963.
- 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:

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

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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:

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

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SEMESTER-IV

S.No	Class	Semester	Subject name	Subject Code
1	II MSc.	IV Semester	Functional Analysis	7MMA4C1
			Operations Research	7MMA4C2
			Topology-II	7MMA4C3
			Advanced Statistics	7MMA4E1

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:

- G.F.Simmons, Introduction to Topology and Modern Analysis, Tata McGraw Hill Publishing Company, New Delhi, 2004.
- H.C.Goffman and G.Fedrick, First Course in Functional Analysis, Prentice Hall of India, New Delhi, 1987.
- 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 (8th 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:

- J.K.Sharma, Operations Research, Theory and Applications, 3rd edition, Macmillan India Ltd, 2007.
- F.S.Hillier and G.J.Lieberman, Introduction to Operations Research (8th 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:

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

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:

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

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ALAGAPPA UNIVERSITY, KARAIKUDI
NEW SYLLABUS UNDER CBCS PATTERN
(w.e.f.2022-2023 and w.e.f. 2017-2018)
M.Sc., MATHEMATICS – PROGRAMME STRUCTURE (2022 - 23)

S.No	Course Code	Courses	Title of the paper	T/P	Credits	Hours/ Week	Marks		
I - Semester							I	E	Total
1	22MMA1C1	CC	Algebra - I	T	4	6	25	75	100
2	22MMA1C2	CC	Analysis - I	T	4	6	25	75	100
3	22MMA1C3	CC	Differential Geometry	T	4	6	25	75	100
4	22MMA1C4	CC	Ordinary Differential Equations	T	4	6	25	75	100
5	22MMA1E1	DSE-I	Number Theory	T	4	4	25	75	100
			Library/ Yoga/Counseling/Fieldtrip			2			
					20	30	-	-	500
II - Semester									
6	22MMA2C1	CC	Algebra - II	T	4	5	25	75	100
7	22MMA2C2	CC	Analysis - II	T	4	5	25	75	100
8	22MMA2C3	CC	Partial Differential Equations	T	4	5	25	75	100
9	22MMA2C4	CC	Probability And Statistics	T	4	5	25	75	100
10	22MMA2E1	DSE-II	Fuzzy Mathematics	T	4	4	25	75	100
11	-	NME-I	Non Major Elective	T	2	3	25	75	100
			Library/ Yoga/Counseling/Fieldtrip			3			
		SLC	Self-learning course–MOOCs		Extra credit				
					22	30	-	-	600
III - Semester									
12	7MMA3C1	CC	Complex Analysis	T	5	6	25	75	100
13	7MMA3C2	CC	Topology - I	T	5	6	25	75	100
14	7MMA3C3	CC	Probability And Statistics	T	5	6	25	75	100
15	7MMA3E1	DSE –III	Discrete Mathematics	T	4	6	25	75	100
16	7MMA3E6	DSE –IV	Combinatorial Mathematics	T	4	6	25	75	100
					23	30	-	-	500
IV- Semester									
18	7MMA4C1	CC	Functional Analysis	T	5	8	25	75	100
19	7MMA4C2	CC	Operations Research	T	5	8	25	75	100
20	7MMA4C3	CC	Topology - II	T	5	7	25	75	100
21	7MMA4E1	DSE - V	Advanced Statistics		4	7	25	75	100
			Library/ yoga/ Counseling/Fieldtrip			1			
				Total	19	30	-	-	400
					84	120	-	-	2000

SEMESTER-1

Semester	Class	Subject name	Subject Code
I	I M.Sc	Algebra –I	22MMA1C1
		Analysis- I	22MMA1C2
		Differential Geometry	22MMA1C3
		Ordinary Differential Equations	22MMA1C4
		Number Theory	22MMA1E1

<table>
<tr><td colspan="6">Semester - I</td></tr>
<tr><td colspan="2" rowspan="2">Course code:
22MMA1C1</td><td>Core Course - I</td><td>T/P</td><td>C</td><td>H/W</td></tr>
<tr><td>ALGEBRA – I</td><td>T</td><td>4</td><td>6</td></tr>
<tr><td>Objectives</td><td colspan="5"> To learn some foundations in Algebraic structures like Groups and Rings. To train the students in problem solving in Algebra.</td></tr>
<tr><td>Unit -I</td><td colspan="5">Normal subgroups and Quotient groups – Homomorphisms – Automorphisms – Cayley’s Theorem – Permutation Groups.</td></tr>
<tr><td>Unit-II</td><td colspan="5">Another counting Principle – Sylow’s Theorem – Direct products.</td></tr>
<tr><td>Unit -III</td><td colspan="5">Ring Theory: Definition and examples of rings – Some special classes of Rings – Homomorphisms.</td></tr>
<tr><td>Unit -IV</td><td colspan="5">Ideals and Quotient Rings – More ideals and Quotient Rings – The field of quotients of an Integral Domain.</td></tr>
<tr><td>Unit- V</td><td colspan="5">Enclidean Rings – A Particular Euclidean Ring – Polynomial Rings – Polynomials over the Rational Field.</td></tr>
<tr><td colspan="6">Text Book
I.N.Herstein, 1975 Topics in Algebra, 2nd Edition Wiley Eastern Limited, New Delhi.
Chapter 2 : Sections 2.6 to 2.13
Chapter 3 : except Section 3.11
Books for Supplementary Reading and Reference: M.Artin,
1991,Algebra, Prentice Hall of India.
John B.Fraleigh, 1982 A First Course in Abstract Algebra, Addison Wesley, Mass.
Joseph A. Galian, 2008 Contemporary Abstract Algebra, 4th edition, Narosa Publ. House, New Delhi.
D.S.Malik, J.N.Mordeson and M.K.Sen, 1997 Fundamentals of Abstract Algebra, McGraw Hill (International Edition), New York.
Vijay K. Khanna, S.K. Bhamri, 2013, A Course in Abstract Algebra, 4th edition, Vikas Publishing House Pvt Ltd.,</td></tr>
<tr><td>Outcomes</td><td colspan="5">Outcomes
Students will be able to
 Explain the fundamental concepts of algebraic structures.
 Demonstrate accurate and efficient use of ring theory.</td></tr>
</table>

<table>
<tr><td colspan="6">Semester - I</td></tr>
<tr><td colspan="2" rowspan="2">Course code:
22MMA1C2</td><td>Core Course - II</td><td>T/P</td><td>C</td><td>H/W</td></tr>
<tr><td>ANALYSIS – I</td><td>T</td><td>4</td><td>6</td></tr>
<tr><td>Objectives</td><td colspan="5">To give a thorough knowledge of the various aspects of Real line and Metric Spaces which is imperative for any advanced learning in Pure Mathematics.
To train the students for solving problems on continuity and differentiation.</td></tr>
<tr><td>Unit -I</td><td colspan="5">Metric Spaces – Compact sets – Perfect sets – Connected sets.</td></tr>
<tr><td>Unit-II</td><td colspan="5">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.</td></tr>
<tr><td>Unit -III</td><td colspan="5">Power series – Summation by parts – Absolute convergence – Addition and Multiplication of series.</td></tr>
<tr><td>Unit -IV</td><td colspan="5">Continuity: Limits of functions – Continuous functions, Continuity and Compactness, Continuity and Connectedness – Discontinuities – Monotonic functions – infinite limits and limits at infinity.</td></tr>
<tr><td>Unit -V</td><td colspan="5">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.</td></tr>
<tr><td colspan="6">Text Book
Walter Rudin, 1976, Principles of Mathematical Analysis, 3rd Edition (Relevant portions of chapters 2, 3, 4 & 5), McGraw-Hill Book Company.

Books for Supplementary Reading and Reference:
T.M.Apostal, 1985, Mathematical Analysis, Narosa Publ. House, New Delhi.
Tom P. Apostol, 1985, Mathematical Analysis, Narosa Publishing House, New Delhi.
V.Ganapathy Iyer, 1970, Mathematical Analysis, Tata McGraw Hill, New Delhi.
H.L.Royden, 1993, Real Analysis, Macmillan Publ.co., Inc. 4th edition, New York.
A.J. White, 1968, Real Analysis: An Introduction, Addison Wesley Publishing Co., Inc.</td></tr>
<tr><td>Outcomes</td><td colspan="5">Students will be able to
Acquire knowledge on the concepts of compact and connectedness
Understand the base of Limit function and monotonic functions.</td></tr>
</table>

<table>
<tr><td colspan="6">Semester - I</td></tr>
<tr><td rowspan="2">Course code:
22MMA1C3</td><td colspan="3">Core Course - III</td><td>T/P</td><td>C</td><td>H/W</td></tr>
<tr><td colspan="3">DIFFERENTIAL GEOMETRY</td><td>T</td><td>4</td><td>6</td></tr>
<tr><td>Objectives</td><td colspan="6"> To learn space curves, surfaces, Geodesics and curvature.
To analyze the geometrical problems and facts.</td></tr>
<tr><td>Unit -I</td><td colspan="6">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.</td></tr>
<tr><td>Unit-II</td><td colspan="6">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.</td></tr>
<tr><td>Unit- III</td><td colspan="6">Geodesics – Canonical geodesic equations – Normal property of geodesics – Existence Theorems – Geodesic parallels.</td></tr>
<tr><td>Unit -IV</td><td colspan="6">Geodesic Curvature – Gaurs – Bonnet Theorem – Gaussian Curvature.</td></tr>
<tr><td>Unit- V</td><td colspan="6">Non-Intrinsic Properties of a Surface – The second fundamental form – Principal Curvature – Lines of Curvature .</td></tr>
<tr><td colspan="7">Text Book
T.J.Willmore, An Introduction to Differential Geometry, Oxford University Press (17th Impression) New Delhi 2002 (Indian Print)
Chapter 1 : Sections 1 to 9
Chapter 2 : Sections 1 to 17
Chapter 3 : Sections 1 to 4
Books for Supplementary Reading and Reference:
Kobayashi S. and Nomizu. K. 1963 Foundations of Differential Geometry, Interscience Publishers.
D.J.Struik, 1961 Classical Differential Geometry, Addison Wesley Publishing Company INC, Massachusetts.
D.Somasundaram, 2005 Differential Geometry, A First Course, Narosa Publishing House, Chennai.
Wihelm Klingenberg: 1978 A course in Differential Geometry, Graduate Texts in Mathematics, Springer Verlag.</td></tr>
<tr><td>Outcomes</td><td colspan="6">Students will be able to
 Understand the advanced concepts in differential geometry of space curves.
 Acquire the knowledge for the study of surfaces leading to advanced courses in geometry.</td></tr>
</table>

Semester - I				
Course code: 22MMA1C4	Core Course - IV	T/P	C	H/W
	ORDINARY DIFFERENTIAL EQUATIONS	T	4	6

Objectives	To develop knowledge of differential equations and their applications. To study the existence, uniqueness, stability behavior of the solutions of the ODE.
Unit -I	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	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 – sScond order equations with regular singular points – an example – Second order equations with regular singular points – general case
Unit -IV	Exceptional cases – Bessel equation – Bessel equation (continued) – Regular points at infinity. Existence and uniqueness of solutions to first order equations: Equations with variables separated – Exact equations
Unit- V	Method of successive approximations – Lipchitz condition – Convergence of the successive approximations – Nonlocal existence of solutions – Approximations to solutions and uniqueness of solutions

Text Book

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

Chapter 2 : sections 2.7 to 2.10
Chapter 3 : sections 3.5 to 3.8
Chapter 4 : sections 4.1 to 4.4 & 4.6 to 4.9
Chapter 5 : sections 5.2 to 5.8

Books for Supplementary Reading and Reference:

D.Somasundaram, 2002 Ordinary Differential Equations, Narosa Publishing House, Chennai.

E.A. Coddington and N. Levinson, 1955 Theory of Ordinary Differential Equaitons, McGraw Hill Publishing Company, New York.

M.D.Raisinghania, 2001 Advanced Differential Equations, S.Chand and Company Ltd, New Delhi.

W.T. Reid, 1971 Ordinary Differential Equations, John Wiley & Sons, New York.

Outcomes	Students will be able to Acquire the knowledge of mathematical techniques for solving higher order ODE. Understand the conditions for the existence and uniqueness of solution for initial and boundary value problems.

Semester - I				
Course code: 22MMA1E1	DSE – 1-A	T/P	C	H/W
	NUMBER THEORY	T	4	4
Objectives	To provide an introductory course in number theory. To study various arithmetical functions, multiplicative functions and division functions.			
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.			
Unit- III	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. 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).			
Unit -IV	The average order of the division functions σ £(n) – the average order of (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 -V	Congruence: Definition and Basic properties of congruence - Residue classes and complete residue systems linear congruence – reduced residue systems and the Euler – Fermat theorem– Polynomial congruence modulo Lagrange's theorem – Applications of Lagrange's theorem Simultaneous linear congruence - the Chinese remainder theorem – Application of the Chinese remainder theorem – polynomial congruence with prime power moduli - the Principle of cross Classification - a Decomposition property of reduced Residue systems.			

Text Book

Tom M. Apostal, Introduction to Analytic Number theory, Springer Verlag.
Chapters : 1, 2, 3 & 5.

Books for Supplementary Reading and Reference:

D.M.Burton, 2001 Elementary Number Theory, Universal Book Stall, New Delhi.

George Andrews, 1994 Number Theory, Courier Dover Publications.

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

William J. Leveque, 1977 Fundamentals of Number Theory, Addison-Wesley Publishing Company, Phillipines.

Outcomes	Students will be able to • Understand the concepts of Lioville's function, bell series and Dirichlet multiplication. • Acquire the skills to solve simultaneous congruence problems.

SEMESTER-II

Semester	Class	Subject name	Subject Code
II	I M.Sc.,	**Algebra –II**	**22MMA2C1**
		Analysis-II	**22MMA2C2**
		Partial Differential Equations	**22MMA2C3**
		Probability and Statistics	**22MMA2C4**
		Fuzzy Mathematics	**22MMA2E1**

Semester - II				
Course code: 22MMA2C1	Core Course - V	T/P	C	H/W
	ALGEBRA – II	T	4	5

Objectives	To introduce the basic concepts and methods in the study of linear transformation on finite dimensional vector spaces. To introduce the general concepts in extension fields.
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	Linear Transformations: The Algebra of linear transformations – Characteristic roots – Matrices.
Unit- V	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 4 : Sections 4.1 to 4.4
Chapter 5 : Sections 5.1, 5.3 & 5.5
Chapter 6 : Sections 6.1, 6.2, 6.3, 6.4 & 6.10

Books for Supplementary Reading and Reference:

DavidS.Dummit and Richard M.Foote, 2015 Abstract Algebra, Third Edition, Wiley Student Edition.

John, B. Fraleigh, A First Course in Abstract Algebra, Addison-Wesley Publishing company.

N.Jacobson, 1980 Basic Algebra, Vol. I & II W.H.Freeman, also Published by Hindustan Publishing Company, New Delhi.

P.B.Bhattacharya, S.K.Jain and S.R.Nagpaul, 1997 Basic Abstract Algebra (2nd edition) Cambridge University Press, (Indian Edition)

S.Lang, , 1993 Algebra 3rd edition, Addison-Wesley, Mass.

Outcomes	Students will be able to Perform algebraic operations on polynomial expressions. Identify the degree leading coefficient and the leading term of a polynomial expression.

Semester - II				
Course code: 22MMA2C2	Core Course - VI	T/P	C	H/W
	ANALYSIS – II	T	4	5

Objectives	• To impart knowledge on the concept of functions of Riemann-Stieltjes integrals. • To introduce lebesgue measure, measurable spaces and lebesgue measurable functions.
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.
Unit- V	Little wood's three principles. Lebesgue Integral: Riemann integral – Lebesgue Integral of a bounded function over a set of finite measure.

Text Book

H.L. Royden, 1988 Real Analysis (3rd edition) Macmillan Publishing Company, New York,.(For Measure Theory chapters 3 and 4 (4.1 &4.2 only).

Walter Rudin, 1976 Principles of Mathematics Analysis (3rd edition), McGraw Hill. (For Analysis part Chapters 6, 7 and 8)

Books for Supplementary Reading and Reference:

G.De Barra, 1987 Measure Theory and Integration, Wiley Easten Ltd., New Delhi.

Malik S.C. and Savita Arora, 1991 Mathematical Analysis, Wiley Eastern Limited, New Delhi,.

N.L.Carothers, 2013 Real Analysis, Cambridge University press, Indian edition.

Serge Lang, 1969 Analysis I & II, Addison-Wesley Publishing Company, Inc.

Outcomes	Students will be able to • Acquire the knowledge on the concept of some special functions. • Realize that this course had laid the foundation for the variety of courses.

Semester - II				
Course code: 22MMA2C3	Core Course - VII	T/P	C	H/W
	PARTIAL DIFFERENTIAL EQUATIONS	T	4	5

Objectives	□ To introduce mathematical techniques for analyzing and solving partial differential equations. □ To apply partial differential equations to solve dynamical problems.
Unit -I	Partial differential equations of the first order: Partial differential equations – Origins of first order Partial differential equations – Cauchy's problem for first order equations.
Unit-II	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 – Charpit's 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

I.N.Sneddon, 1986 Elements of Partial Differential Equations, McGraw Hill Book Company.

Chapter 2 : Sections 2.1 to 2.13
Chapter 3 : Sections 3.1, 3.4, 3.5, 3.9 and 3.10
Chapter 4 : Sections 4.2 and 4.4
Chapter 5 : Section 5.2
Chapter 6 : Sections 6.3 and 6.4

Books for Supplementary Reading and Reference:

E.T.Copson, Partial Differential Equations, Cambridge University Press.

J.N.Sharma and K.Singh, 2001 Partial Differential Equations for Engineers and Scientists, Narosa Publishing House, Chennai.

K.Sankara Rao, 2006, Introduction to Partial Differential Equations, 2nd Edition, Prentice – Hall of India, New Delhi.

M.D.Raisinghania, 2001 Advanced Differential Equations, S.Chand & Company Ltd., New Delhi.

Outcomes	Students will be able to □ Understand the various concepts based on partial differential equations. □ Develop clear thinking and analyzing for solving problems in partial differential equations.

Semester - II				
Course code: 22MMA2C4	Core Course - VIII	T/P	C	H/W
	PROBABILITY AND STATISTICS	T	4	5

Objectives	To introduce random variables of discrete and continuous type. To enable the students to learn about distribution functions and limiting distributions.
Unit -I	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.
Unit- III	Some special Distributions: The Binomial and Related Distributions – The Poisson Distribution– The Gamma and Chi-square Distributions – The 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 X and $ns^2/\square^2$ – 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

Robert V.Hogg and Allen.T, 1994 Introduction to Mathematical Statistics, 5th edition, Craig Pearson Education Asia.

Chapter 1 : Sections 1.5 to 1.11
Chapter 2 : Sections 2.1 to 2.4
Chapter 3 : Sections 3.1 to 3.4
Chapter 4 : Sections 4.1 to 4.9
Chapter 5 : Sections 5.1 to 5.5

Books for Supplementary Reading and Reference:

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

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

Marek Capinski and Thomasz Zastawniak, 2003 Probability through problems, Springer Verlag, New York.

Sharma .T.K, 2005 A text book of probability and theoretical distribution, Discovery publishing house, New Delhi.

Outcomes	Students will be able to Acquire the knowledge of different distributions like beta, t and F. Understand standard concepts and methods of distributions.

Course code: 22MMA2E1	DSE – 2 A	T/P	C	H/W
	FUZZY MATHEMATICS	T	4	4

Objectives	To introduce the algebraic concepts of fuzzy mathematics. To develop the theory and problems on fuzzy relations and fuzzy measures.
Unit -I	Crisp Set - Fuzzy set - Basic Concept of fuzzy set - Extension Principles - fuzzy Logic.
Unit-II	Operations on Fuzzy Sets - Fuzzy Complement - Fuzzy Union - Fuzzy Intersection - Combination of operations.
Unit- III	Fuzzy Relations – Binary Relation – Inverse Fuzzy Relation - Fuzzy equivalence Relation - Proximity Relation- Fuzzy Relations Equation.
Unit -IV	Fuzzy measures - Belief and Plausibility measure- Probability measure – Dempster's rule of Combination - Possibility and Necessity measures.
Unit- V	Measures of uncertainty and Information- Measures of Fuzziness - Heartly Information – Shannon entropy - Boltzmann entropy.

Text Book

George J.Klir and Tina A Folger, Fizzy Sets, 2008 Uncertainty and Information, Prentice Hall of India Private Ltd., New Delhi.

Chapter 1 : Sections 1.1 to 1.4 & 1.6
Chapter 2 : Sections 2.1 to 2.5
Chapter 3 : Sections 3.1 to 3.4 & 3.8
Chapter 4 : Sections 4.1 to 4.5
Chapter 5 : Sections 5.1 to 5.3

Books for Supplementary Reading and Reference:

M. Ganesh, 2006 Introduction to Fuzzy sets and Fuzzy logic, Prentice Hall of India, New Delhi.

A.Kaufman, 1975 Introduction to the Theory of Fuzzy Subsets, Academic Press.

V.Novak, 1969 Fuzzy Sets and Their Applications, Adom Hilger, Bristol.

M. Vasuky,2019 Fuzzy Mathematics, Shanlax Publications, Madurai.

H.J.Zimmermann, 1996 Fuzzy Set Theory and its Applications, Allied Publishers, Chennai, 1996.

Outcomes	Students will be able to Gain an in-depth knowledge in the concept of fuzzy set theory. Acquire knowledge in solving fuzzy mathematical problems.

SEMESTER-III

S.No	Class	Semester	Subject name	Subject Code
1	II M.Sc	III Semester	COMPLEX ANALYSIS	7MMA3C1
			TOPOLOGY-I	7MMA3C2
			PROBABILITY AND STATISTICS	7MMA3C3
			DISCRETE MATHEMATICS	7MMA3E1
			COMBINATORIAL MATHEMATICS	7MMA3E6

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:

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

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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:

- James Dugundji, Topology, Prentice Hall of India, New Delhi, 1975.
- 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:

- M.Fisz, Probability, Theory and Mathematical Statistics, John Wiley and Sons, New York. 1963.
- 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:

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

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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:

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

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SEMESTER-IV

S.No	Class	Semester	Subject name	Subject Code
1	II MSc.	IV Semester	Functional Analysis	7MMA4C1
			Operations Research	7MMA4C2
			Topology-II	7MMA4C3
			Advanced Statistics	7MMA4E1

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:

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

- J.K.Sharma, Operations Research, Theory and Applications, 3^{rd} edition, Macmillan India Ltd, 2007.
- 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:

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

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:

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

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ALAGAPPA UNIVERSITY, KARAIKUDI
NEW SYLLABUS UNDER CBCS PATTERN (w.e.f.2023-24)

M.Sc., MATHEMATICS – PROGRAMME STRUCTURE
(2023 - 24)

S.No	Course Code	Courses	Title of the paper	T/P	Credits	Hours/ Week	Marks		
III - Semester									
1	22MMA3C1	CC	Complex Analysis	T	4	5	25	75	100
2	22MMA3C2	CC	Topology - I	T	4	5	25	75	100
3	22MMA3C3	CC	Graph Theory	T	4	5	25	75	100
4	22MMA3C4	CC	Mechanics	T	4	5	25	75	100
5	22MMA3E1/ 22MMA3E2// 22MMA3E3	DSE –III	Advance statistics / Differential Equation/ Automata Theory	T	4	4	25	75	100
6.	-	NME – II	Non – Major Elective Library/yoga/Counselling/ Fieldtrip	T	2	3	25	75	100
		SLC	Self – Learning course – MOOC's			3			
				Total	22	30	-	-	600

SEMESTER-III

Semester	Class	Subject name	Subject Code
III	II M.Sc.,	**Complex Analysis**	**22MMA3C1**
		Topology-I	**22MMA3C2**
		Graph Theory	**22MMA3C3**
		Mechanics	**22MMA3C4**
		Advanced Statistics	**22MMA3E1**

Semester - III				
Course code: 22MMA3C1	Core Course -IX	T/P	C	H/W
	COMPLEX ANALYSIS	T	4	5

Objectives	To introduce a modern treatment to classical complex analysis. To develop a clear knowledge on complex integration, calculus of residues, Jensen's formula.
Unit -I	Power series – Abel's Limit Theorem - 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, 1979 Complex Analysis, 3rd edition, McGraw Hill International Book Company.

Chapter 2 : Sections 2.4 & 2.5
Chapter 3 : Sections 2 & 3
Chapter 4 : Sections 1, 2, 3, & 5
Chapter 5 : Sections 1.1, 1.2, 1.3, 2.1, 2.2, 2.3 & 3.3

Books for Supplementary Reading and Reference:

John B.Conway, 2000 Functions of One Complex Variable, 2nd edition, Springer-Verlag, International Student Edition, Narosa Publishing Company.

S. Ponnusamy, 1997 Foundations of Complex Analysis, Narosa Publishing House, New Delhi.

S.Ponnusamy, 2004 Foundations of Complex Analysis, Narosa Publication House, New Delhi.

Serge Lang, 1977 Complex Analysis, Addison Wesley.

Outcomes	Students will be able to Understand the various intrinsic concepts and the theory of complex analysis. Acquire the knowledge of analyticity and complex integration.

Semester - III				
Course code: 22MMA3C2	Core Course -X	T/P	C	H/W
	TOPOLOGY – I	T	4	5

Objectives	• To study the concepts concerned with properties that are preserved under continuous deformations of objects. • To train the students to develop analytical thinking on continuity and connectivity.
Unit -I	Topological Spaces – Basis of a topology – the order topology – the product topology on X□Y– 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.
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, 1987 Topology a first course, Prentice Hall of India Pvt. Ltd., New Delhi.

Chapter 2 : Sections 2.1 to 2.11
Chapter 3 : Sections 3.1 to 3.3
Chapter 4 : Sections 3.5 to 3.7
Chapter 5 : Sections 4.1 & 4.4

Books for Supplementary Reading and Reference:

James Dugundji, 1975 Topology, Prentice Hall of India, New Delhi.

George F.Simmons, 1963 Introduction to Topology and Modern Analysis, McGraw Hill Book Co.

J.L. Kelly, General Topology, Van Nostrand, Reinhold Co., New York

L.Steen and J.Seeback, 1970 Counter examples in Topology, Holt, Rinehart and Winston, New York.

Outcomes	Students will be able to • Demonstrate an understanding of the concepts of metric spaces and topological spaces and their role in mathematics. • Demonstrate familiarity with a range of examples of topological structures.

Semester - III				
Course code: 22MMA3C3	Core Course -XI	T/P	C	H/W
	GRAPH THEORY	T	4	5

Objectives	To introduce a border view of concepts in basic graph theory. To emphasize on application aspect of graph theory.
Unit -I	Graphs and Simple Graphs – Graph Isomorphism – Incidence and Adjacency matrix – Subgraphs – Vertex degrees – Paths and connections – Cycles – Trees.
Unit-II	Connectivity – Blocks - Euler Tours and Hamiltonian cycles.
Unit- III	Matchings – Matchings and Coverings in Bipartite graphs - Edge chromatic number – vizing's theorem.
Unit -IV	Independent sets and Cliques – Chromatic number – Brook's theorems.
Unit- V	Plane and Planar graphs – Duals graphs – Euler's formula – Bridges – Five Colour theorem and Four Colour conjecture.

Text Book

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

Chapter 1 : Sections 1.1, 1.2, 1.3, 1.4, 1.5, 1.6 & 1.7
Chapter 2 : Section 2.1
Chapter 3 : Section 3.1
Chapter 4 : Sections 4.1 & 4.2
Chapter 5 : Sections 5.1 & 5.2
Chapter 6 : Sections 6.1 & 6.2
Chapter 7 : Section 7.1
Chapter 8 : Sections 8.1 & 8.2
Chapter 9 : Sections 9.1, 9.2, 9.3, 9.4 & 9.6

Books for Supplementary Reading and Reference:

J.A. Bondy, U.S.R. Murty, 1976 Graph Theory with Applications, Mac MilanPress Ltd.

R.Balakrishnan and K.Renganathan, 1999 A Text Book of Graph Theory, Springer Verlag, New York.

S.A.Choudum, 1987 A First Course in Graph Theory, Macmillan, India Ltd.

Gary Chartrand, Linda Lesniak, Ping Zhang, 2010 Graphs and Digraph, CRC press. F.Harary, 1969 Graph Theory, Addison - Wesley, Reading, Mass.

Outcomes	Students will be able to Acquire fundamental knowledge of finding shortest paths. Develop the skills on five colour theorem and four colour conjecture.

<table>
<tr><td colspan="6">Semester - III</td></tr>
<tr><td rowspan="2">Course code:
22MMA3C4</td><td colspan="2">Core Course -XII</td><td>T/P</td><td>C</td><td>H/W</td></tr>
<tr><td colspan="2">MECHANICS</td><td>T</td><td>4</td><td>5</td></tr>
<tr><td>Objectives</td><td colspan="5">To introduce various principles in dynamical systems.
To learn the techniques involved in the integrals of motion.</td></tr>
<tr><td>Unit -I</td><td colspan="5">The Mechanical system – Generalized coordinates – Constraints – Virtual work – Energy and Momentum.</td></tr>
<tr><td>Unit-II</td><td colspan="5">Derivation of Lagrange’s equations – examples – Integrals of motion.</td></tr>
<tr><td>Unit- III</td><td colspan="5">Hamilton’s Principle – Hamilton’s equations – other variations principle.</td></tr>
<tr><td>Unit -IV</td><td colspan="5">Hamilton Principle function – Hamilton – Jacobi equations.</td></tr>
<tr><td>Unit- V</td><td colspan="5">Differential forms and Generation functions – Special Transformations – Lagrange and Poisson brackets.</td></tr>
<tr><td colspan="6">Text Book
D.Greenwood, 1985 Classical Dynamics, Prentice Hall of India, New Delhi.
Chapter 1 : Sections 1.1 to 1.5
Chapter 2 : Sections 2.1 to 2.3
Chapter 4 : Sections 4.1 to 4.3
Chapter 5 : Sections 5.1 & 5.2
Chapter 6 : Sections 6.1 to 6.3

Books for Supplementary Reading and Reference:
H.Goldstein, , 2001 Classical Mechanics, 3rd edition, Narosa Publishing House, New Delhi.
N.C.Rane and P.S.C Joag, 1991 Classical Mechanics, Tata McGraw Hill, New Delhi.
J.L.Synge and B.A.Griffth, 1970 Principles of Mechanics, McGraw Hill Book Co., New York.
P. Duraipandian, Laxmi Duraipandian and Muthamizh Jayapragasam, 1979 Mechanics, S Chand Publishing, 1st edition.</td></tr>
<tr><td>Outcomes</td><td colspan="5">Students will be able to
Work with the equations of motion using different principles.
Understand the techniques involved in Hamilton’s principle.</td></tr>
</table>

Semester - III				
Course code: 22MMA3E1	DSE-3 A	T/P	C	H/W
	ADVANCED STATISTICS	T	4	4

Objectives	□ To learn some concepts on statistical inference, estimation and statistical tests. □ To enable the students to gain a thorough knowledge of 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 – Completeness 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.
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.

Text Book

Robert V. Hogg and Allen T.Craig, 2014 Introduction to Mathematical Statistics (5^{th} Edition) by Pearson Education, Asia.

Chapter 6 : Sections 6.1 to 6.6
Chapter 7 : Sections 7.1 to 7.6
Chapter 8 : Sections 8.1 to 8.3
Chapter 9: Sections 9.1 to 9.3
Chapter 5 : Sections 10.1 to 10.4

Books for Supplementary Reading and Reference:

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

Kapoor V.K. Gupta S.C, 2014 Elementary Mathematics Statistics, Sultan Chand and Sons.

Manish Malik, 2020 probability and mathematical statistics, Alpha plus institute mathematics pvt. Ltd., 1^{st} edition.

V.K.Rohatgi, 1998 An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Ltd., New Delhi, (3^{rd} Print).

Outcomes	Students will be able to □ Understand basic theoretical and applied principles of statistics. □ Gain a thorough knowledge of applied statistics for problems solving.