PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR

SALEM – 636011

DEGREE OF MASTER OF SCIENCE

CHOICE BASED CREDIT SYSTEM

SYLLABUS FOR

M.SC. MATHEMATICS

(SEMESTER PATTERN)

(For Candidates admitted in the Colleges affiliated to Periyar University from 2026-2027 onwards)

INTRODUCTION

M.Sc. Mathematics: Programme Outcome, Programme Specific Outcome and Course Outcome

Mathematics is the study of quantity, structure, space and change, focusing on problem solving, with wider scope of application in science, engineering, technology, social sciences etc. The key core areas of study in Mathematics include Algebra, Analysis (Real & Complex), Differential Equations, Geometry, and Mechanics. The Master Degree M.Sc. Mathematics is awarded to the students on the basis of knowledge, understanding, skills, attitudes, values and academic achievements expected to be acquired by learners at the end of the Programme. Learning outcomes of Mathematics are aimed at facilitating the learners to acquire these attributes, keeping in view of their preferences and aspirations for gaining knowledge of Mathematics.

Master degree in Mathematics is the culmination of in-depth knowledge of algebra, Real analysis, geometry, differential equations and several other branches of Mathematics. This also leads to study of related areas like Computer science, Financial Mathematics, Mathematical Statistics and many more. Thus, this programme helps learners in building a solid foundation for higher studies in Mathematics. The skills and knowledge gained have intrinsic aesthetics leading to proficiency in analytical reasoning. This can be utilised in Mathematical modelling and solving real life problems.

Students completing this programme will be able to present Mathematics clearly and precisely, make abstract ideas precise by formulating them in the language of Mathematics, describe Mathematical ideas from multiple perspectives and explain fundamental concepts of Mathematics to non-Mathematicians.

Completion of this programme will also enable the learners to join teaching profession, enhance their employability for government jobs, jobs in banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

First Year – Semester – I

Part	List of Courses	Credits	No. of Hours
	Core – I Linear Algebra	5	6
	Core – II Real Analysis – I	5	6
	Core – III Ordinary Differential Equations	4	5
	Core – IV Mechanics	4	6
	Elective – I (Any one of the following) 1. Graph Theory 2. Fuzzy Sets & Their Applications	3	5
	Skill Enhancement Course – I 1. Numerical Methods using Sci-lab (Practical)	2	2
		23	**30**

Semester-II

Part	List of Courses	Credits	No. of Hours
	Core – V Advanced Algebra	5	6
	Core – VI Real Analysis - II	5	6
	Core – VII Partial Differential Equations	4	5
	Core – VIII Differential Geometry	4	5
	Elective – II (Any one of the Following) 1. Numerical Analysis 2. Number Theory & Cryptography	3	5
	Non-Major Elective Course – I	2	2
	Human Rights	1	1
		24	**30**

Second Year – Semester – III

Part	List of Courses	Credits	No. of Hours
	Core – IX Complex Analysis	5	6
	Core – X Measure Theory & Integration	5	6
	Core – XI Topology	5	6
	Core – XII Calculus of Variations and Integral Equations	4	6
	Elective – III (Any one of the Following) 1. Mathematical Programming 2. Discrete Mathematics	3	4
	Non-Major Elective Course – II	2	2
	Internship / Industrial Activity [Credits]	1	Commended / Highly Commended
		25	**30**

Semester-IV

Part	List of Courses	Credits	No. of Hours
	Core – XIII Functional Analysis	5	6
	Core – XIV Probability Theory	5	6
	Elective – IV 1. Fluid Dynamics 2. Machine Learning	3	6
	Skill Enhancement Course – II Data Analytics using Python (Practical)	2	4
	Extension Activity	1	-
	Project with VIVA VOCE	4	8
		20	**30**

Total 92 Credits for PG Courses.

<table>
<tr><td>Title of the Course</td><td colspan="6">LINEAR ALGEBRA</td></tr>
<tr><td>Paper Number</td><td colspan="6">CORE I</td></tr>
<tr><td rowspan="2">Category Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
5</td><td>Tutorial
1</td><td>Lab Practice
--</td><td>Total
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<tr><td colspan="2">Pre-requisite</td><td colspan="5"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="5"></td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="5">UNIT I : Linear Transformation
The algebra of linear transformations-Isomorphism of vector spaces-Representations of linear transformations by matrices - Linear functional-The double dual – The transpose of a linear transformation. (Chapter 3: Sections: 3.1 - 3.7).</td></tr>
<tr><td colspan="2"></td><td colspan="5">UNIT II : Algebra of Polynomials
The algebra of polynomials - Lagrange interpolation - Polynomial ideals - The prime factorization of a polynomial - Determinant functions. (Chapter 4: Sections: 4.1 - 4.5, Chapter 5: Sections: 5.1 & 5.2).</td></tr>
<tr><td colspan="2"></td><td colspan="5">UNIT III Determinants
Permutations and the uniqueness of determinants-Classical adjoint of a (square) matrix - Inverse of an invertible matrix using determinants - Characteristic values - Annihilating polynomials. (Chapter 5: Sections: 5.3 & 5.4, Chapter 6: Sections: 6.1 - 6.3).</td></tr>
<tr><td colspan="2"></td><td colspan="5">UNIT IV : Diagonalization
Invariant subspaces - Simultaneous triangulations - Simultaneous diagonalizations - Direct-sum decompositions - Invariant sums - Primary decomposition theorem. (Chapter 6: Sections: 6.4 -6.8).</td></tr>
<tr><td colspan="2"></td><td colspan="5">UNIT V : The Rational and Jordan Forms
Cyclic subspaces and annihilators-Cyclic decompositions and rational form-The Jordan form-Computation of invariant factors.(Chapter 7: Sections 7.1 - 7.4).</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="5">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="5">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="5">TEXT BOOK:
Kennath M. Hoffman and Ray Kunze, Linear Algebra, 2 Edition, Pearson India Publishing, New Delhi, 2015.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="5">1. M.Artin,Algebra, Prentice Hall of India Pvt. Ltd., New Delhi ,2005
2. S.H.Friedberg,A.J.Insel and L.E.Spence, Linear Algebra,4th Edition, Prentice Hall of India Pvt. Ltd., New Delhi,2009.
3. I.N Herstein : Topics in Algebra, 2nd Edition, Wiley Eastern Ltd. New Delhi, 2013.
4. J.J.Rotman,Advanced Modern Algebra,2nd Edition, Graduate Studies in Mathematics, Vol.114, AMS, Providence, Rhode Island,2010.
5. G.Strang, Introduction to Linear Algebra,2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi,2013.</td></tr>
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<tr><td colspan="2">Title of the Course</td><td colspan="6">Real Analysis – I</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE II</td></tr>
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<tr><td colspan="2">Objectives of the Course</td><td colspan="6"></td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT I: Basic Topology Finite, Countable and Uncountable Sets – Metric Spaces – Compact Sets – Connected Sets (Perfect sets - Omitted). (Chapter 2 Pages 24 – 40, 42 – 46).</td></tr>
<tr><td colspan="6">Unit II: Numerical Sequences and Series Convergent sequences – Subsequences – Cauchy sequences - Upper and lower limits - Some special sequences – Series – Series of nonnegative terms - The number e - The root and ratio tests. (Chapter 3 Pages 47 – 68).</td></tr>
<tr><td colspan="6">Unit III: Rearrangements of Series Power series - Summation by parts - Absolute convergence - Addition and multiplication of series– Rearrangements. (Chapter 3 Pages 69 – 82).</td></tr>
<tr><td colspan="6">UNIT IV: Continuity Limit of Functions – Continuous functions - Continuity and Compactness – Continuity and Connectedness – Discontinuities – Monotonic functions – Infinite limits and Limits at infinity. (Chapter 4 Pages 83 – 102).</td></tr>
<tr><td colspan="6">UNIT V: Differentiation The derivative of a real function – Mean value theorems – The continuity of the Derivative – L' Hospital's Rule – Derivatives of Higher order – Taylor's theorem – Differentiation of Vector–valued functions. (Chapter 5 Pages 103 – 119).</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">1. Walter Rudin, "Principles of Mathematical Analysis", 3rd Edition, McGraw Hill Book Co., Kogaskusha, 1976.</td></tr>
</table>

Reference Books	1. Tom M. Apostol, *"Mathematical Analysis*", Narosa Publishers, New Delhi, 2002. 2. R. G. Bartle and D.R. Sherbert, "Introduction to Real Analysis", John Wiley & Sons, New York, 1982. 3. W.J. Kaczor and M.T. Nowak, "Problems in Mathematical Analysis I – Real Numbers , Sequences and Series", American Mathematical Society, 2000. 4. W.J. Kaczor and M.T. Nowak, "Problems in Mathematical Analysis II – Continuity and Differentiation", American Mathematical Society, 2000. 5. Steven G. Krantz, Real Analysis and Foundations, 4th Edition, CRC Press, 2017. 6. H.H.Sohrab, *"Basic Real Analysis*", Springer International Edition, India, 2006.

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<tr><td colspan="2">Title of the Course</td><td colspan="8">ORDINARY DIFFERENTIAL EQUATIONS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE III</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">1</td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">UG level Calculus and Differential Equations</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">To develop strong background on finding solutions to linear differential equations with constant and variable coefficients and also with singular points, to study existence and uniqueness of the solutions of first order differential equations</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="8">UNIT-I : Linear equations with constant coefficients
Second order homogeneous equations-Initial value problems-Linear dependence and independence-Wronskian and a formula for Wronskian-Non-homogeneous equation of order two.Chapter 2: Sections 1 to 6</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT-II : Linear equations with constant coefficients
Homogeneous and non-homogeneous equation of order n –Initial value problems-Annihilator method to solve non-homogeneous equation- Algebra of constant coefficient operators. Chapter 2: Sections 7 to 12.</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT-III : Linear equation with variable coefficients
Initial value problems -Existence and uniqueness theorems – Solutions to solve a non-homogeneous equation – Wronskian and linear dependence – reduction of the order of a homogeneous equation – homogeneous equation with analytic coefficients-The Legendre equation. Chapter : 3 Sections 1 to 8 (Omit section 9)</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT-IV :Linear equation with regular singular points
Euler equation – Second order equations with regular singular points –Exceptional cases – Bessel Function. Chapter 4 : Sections 1 to 4 and 6 to 8 (Omit sections 5 and 9)</td></tr>
<tr><td colspan="2"></td><td colspan="8">UNIT-V: Existence and uniqueness of solutions to first order equations: Equation with variable separated – Exact equation – method of successive approximations – the Lipschitz condition – convergence of the successive approximations and the existence theorem. Chapter 5: Sections 1 to 6 (Omit Sections 7 to 9)</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="8">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">E.A.Coddington, A introduction to ordinary differential equations (3rd Printing) Prentice-Hall of India Ltd., New Delhi, 1987.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="8">1. Williams E. Boyce and Richard C. DI Prima, Elementary differential equations and boundary value problems, John Wiley and sons, New York, 1967.
2. George F Simmons, Differential equations with applications and historical notes, Tata McGraw Hill, New Delhi, 1974.
3. N.N. Lebedev, Special functions and their applications, Prentice Hall of India, New Delhi, 1965.
4. M.D.Raisinghania, Advanced Differential Equations, S.Chand & Company Ltd. New Delhi 2001</td></tr>
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<tr><td colspan="2">Title of the Course</td><td colspan="8">MECHANICS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE IV</td></tr>
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<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">1</td><td colspan="2">--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">UG level Calculus and Differential equations.</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">To study mechanical systems under generalized coordinate systems, virtual work, energy and momentum, to study mechanics developed by Newton, Langrange, Hamilton Jacobi and Theory of Relativity due to Einstein.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT-I: Mechanical Systems: The Mechanical system- Generalised coordinates – Constraints - Virtual work - Energy and Momentum
Chapter 1: Sections 1.1 to 1.5</td></tr>
<tr><td colspan="8">UNIT-II: Lagrange's Equations: Derivation of Lagrange’s equations- Examples- Integrals of motion.
Chapter 2 : Sections 2.1 to 2.3 (Omit Section 2.4)</td></tr>
<tr><td colspan="8">UNIT-III: Hamilton's Equations: Hamilton's Principle - Hamilton’s Equation - Other variational principle.
Chapter 4 : Sections 4.1 to 4.3 (Omit section 4.4)</td></tr>
<tr><td colspan="8">UNIT – IV: Hamilton-Jacobi Theory: Hamilton Principle function – Hamilton-Jacobi Equation - Separability
Chapter 5 : Sections 5.1 to 5.3</td></tr>
<tr><td colspan="8">UNIT-V: Canonical Transformation: Differential forms and generating functions – Special Transformations– Lagrange and Poisson brackets.
Chapter 6 : Sections 6.1, 6.2 and 6.3 (omit sections 6.4, 6.5 and 6.6)</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="8">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">D. Greenwood, Classical Dynamics, Prentice Hall of India, New Delhi, 1985.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="8">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, 1991.
3. J.L.Synge and B.A.Griffth, Principles of Mechanics (3rd Edition) McGraw Hill Book Co., New York, 1970.</td></tr>
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<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Graph Theory</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">Elective – I (Optional)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
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<tr><td colspan="2">Pre-requisite</td><td colspan="6"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6"></td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT I: Basic Results: Introduction-Basic Concepts-Subgraphs-Degrees of Vertices - Paths and Connectedness - Automorphism of a Simple Graph. (Chapter 1: Sections 1.1 - 1.6).
Directed Graphs: Introduction-Basic Concepts-Tournaments. (Chapter 2: Sections 2.1 -2.3).</td></tr>
<tr><td colspan="6">UNIT II: Connectivity and Trees: Connectivity: Introduction-Vertex cut and Edge Cut-Connectivity and Edge Connectivity. (Chapter 3: Sections 3.1- 3.3). Trees: Introduction-Definition, Characterization and Simple Properties-Centers and Centroids- Cutting the Number of Spanning Trees-Cayley's Formula. (Chapter 4: Sections 4.1- 4.5).</td></tr>
<tr><td colspan="6">UNIT III: Independent Sets, Matchings and Cycles: Independent Sets and Matchings: Introduction-Vertex-Independent Sets and Vertex Coverings-Edge-Independent sets-Matchings and Factors-Matchings in Bipartite Graphs. (Chapter 5: Sections 5.1- 5.5). Cycles: Introduction-Eulerian Graphs-Hamiltonian Graphs. (Chapter 6: Sections 6.1- 6.3).</td></tr>
<tr><td colspan="6">UNIT IV: Graph Colorings: Introduction-Vertex colorings-Critical Graphs-Edge colorings of Graphs-Kirkman's Schoolgirl- Problem-Chromatic Polynomials. (Chapter 7: Sections 7.1, 7.2, 7.3 (7.2.1 & 7.2.3 only), 7.6, 7.8, and 7.9).</td></tr>
<tr><td colspan="6">UNIT V : Planarity: Introduction- Planar and Nonplanar Graphs –Euler Formula and its Consequences- K_5 and $K_{3,3}$ are Nonplanar Graphs – Dual of a Plane Graph- The Four-Color Theorem and the Heawood Five- Color Theorem-Hamiltonian Plane Graphs-Tait Coloring.(Chapter 8: Sections 8.1 - 8.6 ,8.8 and 8.9).</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">R.Balakrishnan and K.Ranganathan, Text Book of Graph Theory, (2nd Edition), Springer, New York, 2012.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="6">1. J.A.Bondy and U.S.R. Murty, Graph Theory with Applications, North Holland, New York, 1982.
2. Narasing Deo, Graph Theory with Application to Engineering and Computer Science, Prentice Hall of India, New Delhi. 2003.
3. F. Harary, Graph Theory, Addison – Wesely Pub. Co. The Mass. 1969.
4. L. R.. Foulds, Graph Theory Application, Narosa Publ. House, Chennai, 1933.</td></tr>
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<tr><td colspan="2">Title of the Course</td><td colspan="7">FUZZY SETS AND THEIR APPLICATIONS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">ELECTIVE – I (Optional)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
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<tr><td colspan="2">Objectives of the Course</td><td colspan="7">This course introduces advanced topics in Linear and non-linear Programming</td></tr>
<tr><td colspan="2" rowspan="4">Course Outline</td><td colspan="7">Unit I Fuzzy sets: Fuzzy sets – Basic types – Basic concepts - Characteristics – Significance of the paradigm shift – Additional properties of α - Cuts (Chapter 1: Sections 1.3 to 1.5 and Chapter 2: Sections 2.1)</td></tr>
<tr><td colspan="7">Unit II Fuzzy Sets Versus CRISP Sets: Representation of Fuzzy sets – Extension principle of Fuzzy sets – Operation on Fuzzy Sets – Types of Operation – Fuzzy complements. (Chapter 2: Sections 2.2 to 2.3 and Chapter 3: Sections 3.1 to 3.2)</td></tr>
<tr><td colspan="7">Unit III Operations on Fuzzy Sets: Fuzzy intersection – t-norms, Fuzzy unions – t conorms – Combinations of operations – Aggregation operations. (Chapter 3: Sections 3.3 to 3.6)</td></tr>
<tr><td colspan="7">Unit IV Fuzzy Arithmetic:Fuzzy numbers – Linguistic variables – Arithmetic operation on intervals – Lattice of Fuzzy numbers. (Chapter 4: Sections 4.1 to 4.4)</td></tr>
<tr><td colspan="2"></td><td colspan="7">Unit V Constructing Fuzzy Sets: Methods of construction: An overview – Direct methods with one expert – Direct method with multiple experts – indirect method with multiple experts and one expert – Construction from Sample data. (Chapter 10: Sections 10.1 to 10.7)</td></tr>
<tr><td colspan="2">Extended Professional Component</td><td colspan="7">Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="7">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="7">1. G.J. Klir, and Bo Yuan, Fuzzy Sets and fuzzy Logic: Theory and Applications, Prentice Hall of India Ltd., New Delhi, 2005.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="7">1. H.J. Zimmermann, Fuzzy Set Theory and its Applications, Allied Publishers, Chennai, 1996.
2. A.Kaufman, Introduction to the Theory of Fuzzy Subsets, Academic Press, New York, 1975.
3. V.Novak, Fuzzy Sets and Their Applications, Adam Hilger, Bristol, 1969.</td></tr>
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<tr><td colspan="2">Title of the Course</td><td colspan="8">NUMERICAL ANALYSIS USING SCILAB (Practical)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">SEC</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
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<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
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<tr><td colspan="2">Objectives of the Course</td><td colspan="8"></td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT I
Transcendental and Polynomial Equations</td></tr>
<tr><td colspan="8">UNIT II
System of Linear Algebraic Equations and Eigenvalue Problems</td></tr>
<tr><td colspan="8">UNIT III
Interpolation and Approximation</td></tr>
<tr><td colspan="8">UNIT IV
Differentiation and Integration</td></tr>
<tr><td colspan="8">UNIT V
Ordinary Differential Equations Initial Value Problems</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="8">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">Numerical Methods For Scientific And Engineering Computation by M. K. Jain, S. R. K. Iyengar And R.K. Jain.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="8">Numerical Methods and principles analysis and algorithms ,S.Pal, Oxford University Press</td></tr>
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<tr><td colspan="2">Title of the Course</td><td colspan="7">Advanced Algebra</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">CORE V</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
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<tr><td colspan="2">Pre-requisite</td><td colspan="7"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">The objectives of this course are to introduce the structure and properties of Euclidean rings and their role in divisibility theory, develop an understanding of polynomial rings over fields and commutative rings, study field extensions, algebraic elements, and roots of polynomials explore the fundamental ideas of Galois theory and their applications to polynomial equations analyze finite fields and understand the structure of finite division rings through Wedderburn's Theorem.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="7">UNIT I: Euclidean Rings – A Particular Euclidean Ring.
Chapter 3: Sections 3.7 – 3.8</td></tr>
<tr><td colspan="7">UNIT II: Polynomial Rings – Polynomials over the Rational Field – Polynomial Rings over Com-mutative Rings.
Chapter 3: Sections 3.9 – 3.11</td></tr>
<tr><td colspan="7">UNIT III: Extension Fields – Roots of Polynomials.
Chapter 5: Sections 5.1 and 5.3</td></tr>
<tr><td colspan="7">UNIT IV: More about Roots – The Elements of Galois Theory.
Chapter 5: Sections 5.5 – 5.6</td></tr>
<tr><td colspan="7">UNIT V: Finite Fields – Wedderburn's Theorem on Finite Division Rings.
Chapter 7: Sections 7.1 – 7.2</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="7">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="7">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="7">I.N. Herstein, Topics in Algebra, Second Edition, Wiley India Pvt. Ltd., New Delhi, 2009.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="7">1. M.Artin, Algebra, Prentice Hall of India, 1991.
2. P.B.Bhattacharya, S.K.Jain and S.R.Nagpaul, Basic Abstract Algebra, (II Edition), Cam-bridge University Press, 1997.(Indian Edition)
3. D. S. Dummit and R. M. Foote, Abstract Algebra, 3rd Edition, John Wiley and Sons, New Delhi, 2011.
4. J.B.Fraleigh, A First Course in Abstract Algebra, Addison Wesley, Mass, 1982.
5. J. A. Gallian, Contemporary Abstract Algebra, 7th Edition, Brooks/Cole-Cengage Learning, USA, 2010.
6. V.K.Khanna and S.K.Bhambri, A Course in Abstract Algebra, Vikas Publishing House Pvt. Ltd, 1993.
7. D.S. Malik, J.N. Mordeson and M.K. Sen, Fundamental of Abstract Algebra, McGraw Hill (International Edition), New York, 1997.</td></tr>
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<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">Real Analysis – II</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE VI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
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<tr><td colspan="2">Pre-requisite</td><td colspan="8"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8"></td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">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. (Chapter 6 Pages 120 – 142).</td></tr>
<tr><td colspan="8">UNIT II: Sequences and Series of Functions Discussion of main problem – Uniform Convergence - Uniform Convergence and Continuity - Uniform Convergence and Integration – Uniform Convergence and Differentiation. (Chapter 7 Pages 143 – 154).</td></tr>
<tr><td colspan="8">Unit III: Sequences and Series of Functions (contd…) Equicontinuous families of functions – Stone-Weierstrass Theorems – Algebra of complex valued functions. (Chapter 7 Pages 155 – 171).</td></tr>
<tr><td colspan="8">Unit IV: Some special functions Power series – The Exponential and Logarithmic functions – Trigonometric Functions – Fourier series - The Gamma functions (Algebraic completeness of the complex field - omitted). (Chapter 8 Pages 172 – 203 (Omitted Theorem 8.8)).</td></tr>
<tr><td colspan="8">Unit V: Functions of several variables Linear transformations – Differentiation – The contraction principle - The inverse function theorem – The implicit function theorem. (Chapter 9 Pages 204 – 228).</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="8">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">1. Walter Rudin, “Principles of Mathematical Analysis”, 3rd Edition, McGraw Hill Book Co., Kogaskusha, 1976.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="8">1. T.M. Apostol, “MathematicalAnalysis”, Narosa Publishers, New Delhi,1985.
2. A. Browder, “Mathematical Analysis, an Introduction”, Springer-Verlag, New York, 1996.
3. K.A. Ross, “Elementary Analysis: The Theory of Calculus”, 2nd Edition, Springer, New York, 2013.
4. M. Stoll, “Introduction to Real Analysis”, 2nd Edition, Addison-Wesley Longman Inc, 2001</td></tr>
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<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">PARTIAL DIFFERENTIAL EQUATIONS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE VII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td>Credits</td><td>4</td><td>Course Code</td><td colspan="2"></td></tr>
<tr><td>Semester</td><td>II</td><td colspan="4"></td></tr>
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<tr><td colspan="2">Objectives of the Course</td><td colspan="8">The objective of this course is to enable the students to understand the concepts related to the solution of partial differential equations arising in various fields.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT I Second order Partial Differential Equations: Origin of second order partial differential equations – Linear differential equations with constant coefficients – Method of solving partial (linear) differential equation – Classification of second order partial differential equations – Canonical forms – Adjoint operators – Riemann method. (Chapter 2: Sections 2.1 to 2.5).</td></tr>
<tr><td colspan="8">UNIT II Elliptic Differential Equations: Elliptic differential equations – Occurrence of Laplace and Poisson equations – Boundary value problems – Separation of variables method – Laplace equation in cylindrical – Spherical co-ordinates, Dirichlet and Neumann problems for circle – Sphere.(Chapter 3 : Sections 3.1 to 3.9).</td></tr>
<tr><td colspan="8">UNIT III Parabolic Differential Equations: Parabolic differential equations – Occurrence of the diffusion equation – Boundary condition – Separation of variable method – Diffusion equation in cylindrical – Spherical co-ordinates. (Chapter 4: Sections 4.1 to 4.5).</td></tr>
<tr><td colspan="8">UNIT IV Hyperbolic Differential Equations: Hyperbolic differential equations – Occurrence of wave equation – One dimensional wave equation – Reduction to canonical form – D'Alembertz solution – Separation of variable method – Periodic solutions – Cylindrical – Spherical co-ordinates – Duhamel principle for wave equations.(Chapter 5 : Sections 5.1 to 5.6 and 5.9).</td></tr>
<tr><td colspan="8">UNIT V Integral Transform: Laplace transforms – Solution of partial differential equation – Diffusion equation – Wave equation – Fourier transform – Application to partial differential equation – Diffusion equation – Wave equation – Laplace equation. (Chapter 6: Sections 6.2 to 6.4).</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="8">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">J.N. Sharma and K.Singh, Partial Differential Equation for Engineers and Scientists, Narosa publ. House, Chennai, 2001.</td></tr>
</table>

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

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">Differential Geometry</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE VIII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
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<tr><td colspan="2">Pre-requisite</td><td colspan="6"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6"></td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT I :Theory of Space Curves: Theory of space curves – Representation of space curves – Unique parametric representation of a space curve – Arc-length – Tangent and osculating plane – Principle normal and binormal – Curvature and torsion – Behaviour of a curve near one of its points – The curvature and torsion of a curve as the intersection of two surfaces. (Chapter 1: Sections 1.1 to 1.9).</td></tr>
<tr><td colspan="6">UNIT II : Theory of Space Curves (Contd.): Contact between curves and surfaces – Osculating circle and osculating sphere – Locus of centre of spherical curvature – Tangent surfaces – Involutes and Evolutes – Intrinsic equations of space curves – Fundamental Existence Theorem – Helices. (Chapter 1: Sections 1.10 to 1.13 and 1.16 to 1.18)</td></tr>
<tr><td colspan="6">UNIT III : Local Intrinsic properties of surface: Definition of a surface – Nature of points on a surface – Representation of a surface – Curves on surfaces – Tangent plane and surface normal – The general surfaces of revolution – Helicoids – Metric on a surface – Direction coefficients on a surface. (Chapter 2: Sections 2.1 to 2.10).</td></tr>
<tr><td colspan="6">UNIT IV : Local Intrinsic properties of surface and geodesic on a surface: Families of curves – Orthogonal trajectories – Double family of curves – Isometric correspondence – Intrinsic properties – Geodesics and their differential equations – Canonical geodesic equations – Geodesics on surface of revolution. (Chapter 2: Sections 2.11 to 2.15 and Chapter 3: Sections 3.1 to 3.4)</td></tr>
<tr><td colspan="6">UNIT V: Geodesic on a surface: Normal property of Geodesics – Differential equations of geodesics using normal property – Existence theorems – Geodesic parallels – Geodesic curvature – Gauss Bonnet Theorems – Gaussian curvature – Surface of constant curvature. (Chapter 3: Sections 3.5 to 3.8 and Sections 3.10 to 3.13)</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">D.Somasundaram, Differential Geometry, Narosa Publ. House, Chennai, 2005.</td></tr>
</table>

Reference Books	1. T. Willmore, An Introduction to Differential Geometry, Clarendan Press, Oxford, 1959. 2. D.T Struik, Lectures on Classical Differential Geometry, Addison – Wesely, Mass. 1950. 3. J.A. Thorpe, Elementary Topics in Differential Geometry, Springer – Verlag, New York, 1979.

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">Numerical Analysis</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">Elective – II (Optional)</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td colspan="2"></td></tr>
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<tr><td colspan="2">Pre-requisite</td><td colspan="8"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">The objectives of this course are to make the students familiarize with the ways of solving complicatedϖ mathematical problems numerically. To provide numerical methods for solving the non-linear equations, interpolation,ϖ differentiation, integration, ordinary and partial differential equations. Describing and understanding error analysis in numerical methods.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT I : Numerical solutions to ordinary differential equation:
Numerical solutions to ordinary differential equation – Power series solution – Pointwise method – Solution by Taylor‟s series – Taylor‟s series method for simultaneous first order differential equations – Taylor‟s series method for Higher order Differential equations – Predictor – Corrector methods – Milne‟s method – Adam – Bash forth method. (Chapter 11: Sections 11.1 to 11.6 and Sections 11.18 to 11.20).</td></tr>
<tr><td colspan="8">UNIT II: Picard and Euler Methods:
Picard‟s Method of successive approximations – Picard‟s method for simultaneous first order differential equations – Picard‟s method for simultaneous second order differential equations – Euler‟s Method – Improved Euler‟s method – Modified Euler‟s Method. (Chapter 11: Sections 11.7 to 11.12).</td></tr>
<tr><td colspan="8">UNIT III : Runge – Kutta Method:
Runge‟s method – Runge-Kutta methods – Higher order Runge-Kutta methods-RungeKutta methods for simultaneous first order differential equations – Runge-Kutta methods for simultaneous second order differential equations.
(Chapter 11: Sections 11.13 to 11.17).</td></tr>
<tr><td colspan="8">UNIT IV : Numerical Solutions to Partial Differential Equations:
Introduction Difference Quotients – Geometrical representation of partial differential quotients – Classifications of partial differential equations – Elliptic equation – Solution to Laplace‟s equation by Liebmann‟s iteration process. (Chapter 12: Sections 12.1 to12.6).</td></tr>
<tr><td colspan="8">UNIT V : Numerical Solutions to Partial Differential Equations (Contd.):
Poisson equation – its solution – Parabolic equations – Bender – Schmidt method – Crank – Nicholson method – Hyperbolic equation – Solution to partial differential equation by Relaxation method. (Chapter 12: Sections 12.7 to 12.10).</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="8">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
</table>

Recommended Text	V.N Vedamurthy and Ch. S.N. Iyengar, Numerical Methods, Vikas Publishing House Pvt Ltd., 1998.
Reference Books	1. S.S. Sastry, Introductory methods of Numerical Analysis, Prentice of India, 1995. 2. C.F. Gerald, and P.O. Wheathy, Applied Numerical Analysis, Fifth Edition, Addison Wesley, 1998. **3.** M.K. Venkatraman, Numerical methods in Science and technology, National Publishers Company, 1992. **4.** P. Kandasamy, K. Thilagavathy, K. Gunavathy, Numerical Methods, S. Chand & Company, 2003.

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">NUMBER THEORY AND CRYPTOGRAPHY</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">Elective – II (Optional)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
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<tr><td colspan="2">Pre-requisite</td><td colspan="8"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">To understand fundamental number-theoretic algorithms such as the Euclidean algorithm, the Chinese Remainder algorithm, binary powering, and algorithms for integer arithmetic. To understand fundamental algorithms for symmetric key and publickey cryptography. To understand the number-theoretic foundations of modern cryptography and the principles behind their security.To implement and analyze cryptographic and number-theoretic algorithms.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT – I Elementary Number Theory: Time Estimates for doing arithmetic – divisibility and Euclidean algorithm – Congruences – Application to factoring. Chapter 1</td></tr>
<tr><td colspan="8">UNIT – II Introduction to Classical Crypto systems – Some simple crypto systems – Enciphering matrices DES Chapter 3</td></tr>
<tr><td colspan="8">UNIT - III Finite Fields, Quadratic Residues and Reciprocity (Chapter 2)</td></tr>
<tr><td colspan="8">UNIT – IV Public Key Cryptography Chapter 4</td></tr>
<tr><td colspan="8">UNIT – V Primality, Factoring, Elliptic curves and Elliptic curve crypto systems (Chapter 5, sections 1,2,3 &5 (omit section 4), Chapter 6, sections 1& 2 only)</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="8">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">Neal Koblitz, A Course in Number Theory and Cryptography, Springer-Verlag, New York,1987</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="8">1. I.Niven and H.S.Zuckermann, An Introduction to Theory of Numbers (Edn. 3), Wiley Eastern Ltd., New Delhi,1976
2. David M.Burton, Elementary Number Theory, Brown Publishers, Iowa,1989
3. K.Ireland and M.Rosen, A Classical Introduction to Modern Number Theory, Springer Verlag, 1972
4. N.Koblitz, Algebraic Aspects of Cryptography, Springer 1998.</td></tr>
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<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">Complex Analysis</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE IX</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
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<tr><td colspan="2">Pre-requisite</td><td colspan="8"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8"></td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT I: Complex Integration : Complex Integration – Fundamental Theorems – Line integrals –Rectifiable Arcs-Line Integrals as Arcs – Cauchy’s Theorem for a Rectangle and in a disk – Cauchy’s Integral Formula – Index of point with respect to a closed curve- The Integral formula – Higher order derivatives – Local properties of analytic functions – Taylor’s Theorem – Zeros and Poles –Local mapping - Maximum Principle. (Chapter 4: Sections 1 to 3).</td></tr>
<tr><td colspan="8">UNIT II: Complex Integration (Contd.): The general form of Cauchy’s Theorem – Chains and Cycles – Simple connectivity – Homology – General statement of cauchy’s theorem – Proof of Cauchy’s theorem – Locally exact differentials – Multiply connected regions – Calculus of residues – Residue Theorem – Argument Principle-Evaluation of Definite Integrals. (Chapter 4: Sections 4 and 5).</td></tr>
<tr><td colspan="8">UNIT III: Harmonic Functions and Power Series Expansions : Harmonic Functions – Definition and basic properties- Mean-Value Property-Poisson’s formula –Schwarz’s Theorem – Reflection Principle- Weierstrass’s theorem- Taylor’s series –Laurent series. (Chapter 4: Sections 6 and Chapter 5: Sections 1).</td></tr>
<tr><td colspan="8">Unit IV: Entire functions: Jensen’s formula – Hadamards theorem. Normal Families: Equicontinuity – Normality and compactness – Arzela’s theorem – Families of analytic functions – The classical definition. (Chapter 5: Sections 3 and 5).</td></tr>
<tr><td colspan="8">UNIT V: Conformal Mapping: The Riemann Mapping Theorem, Conformal Mapping of Polygons. (Chapter 6: Sections 1, 2).</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="8">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">L.V Ahlfors, Complex Analysis, 3rd edition, Mc Graw Hill Inter., Edition, New Delhi,1979</td></tr>
</table>

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

<table>
<tr><td>Title of the Course</td><td colspan="6">Measure Theory & Integration</td></tr>
<tr><td>Paper Number</td><td colspan="6">CORE X</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td></tr>
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<tr><td>Pre-requisite</td><td colspan="6"></td></tr>
<tr><td>Objectives of the Course</td><td colspan="6"></td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="6">UNIT I : Lebesgue Measure:
Lebesgue Measure – Introduction – Outer measure – Measurable sets and Lebesgue measure – Measurable functions – Little Woods' Three Principles. (Chapter 3: Sections 1 to 3, 5 and 6).</td></tr>
<tr><td colspan="6">UNIT II : Lebesgue integral :
Lebesgue integral – The Riemann integral – Lebesgue integral of bounded functions over a set of finite measure – The integral of a nonnegative function – The general Lebesgue integral. (Chapter 4: Sections 1 to 4).</td></tr>
<tr><td colspan="6">UNIT III : Differentiation and Integration :
Differentiation and Integration – Differentiation of monotone functions – Functions of bounded variation – Differentiation of an integral – Absolute continuity. (Chapter 5: Sections 1 to 4).</td></tr>
<tr><td colspan="6">UNIT IV : General Measure and Integration :
General Measure and Integration – Measure spaces – Measurable functions – Integration – Signed Measure – The Radon – Nikodym theorem. (Chapter 11: Sections 1 to 3, 5 and 6) .</td></tr>
<tr><td colspan="6">UNIT V : Measure and Outer Measure :
Measure and outer measure – outer measure and measurability – The Extension theorem – Product measures. (Chapter 12: Sections 1, 2 and 4).</td></tr>
<tr><td>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td>Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td>Recommended Text</td><td colspan="6">TEXT BOOK:
1. H.L.Royden, Real Analysis, Mc Millan Publ. Co, New York, 1993</td></tr>
<tr><td>Reference Books</td><td colspan="6">BOOKS FOR REFERENCE:
1. G. de Barra, Measure Theory and integration, Wiley Eastern Ltd, 1981.
2. P.K. Jain and V.P. Gupta, Lebesgue Measure and Integration, New Age Int. (P) Ltd., New Delhi,2000.
3. Walter Rudin, Real and Complex Analysis, Tata McGraw Hill Publ. Co. Ltd., New Delhi, 1966.</td></tr>
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<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">Topology</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE XI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">1</td><td colspan="2">--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8"></td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT I : Topological spaces: Topological spaces - Basis for a topology – The Order Topology - The Product Topology on XxY – The Subspace Topology – Closed sets and Limit points. (Chapter 2: sections 12 to17).</td></tr>
<tr><td colspan="8">UNIT II: Continuous functions: Continuous Functions– The Product Topology – The Metric Topology. (Chapter 2: Sections 18 to 21).</td></tr>
<tr><td colspan="8">UNIT III: Connectedness: Connected Spaces – Connected Subspaces of the Real line – Components and Local Connectedness. (Chapter 3: Sections 23 to 25)</td></tr>
<tr><td colspan="8">UNIT IV: Compactness: Compact spaces – Compact Subspace of the real line –Limit Point Compactness – Local Compactness. (Chapter 3: Sections 26 to 29).</td></tr>
<tr><td colspan="8">UNIT V: Countability and Separation axioms: The Countability Axioms – The Separation Axioms – Normal Spaces – The Urysohn Lemma – The Urysohn Metrization Theorem – The Tietze extension theorem. (Chapter 4: Sections 30 to 35).</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="8">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">James R.Munkres – Topology, 2nd edition, Prentice Hall of India Ltd., New Delhi, 2005.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="8">1. J. Dugundji, Topology, Prentice Hall of India, New Delhi, 1975.
2. G.F.Simmons, Introduction to Topology and Modern Analysis, McGraw Hill Book Co, New York, 1963.
3. S.T. Hu, Elements of General Topology, Holden Day, Inc. New York, 1965.</td></tr>
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<table>
<tr><td>Title of the Course</td><td colspan="6">CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS</td></tr>
<tr><td>Paper Number</td><td colspan="6">CORE XII</td></tr>
<tr><td>Category Core</td><td colspan="6">Year II | Credits 4 | Course Code
Semester III</td></tr>
<tr><td>Instructional Hours per week</td><td colspan="6">Lecture 5 | Tutorial 1 | Lab Practice -- | Total 6</td></tr>
<tr><td>Pre-requisite</td><td colspan="6"></td></tr>
<tr><td>Objectives of the Course</td><td colspan="6">To introduce the concept of calculus of variations and integral equations and theirϖ applications. To study the different types of transforms and their properties.</td></tr>
<tr><td>Course Outline</td><td colspan="6">UNIT I: Variational Problems with Fixed Boundaries:
The concept of variation and its properties – Euler‟s equation- Variational problems for Functionals – Functionals dependent on higher order derivatives – Functions of several independent variables – Some applications to problems of Mechanics. (Chapter 1: Sections 1.1 to 1.7 of [1]).</td></tr>
<tr><td></td><td colspan="6">UNIT II: Variational Problems with Moving Boundaries:
Movable boundary for a functional dependent on two functions – one-side variations - Reflection and Refraction of extremals - Diffraction of light rays.
(Chapter 2: Sections 2.1 to 2.5 of [1]).</td></tr>
<tr><td></td><td colspan="6">UNIT III: Integral Equation:
Introduction – Types of Kernels – Eigen Values and Eigen functions – Connection with differential equation – Solution of an integral equation – Initial value problems – Boundary value problems. (Chapter 1: Section 1.1 to 1.3 and 1.5 to 1.8 of [2]).</td></tr>
<tr><td></td><td colspan="6">UNIT IV: Solution of Fredholm Integral Equation:
Second kind with separable kernel – Orthogonality and reality eigen function – Fredholm Integral equation with separable kernel – Solution of Fredholm integral equation by successive substitution – Successive approximation – Volterra Integral equation – Solution by successive substitution.
(Chapter 2: Sections 2.1 to 2.3 and Chapter 4 Sections 4.1 to 4.5 of [2]).</td></tr>
<tr><td></td><td colspan="6">UNIT V: Hilbert – Schmidt Theory:
Complex Hilbert space – Orthogonal system of functions- Gram Schmidt orthogonalization process – Hilbert – Schmidt theorems – Solutions of Solutions of Fredholm integral equation of first kind. (Chapter 3: Section 3.1 to 3.4 and 3.8 to 3.9 of [2]).</td></tr>
<tr><td>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td>Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
</table>

Recommended Text	1. A.S Gupta, Calculus of Variations with Application, Prentice Hall of India, New Delhi, 2005.(For UnitsI and II), 2. Sudir K.Pundir and Rimple Pundir, Integral Equations and Boundary Value Problems, Pragati Prakasam,Meerut, 2005.(For UnitsIII,IV and V).
Reference Books	1. F.B. Hildebrand, Methods of Applied Mathematic Prentice – Hall of India Pvt. New Delhi, 1968, 2. R. P. Kanwal, Linear Integral Equations, Theory and Techniques, Academic Press, New York, 1971. **3.** L. Elsgolts, Differential Equations and Calculus of Variations, Mir Publishers, Moscow, 1973

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">MATHEMATICAL PROGRAMMING</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">Elective – III (Optional)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td>Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>3</td><td>1</td><td>--</td><td colspan="3">4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">This course introduces advanced topics in Linear and non-linear Programming</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="6">UNIT-I INTEGER LINEAR PROGRAMMING: Types of Integer Linear Programming Problems - Concept of Cutting Plane - Gomory‘s All Integer Cutting Plane Method - Gomory‘s mixed Integer Cutting Plane method - Branch and Bound Method. - Zero-One Integer Programming. Dynamic Programming: Characteristics of Dynamic Programming Problem - Developing Optimal Decision Policy - Dynamic Programming Under Certainty - DP approach to solve LPP. Chapter-7: 7.1 - 7.7 Chapter-20: 20.1 - 20.5</td></tr>
<tr><td colspan="6">UNIT-II CLASSICAL OPTIMIZATION METHODS: Unconstrained Optimization - Constrained Multi-variable Optimization with Equality Constraints - Constrained Multi-variable Optimization with inequality Constraints Non-linear Programming Methods: Examples of NLPP - General NLPP - Graphical solution – Quadratic Programming - Wolfe‘s modified Simplex Methods - Beale‘s Method Chapter-23: 23.1 - 23.4 Chapter-24: 24.1 - 24.4</td></tr>
<tr><td colspan="6">UNIT-III THEORY OF SIMPLEX METHOD: Canonical and Standard form of LP - Slack and Surplus Variables - Reduction of any Feasible solution to a Basic Feasible solution - Alternative Optimal solution - Unbounded solution - Optimality conditions - Some complications and their resolutions - Degeneracy and its resolution. Chapter-25: 25.1 - 25.4, 25.6-25.9</td></tr>
<tr><td colspan="6">UNIT-IV REVISED SIMPLEX METHOD: Standard forms for Revised simplex Method - Computational procedure for Standard form I - comparison of simplex method and Revised simplex Method. Bounded Variables LP problem: The simplex algorithm Chapter-26: 26.1 - 26.4 Chapter-28: 28.1, 28.2</td></tr>
<tr><td colspan="6">UNIT-V PARAMETRIC LINEAR PROGRAMMING: Variation in the coefficients cj , Variations in the Right hand side, bi . Goal Programming: Difference between LP and GP approach - Concept of Goal Programming - Goal Programming Model formulation - Graphical Solution Method of Goal Programming - Modified Simplex method of Goal Programming. Chapter-29: 29.1 - 29.3</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
</table>

Recommended Text	1.J.K.Sharma, Operations Research, Theory and Applications, Third Edition (2007) Macmillan India Ltd.
Reference Books	1. Hamdy A. Taha, Operations Research, (seventh edition) Prentice - Hall of India Private Limited, New Delhi, 1997. 2. F.S. Hillier & J.Lieberman Introduction to Operation Research (7^{th} Edition) TataMcGraw Hill ompany, New Delhi, 2001. 3. Beightler. C, D.Phillips, B. Wilde ,Foundations of Optimization (2nd Edition) Prentice Hall Pvt Ltd., New York, 1979 4. S.S. Rao - Optimization Theory and Applications, Wiley Eastern Ltd. New Delhi. 1990

<table>
<tr><td>Title of the Course</td><td colspan="6">DISCRETE MATHEMATICS</td></tr>
<tr><td>Paper Number</td><td colspan="6">Elective – III (Optional)</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>II</td><td>Credits</td><td>3</td><td>Course Code</td></tr>
<tr><td></td><td></td><td>Semester</td><td>III</td><td></td><td></td><td></td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
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<tr><td colspan="2">Pre-requisite</td><td colspan="5"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="5"></td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="5">UNIT I: The Foundations: Logic and Proofs: Propositional - Applications of Propositional -Propositional Equivalences - Predicates and Quantifiers. (Chapter 1: Sections 1.1 - 1.3). Algorithms: The Growth of Functions. (Chapter 3: Section 3.2).</td></tr>
<tr><td colspan="5">UNIT II: Counting: The Basics of Counting- The Pigeonhole Principle - Permutations and Combinations - Generalized Permutations and Combinations - Generating Permutations and Combinations. (Chapter 5: Sections 5.1- 5.3, 5.5 and 5.6).</td></tr>
<tr><td colspan="5">UNIT III: Advanced Counting Techniques: Applications of Recurrence Relations - Solving Linear Recurrence Relations Generating Functions. (Chapter 6: Sections 6.1, 6.2 and 6.4).</td></tr>
<tr><td colspan="5">UNIT IV: Boolean algebra: Boolean Functions- Representing Boolean Functions - Logic Gates - Minimization of Circuits. (Chapter 10: Sections 10.1 -10.4).</td></tr>
<tr><td colspan="5">UNIT V: Modeling Computation: Finite-State machines with Output- Finite-State machines with No Output-Turing Machines. (Chapter 12: Sections 12.2, 12.3 and 12.5).</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="5">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="5">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="5">Kenneth H.Rosen, Discrete Mathematics and it’s Applications,7th Edition, WCB / McGraw Hill Education ,New York,2008</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="5">1. J.P. Trembley and R.Manohar, Discrete Mathematical Structures applications to Computer Science, Tata McGraw Hills, New Delhi.
2. T.Veerarajan,Discrete Mathematics with Graph Theory and Combinatorics, Tata McGraw Hills Publishing Company Limited ,7th Reprint,2008.</td></tr>
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<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">FUNCTIONAL ANALYSIS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE XIII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">1</td><td colspan="2">--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">To study the three structure theorems of functional analysis viz., Hahn- Banach theorem, open mapping theorem and uniform boundedness principle. To introduce Hilbert spaces and operator theory leading to the spectral theory of operators on a Hilbert space.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT I: Banach Spaces: Banach Spaces- Definition and examples- Continuous linear transformation- Hahn Banach theorem. (Chapter 9: Sections 46 to 48).</td></tr>
<tr><td colspan="8">UNIT II: Banach Spaces and Hilbert Spaces: The natural embedding of N in N**- Open mapping theorem- conjugate of an operator- Hilbert space - Definition and properties. (Chapter 9: Sections 49 to 51, Chapter 10: Sections 52)</td></tr>
<tr><td colspan="8">UNIT III: Hilbert Spaces: Orthogonal complements - Orthonormal sets - Conjugate space H*- Adjoint of an operator (Chapter 10: Sections 53 to 56).</td></tr>
<tr><td colspan="8">UNIT IV: Operations on Hilbert Spaces: Self-adjoint operator - Normal and Unitary operators - Projections. (Chapter 10: Sections 57 to 59).</td></tr>
<tr><td colspan="8">UNIT V: Banach Algebras: Banach Algebras - Definition and examples - Regular and simple elements - Topological divisors of zero - Spectrum - The formula for the spectral radius - The radical and semi simplicity. (Chapter 12: Sections 64 to 69).</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="8">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw Hill Inter. Book Co, New York, 1963.</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="8">1. W. Rudin, Functional Analysis, Tata McGraw Hill Publ. Co, New Delhi, 1973.
2. H.C. Goffman and G. Fedrick, First Course in Functional Analysis, Prentice Hall of India New Delhi, 1987.
3. D. Somasundaram, Functional Analysis S. Viswanathan Pvt.Ltd., Chennai.1994.</td></tr>
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<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">PROBABILITY THEORY</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE – XIV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">1</td><td colspan="2">--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">The objective of this course is to enable the students to understand the concepts related to the solution of various events</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT I Random Events and Random Variables - Random events – Probability axioms – Combinatorial formulae – conditional probability – Bayes Theorem – Independent events – Random Variables – Distribution Function – Joint Distribution – Marginal Distribution – Conditional Distribution – Independent random variables – Functions of random variables. (Chapter 1: Sections 1.1 to 1.7, Chapter 2: Sections 2.1 to 2.9).</td></tr>
<tr><td colspan="8">UNIT II: Parameters of the Distribution - Expectation- Moments – The Chebyshev Inequality – Absolute moments – Order parameters – Moments of random vectors – Regression of the first and second types. (Chapter 3: Sections 3.1 to 3.8).</td></tr>
<tr><td colspan="8">UNIT III: Characteristic functions - Properties of characteristic functions – Characteristic functions and moments – semi-invariants – characteristic function of the sum of the independent random variables – Determination of distribution function by the Characteristic function – Characterstic function of multidimensional random vectors – Probability generating functions. (Chapter 4: Sections 4.1 to 4.7).</td></tr>
<tr><td colspan="8">UNIT IV: Some probability distributions - One point , two point , Binomial – Polya – Hypergeometric – Poisson (discrete) distributions – Uniform – normal gamma – Beta – Cauchy and Laplace (continuous) distributions. (Chapter 5: Section 5.1 to 5.10 (Omit Section 5.11).</td></tr>
<tr><td colspan="8">UNIT V: Limit Theorems - Stochastic convergence – Bernoulli law of large numbers – Convergence of sequence of distribution functions – Levy-Cramer Theorems – De Moivre-Laplace Theorem – Poisson, Chebyshev, Khintchine Weak law of large numbers – Lindberg –Levy Theorem – Lyapunov Theroem – Borel-Cantelli Lemma - Kolmogorov Inequality and Kolmogorov Strong Law of large numbers. (Chapter 6: Sections 6.1 to 6.4, 6.6 to 6.9, 6.11 and 6.12 only).</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="8">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">M. Fisz, Probability Theory and Mathematical Statistics, John Wiley and Sons, New York, 1963.</td></tr>
</table>

Reference Books	**1. R.B. Ash, Real Analysis and Probability, Academic Press, New York, 1972** **2. K.L.Chung, A course in Probability, Academic Press, New York, 1974** **3. Y.S.Chow and H.Teicher, Probability Theory, Springer Verlag. Berlin, 1988 (2nd Edition)** **4. R.Durrett, Probability : Theory and Examples, (2nd Edition) Duxbury Press, New York, 1996** **5. V.K.Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Ltd., New Delhi, 1988(3rd Print)** **6. S.I.Resnick, A Probability Path, Birhauser, Berlin, 1999** **7. B.R.Bhat, Modern Probability Theory (3rd Edition), New Age International (P)Ltd, New Delhi, 1999.** **8. J.P. Romano and A.F. Siegel, Counter Examples in Probability and Statistics, Wadsworth and Brooks / Cole Advanced Books and Software, California, 1968.**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">Fluid Dynamics</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">Elective – IV (Optional)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">1</td><td colspan="2">--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8"></td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT I : Kinematics of Fluids in Motion: Real fluids and Ideal fluids - Velocity of a fluid at a point –Stream lines and path lines -Steady and Unsteady flows - The Velocity Potential - The Vorticity Vector - Local and Particle Rates of Change - The Equation of Continuity - Worked Examples. (Chapter 2: Sections 2.1 - 2.8).</td></tr>
<tr><td colspan="8">UNIT II: Equations of Motion of a Fluid: Pressure at a point in a fluid at rest - Pressure at a point in a moving fluid - Euler's equations of Motion - Bernoulli's equation -Worked Examples - Discussion of the case of steady motion under Conservative Body Forces - Some flows involving axial symmetry (examples 1 and 2 only). (Chapters 3: Sections 3.1, 3.2,3 .4 - 3.7, 3.9).</td></tr>
<tr><td colspan="8">UNIT III: Some Three-Dimensional Flows: Introduction - Sources, Sinks and Doublets-Images in rigid infinite plane - Images in solid spheres – Axis symmetric flows. (Chapter 4: Sections 4.1 - 4.4).</td></tr>
<tr><td colspan="8">UNIT IV : Some Two-Dimensional Flows: The Stream Function - The Complex Velocity Potential for Two Dimensional Irrotational, Incompressible Flow - Complex Velocity Potentials for Standard Two- Dimensional Flows - Some Worked Examples - Two Dimensional Image Systems – The Milne-Thomson Circle Theorem. (Chapter 5: Sections 5.3 - 5.8).</td></tr>
<tr><td colspan="8">UNIT V: Viscous Fluid: Stress components in a real fluid - Relation between Cartesian Components of Stress - Translational motion of fluid element – The Coefficient of Viscosity and Laminar flow - The Navier- Stokes equation of a viscous fluid - Some solvable problems in viscous flow - Steady motion between parallel planes only. (Chapter 8: Sections 8.1 - 8.3, 8.8, 8.9 and 8.10.1).</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="8">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">Frank Chorlton, Textbook of Fluid Dynamics, CBS Publishers & Distributors, 2004</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="8">1. L.M. Milne-Thomson, Theoretical Hydrodynamics, Macmillan, London, 1955.
2. G.K. Batchelor, An Introduction to Fluid Dynamics Cambridge Mathematical Library, 2000.</td></tr>
</table>

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">MACHINE LEARNING</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">Elective – IV (Optional)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2">1</td><td colspan="2">--</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8"></td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="8">UNIT-I : MACHINE LEARNING
Machine Learning : Introduction -Definition –Types of Machine Learning - Supervised , Unsupervised ,Reinforcement Learning- Algorithms for Machine Learning – problems solved by Machine Learning – Tools for Machine Learning – Applications</td></tr>
<tr><td colspan="8">UNIT-II :ROBOTIC PROCESS AUTOMATION(RPA)
Robotic Process Automation(RPA):Introduction to RPA –Need for automation programming constructs in RPA- Robots and Softbots – RPA architecture and process methodologies –Industries best suited for RPA.</td></tr>
<tr><td colspan="8">UNIT-III :CLOUD
Cloud Computing : Need-Definition –Types of Cloud -Types of services –Saas</td></tr>
<tr><td colspan="8">UNIT-IV : CYBER
Cyber Security: Cyber Crime and Information security – Classification of cyber Crime Types.</td></tr>
<tr><td colspan="8">UNIT-V: VIRTUAL
Virtual Reality: Definition- Types of Head Mounted Displays-Tools for Reality</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="8">P. Kaliraj and T.Devi , Higher Education for industry 4.0 and Transformation to Education5.0</td></tr>
<tr><td colspan="2">Reference Books</td><td colspan="8"></td></tr>
<tr><td colspan="2">Website and e-Learning Source</td><td colspan="8">http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org , http://en.wikipedia.org</td></tr>
</table>

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">DATA ANAYTICS USING PYTHON (Practical)</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">SEC II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">--</td><td colspan="2">--</td><td colspan="2">4</td><td>4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8"></td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">COURSE OBJECTIVE: The objective of this course is to provide students with a clear and practical understanding of data analytics using Python and Power BI. The course focuses on data handling, data preparation, basic database concepts, data modeling, and interactive data visualization, enabling students to analyze and present data effectively for decision-making.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT I: PYTHON & DATA HANDLING Python Basics for Analytics: Introduction to data analytics and its applications - Overview of Python for analytics - Python syntax, indentation, and coding standards - Variables and built-in data types - Input and output operations - Type casting and basic operators. Control Structures & Data Structures: Conditional statements: if, if-else, elif - Looping statements: for and while - break, continue, and pass - Lists and list operations - Tuples and sets - Dictionaries - Built-in functions and methods</td></tr>
<tr><td colspan="8">UNIT II: PANDAS FOR DATA ANALYSIS
Introduction to Pandas - Pandas Series and Data Frame - Importing data from CSV and Excel files - Exploring and understanding datasets - Selecting, filtering, and sorting data - Handling missing and duplicate values - Grouping and aggregation operations - Exporting processed data</td></tr>
<tr><td colspan="8">UNIT III: DATA CLEANING & DATASET PREPARATION
Data quality issues in real-world datasets - Data type correction and formatting - Handling missing, incorrect, and inconsistent data - Date and time handling - Renaming and restructuring columns - Merging and joining datasets - Reshaping data using pivot and melt - Preparing datasets for analytics and visualization</td></tr>
<tr><td colspan="8">UNIT IV: DATABASE FUNDAMENTALS
Introduction to databases and DBMS - Types of databases: relational and non-relational (overview) - Tables, records, and fields - Primary keys and foreign keys - Introduction to SQL for analytics - Basic SQL operations: SELECT, WHERE, ORDER BY, GROUP BY</td></tr>
<tr><td colspan="8">UNIT V: DATA MODELING FOR ANALYTICS
Introduction to data modeling - OLTP vs OLAP systems - Fact tables and dimension tables - Measures and attributes - Star schema concepts and examples - Relationships and cardinality - Best practices in analytics data modeling.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
</table>

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Wes McKinney, *Python for Data Analysis*, O'Reilly Media.
Reference Books	1. Cole Nussbaumer Knaflic, *Storytelling with Data* 2. Microsoft Learn – Power BI Guided Learning

NON MAJOR ELECTIVE COURSE

SEMESTER - II
NON MAJOR ELECTIVE COURSE - I
Mathematics for competitive Examination - I

Paper Code:

Max. Mark: 75 Marks
Credit:2
Hours: 2 hrs/week

Course Objective

- To enhance the problem-solving skills.
- To improve the basic mathematical skills to help students who are preparing for any type of competitive examinations.
- To develop knowledge in practicing quantitative aptitude Objective type question and answer in individual for Competitive exams, entrance exams and interviews.

UNIT-I

Numbers, H.C.F, & L.C.M of Numbers and Problems on Numbers. (Section: 1, 2, &7)

UNIT-II

Decimal Fractions, Simplification & Square Roots & Cube Roots. (Section: 3, 4 &5)

UNIT-III

Average, Problems on Ages, Surds & Indices and Percentage. (Section: 6, 8, 9 & 10)

UNIT-IV

Profit & Loss, Ratio & Proportion and Partnership. (Section: 11, 12 & 13)

UNIT-V

Chain Rule, Time & work and Pipes & Cistern.(Section: 14, 15 & 16).

TEXT BOOK:

1. Dr. R.S. Aggarwal. Quantitative Aptitude, S. Chand and Company Ltd., New Delhi, Reprint 2013.

REFERENCE BOOK:

1. Abhijit Guha, Quantitative Aptitude Tata McGraw Hill Publishing Company Limited..New Delhi. Reprint 2005

COURSE OUTCOME

After completion of this course, Students will be able to

Make sense of problems, develop strategies to find solutions and persevere in solving them.Use appropriate technology in a given context.Critique and evaluate quantitative arguments that utilize mathematics, statistical and quantitative information. Solving the problem on numbers, decimal fractions, square root cube roots, Ages, Percentage, Profit & Loss, time and work.

SEMESTER - III
NON MAJOR ELECTIVE COURSE - II
Mathematics for competitive Examination - II

Paper Code:

Max. Mark: 75 Marks
Credit:2
Hours: 2 hrs/week

Course Objective

- To enhance the problem-solving skills.
- To improve the basic mathematical skills to help students who are preparing for any type of competitive examinations.
- To develop knowledge in practicing quantitative aptitude Objective type question and answer in individual for Competitive exams, entrance exams and interviews.

Unit -I

Time & Distance, Problems on Trains and Boats and Streams (Section 17, 18 &19)

Unit- II

Simple Interest, Compound Interest and Logarithms. (Section: 21,22 &23)

Unit-III

Area, Volume & Surface Area and calendar (Sections: 24, 25, &27)

Unit-IV

Clocks, Stocks & shares and Permutations & Combinations (Section: 28, 29 & 30)

Unit-V

True Discount, Banker's Discount, Heights & Distances and odd man out & Series. (Section: 32, 33, 34 &35)

TEXT BOOK:

1. Dr. R.S. Aggarwal. Quantitative Aptitude, S. Chand and Company Ltd., New Delhi, Reprint 2013.

REFERENCE BOOK:

1. Abhijit Guha, Quantitative Aptitude Tata McGraw Hill Publishing Company Limited..New Delhi. Reprint 2005

COURSE OUTCOME

After completion of this course, Students will be able to

Make sense of problems, develop strategies to find solutions and persevere in solving them.Use appropriate technology in a given context.Critique and evaluate quantitative arguments that utilize mathematics, statistical and quantitative information. Solving the problem on Simple Interest, Logarithms, Area , Clocks, Permutations & Combinations, Distances, Odd man out & Series.

SEMESTER - II

<table>
<tr><td>Title of the Course</td><td colspan="8">HUMAN RIGHTS</td></tr>
<tr><td>Paper Number</td><td colspan="8">Compulsory Paper</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">1</td><td rowspan="2">Course Code</td><td rowspan="2" colspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">1</td><td colspan="2">--</td><td colspan="2">--</td><td colspan="2">1</td></tr>
<tr><td>Pre-requisite</td><td colspan="8"></td></tr>
<tr><td>Objectives of the Course</td><td colspan="8">To learn about Basic Facets of Human Rights.</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="8">Unit 1 : Introduction: Meaning and Definitions of Human Rights – Characteristics and Importance of Human Rights – Evolution of Human Rights – Formation, Structure and Functions of the UNO - Universal Declaration of Human Rights – International Covenants – Violations of Human Rights in the Contemporary Era.</td></tr>
<tr><td colspan="8">Unit 2 : Human Rights in India: Development of Human Rights in India – Constituent Assembly and Indian Constitution – Fundamental Rights and its Classification – Directive Principles of State Policy – Fundamental Duties.</td></tr>
<tr><td colspan="8">Unit 3 : Rights of Marginalized and other Disadvantaged People: Rights of Women – Rights of Children – Rights of Differently Abled – Rights of Elderly - Rights of Scheduled Castes – Rights of Scheduled Tribes – Rights of Minorities – – Rights of Prisoners – Rights of Persons Living with HIVAIDS – Rights of LGBT.</td></tr>
<tr><td colspan="8">Unit 4 : Human Rights Movements: Peasant Movements (Tebhaga and Telangana) – Scheduled Caste Movements (Mahar and Ad-Dharmi) – Scheduled Tribes Movements (Santhal and Munda) – Environmental Movements (Chipko and Narmada Bachao Andolan) – Social Reform Movements (Vaikom and Self Respect).</td></tr>
<tr><td colspan="8">Unit 5 : Redressal Mechanisms: Protection of Human Rights Act, 1993 (Amendment 2019) – Structure and Functions of National and State Human Rights Commissions – National Commission for SCs – National Commission for STs – National Commission for Women – National Commission for Minorities – Characteristics and
Objectives of Human Rights Education.</td></tr>
<tr><td>Recommended Text</td><td colspan="8">1. Dr. S. Mehartaj Begum, Human Rights in India: Issues and perspectives, APH Publishing Corporation, New Delhi, 2010.
2. Asha Kiran, The History of Human Rights, Mangalam Publications, Delhi, 2011.
3. Bani Borgohain, Human Rights, Kanishka Publishers & Distributors, New Delhi-2, 2007.
4. Jayant Chudhary, A Textbook of Human Rights, Wisdom Press, New Delhi, 2011.
5. Anju Soni, Human Rights in India, Venus Publication, New Delhi, 2019.</td></tr>
</table>

Reference Books	1. Sudarshanam Gankidi, Human Rights in India: Prospective and Retrospective, Rawat Publications, Jaipur, 2019.Satvinder Juss, Human Rights in India, Routledge, New Delhi, 2020. 2. Namita Gupta, Social Justice and Human Rights in India, Rawat Publications, Jaipur, 2021. 3. Mark Frezo, The Sociology of Human Rights, John Willy & Sons, U.K. 2014. 4. Chiranjivi J. Nirmal, Human Rights in India: Historical, Social and Political Perspectives, Oxford University Press, New York, 2000.

SEMESTER - III
Internship / Industrial Activity

Duration and Semester :

15 days – First year end during summer vacation and the result of internship to be declared in 3rd semester Mark sheet.

Evaluation :

Based on the submission of certificate issued by the company to the student and the internship report submitted by the candidate to the department departmental committee should evaluate the report and conduct viva-voce examination to the students.

Recommendation of the Viva voce board:

Commented (or) Highly commented. No Credit / no marks will be awarded in the mark sheet.

Report Format:

PERIYAR UNIVERSITY

INTERNSHIP TRAINING REPORT FORMAT

1.	*Name of the Candidate*	
2.	*University Examination Registration Number*	
3.	*Name of the College*	
4.	*Name of the Department / Degree*	
5.	*Name of the Industry / Institute in which for Internship Training undergone*	
6.	*Guide / Supervisor under whom the training undertaken*	
7.	*Title of the Training*	
8.	*Brief output of training (not more than 2 pages)*	
9.	*Conclusion*	
10.	*Outcome of the training*	

Signature of the Student Signature of the Guide HOD Principal

SEMESTER IV

Title of the Course		**PROJECT**					
Paper Number							
Category	Core	**Year**	II	**Credits**	4	**Course Code**	
		Semester	IV				

Instructional Hours per week	**Lecture**	**Tutorial**	**Lab Practice**	**Total**
	--	--	--	8

Course Outline:

- Each student is assigned a topic for term paper and seminar. It is an individual work. During the term, the student will meet periodically the faculty to discuss different stages of the term paper preparation and seminar.

- Preparation of Term Paper : Choosing a Topic in consultation with the Student Advisor - Finding sources of materials - Gathering the relevant findings - Outlining the Paper-j Writing the first draft (manuscript) - Converting into Compuscript (using Latex) and Editing the paper as advised by the Advisor.

- Exposure to collect research papers and to prepare documentation of results in a scientific manner with proper citation principles will form integral part of the course.
- Every student is expected to give at least 3 seminar talks during the course of study. Topics for seminars will
- Be approved by the faculty. Preparation of seminar talks in the form of compuscripts (using mathematical software Latex) is compulsory and talks based on the Term paper be delivered using blackboard/ OHP/ LCD.
- Evaluation is based on the (i) Preparation of the compuscript (30%) (ii) Presentation style (30%) (iii) Oral presentation (40%). Passing minimum 50% of (i), (ii) and (iii) put together.

Books for Reference:

1. English Expression:
    1. Carey, G.V. Punctuation, Cambridge University Press.
    2. Partridge, E. Usage and Abusuge: A guide to good English, Middlesex, Penguin.
2. Research Writing :
    1. Berry, R. : How to write a Research paper. Pergamon Press, London.
    2. Cooper, B.C. : Writing Technical Reports, Middlesex , Penguin.
    3. Turabian, Kate L. : A manual for writers of term paper, Thesis and Dissertations, University of Chicago Press.
3. Mathematical Typesetting Software:
    1. Leslie Lamport . LaTeX : A Documentation Preparation System User's Guide and Reference Manual , Addison Wesley, Mass, 1994.
    2. Goossens, Rahtz, and Mittelbach. The LaTeX Graphics Companion, Addison Wesley, Mass, 1997.
    3. George Gratzer, First Steps in LaTeX, Birhauser, 1999.
    4. George Gratzer, Math Into LaTeX, Birhauser, 2000.
    5. F. Mittelbach and M Goossens with Braams, Carlisle, and Rowley, The LaTeX

Companion, second edition, Addison Wesley. Mass, 2004.

4. Mathematical Writing :
    1. N.E. Steenrod, P.R. Halmos, M.M. Schiffer and J.E. Dieudonne. How to write Mathematics, AMS Publication, 1973.
    2. Steven G. Krantz. A Primer of Mathematical Writing, AMS Publication, 1997.
    3. Ellen Swanson, Mathematics into Type, (updated Edition) AMS Publication, 1999.
    4. Steven G. Krantz. Mathematical Publishing, AMS Publication, 2005.

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">EXTENSION ACTIVITY</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6"></td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">1</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td>Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>--</td><td>--</td><td>--</td><td colspan="3">--</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6"></td></tr>
</table>

Extension activities bridge academic institutions and local communities by transferring knowledge and resolving public issues. Key topic include health and hygiene, vocational skill training and environments sustainability. This programs aim to improve societal well-being promote self – reliance and empower marginalized groups.

Testing Pattern (25+75) Internal Assessment

Theory Course: For theory courses there shall be three tests conducted by the faculty concerned and the average of the best two can be taken as the Continuous Internal Assessment (CIA) for a maximum of 25 marks. The duration of each test shall be one / one and a half hour.

Computer Laboratory Courses: For Computer Laboratory oriented Courses, there shall be two tests in Theory part and two tests in Laboratory part. Choose one best from Theory part and other best from the two Laboratory part. The average of the best two can be treated as the CIA for a maximum of 25 marks. The duration of each test shall be one / one and a half hour. There is no improvement for CIA of both theory and laboratory, and, also for University End Semester Examination.

WRITTEN EXAMINATION : THEORY PAPER (BLOOM'S TAXONOMY BASED) QUESTION PAPER MODEL

Intended Learning Skills	**Maximum 75 Marks** **Passing Minimum: 50% Duration : 3 Hrs**
	Part –A (15x 1 = 15 Marks) **Answer ALL questions** **Each Question carries 2mark**
Memory Recall / Example/ Counter Example / Knowledge about the Concepts/ Understanding	**Two questions from each UNIT**
	Question 1 to Question 15
Descriptions/ Application (problems)	**Part – B (2 x 5 = 10 Marks) Answer any Two questions out of 5 questions each questions carries 5 Marks**
Analysis /Synthesis / Evaluation	**There shall be FIVE questions covering all the five units**
	Question 16 to Question 20
Descriptions/ Application (problems)	**Part-C (3x 10 = 30 Marks) Answer ALL questions Each question carries 10 Marks**
Analysis /Synthesis / Evaluation	**Either-or Type** **Both parts of each question from the same UNIT**
	Question 21(a) or 21(b) **To** **Question 25(a) or 25(b)**

MINIMUM MARKS FOR PASSING:

a). Theory Papers:

The candidate shall be declared to have passed the examination if the candidate secures not less than 50 marks in total (CIA mark + Theory Exam mark) with minimum of 38 marks in the Theory Exam conducted by the University. The Continuous Internal Assessment (CIA) Mark 25 is distributed to four components viz., Tests, Assignment, Seminar and Attendance as 10, 05, 05 and 05 marks, respectively.

b). Practical paper:

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

c). Project Work/Dissertation and Viva-Voce:

A candidate should secure 50% of the marks for pass. The candidate should attend viva-voce examination to secure a pass in that paper. Candidate who does not obtain the required minimum marks for a pass in a Paper / Practical/ Project/Dissertation shall be declared Re-Appear (RA) and he / she has to appear and pass the same at a subsequent appearance.

CLASSIFICATION OF SUCCESSFUL CANDIDATES:

Candidates who secure not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in First Class. All other successful candidate shall be declared to have passed in the Second Class. Candidates who obtain 75% of the marks in the aggregate shall be deemed to have passed the examination in the First Class with Distinction provided they pass all the examinations prescribed for the course at the first appearance. Candidates who pass all the examinations prescribed for the course in the first instance and within a period of two academic years from the year of admission to the course only are eligible for University Ranking.

MAXIMUM DURATION FOR THE COMPLETION OF THE PG PROGRAMME:

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

TRANSITORY PROVISION:

Candidates who were admitted to the PG course of study before 2025-2026 shall be permitted to appear for the examinations under those regulations for a period of three years, that is, up to end inclusive of the examination of April / May 2026. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.