Mathematics I Sem RUR Syllabus.

	Subject / Paper Code	Title of the Paper	Instruction Hrs/ Week	Marks			Credits	Examination duration (Hrs)
				Examination	Internal Assessment	Total Marks		
SEMESTER - I		**HARD CORE PAPERS**						
	HCT 1.1	Algebra	4	80	20	100	4	3
	HCT1.2	Real Analysis - I	4	80	20	100	4	3
	HCT1.3	Discrete Mathematics & C-Proramming	4	80	20	100	4	3
	HCT 1.4	Ordinary DifferentialEquations	4	80	20	100	4	3
		SOFT CORE PAPER (ANY ONE)						
	SCT 1.1	Operations Research Fuzzy Sets & Fuzzy Logic	4	80	20	100	4	3
		PRACTICAL						
	HCP 1.1	Programming Lab-I	4	40	10	50	2	3
	Mandatory Credits: English Language Communication Skill		2	---	---	---	2	---

HARD CORE PAPERS

Semester-I	Subject / Paper Code	Title of the Paper	Instruction Hrs/ Week	Marks			Credits	Examination duration (Hrs)
				Examination	Internal Assessment	Total Marks		
	HCT 1.1	Algebra	4	80	20	100	4	3

Course Objective(s):

- Students will study groups, automorphism and applications.
- They will learn to verify permutation groups and fundamental theorems.
- Students will learn ring homomorphism and properties of unique factorization domain.
- Students will learn splitting fields and important theorems with properties .

Course Outcome(s):

- Upon the successful completion of the course, students will be able to
- understand Cauchy's theorem for abelian groups and its application.
- solve the Sylow's theorems and problems.
- solve problems using Gauss lemma,Eisentein criterion, polynomial ring over commutative rings.
- study the splitting fields, degree of splitting fields and normal extension.

Dr. Hanumantha

Syllabus

UNIT-I:Groups: Lagrange's theorem, normal subgroups and quotient groups, homomorphism, isomorphism, Cauchy's theorem for abelian groups, application of Cauchy's theorem, automorphism, inner and outer automorphism.

UNIT- II: Permutation Groups: Examples, orbit, cycle, transposition, alternating groups, Cayley's Theorem, Conjugate class, class equation, Cauchy theorem for finite groups, Sylow's Theorem and Problems: solvable groups, direct products.

UNIT- III: Rings-Homomorphism, Kernal, isomorphism, ideals and quotient rings, maximal ideal, prime ideal, principal ideal ring.Euclidean Ring: Definition and examples, greatest common divisor, prime and irreducible elements, unique factorization domain,unique factorization theorem. Polynomial Rings: Division Algorithm, irreducible polynomial, primitive polynomial, Gauss Lemma, Eisentein criterion, polynomial ring over commutative rings.

UNIT- IV: Extension Fields-Definition and example, algebraic extension, transitivity of algebraic extension, roots of polynomial, Remainder Theorem, Factor theorem. Splitting Fields: Degree of Splitting fields, Perfect Fields, Normal extension.

REFERENCES:

1. I. N. Herstein: *Topics in Algebra* 2nd edition, John Willey and Sons, New York, 1975
2. Surjeet Singh and Qazi Zameeruddin: *Modern Algegra,* 8th Edition, vikas Publishing House pvt.ltd, 2006.
3. M. Artin : *Algebra*, Prentice hall, Upper Saddle River, New Jersey, 1991
4. K. Ciesielski,:*Set Theory for the Working Mathematician,* Cambridge University Press, Cambridge, 1997.
5. Hall and Knight: *Higher Algebra* 6th edition, Arihant Publications, India, 2016.
6. S. K. Jain, P. B. Bhattacharya and S. R. Nagpaul: *Basic Abstract Algebra*, Cambridge University Press, Cambridge, 1997.
7. S. Singh and Q. Zameeruddin: *Modern Algebra*, Vikas Publishing House, India, 1975
8. S. M. Srivatsava: *A Course on Borel Sets*, Springer- Verlag, New York, 1998.
9. U. M. Swamy, A. V. S. N. Murthy, *Algebra: Abstract and Modern 1st Edition,* Pearson Education, India, 2011.

Semester-I	Subject / Paper Code	Title of the Paper	Instruction Hrs/ Week	Marks			Credits	Examination duration (Hrs)
				Examination	Internal Assessment	Total Marks		
	HCT1.2	Real Analysis - I	4	80	20	100	4	3

Course Objective(s):

- To present students the elements and importance of the real analysis.
- To define and recognize the basic properties of the field of real numbers.
- To enable the students to understand differentiability of real functions and its related theorems.
- To understand and analyze the mean value theorems.

Course Outcome(s):

Upon the successful completion of the course, students will be able to

- understand the concepts of Archimedean property, perfect sets and connected sets.
- understand the concepts of convergence of sequences and series.
- test the convergence of the series.
- enumerate the limits of functions, infinite limits and limit at infinity.

Syllabus

UNIT - I:Real number System: Ordered sets, Fields, Real field, Extended real number system, Euclidean spaces. Finite, Countable and Uncountable sets, Metric spaces, Compact sets, Perfect sets, Connected sets.

UNIT - II:Numerical Sequence and Series: Convergent sequences, subsequences, Cauchy sequences, some special sequences, Series, Series of non-negative series, summation by parts, absolute convergence, addition and multiplication of series, Rearrangement.

UNIT - III:Continuity: Limits of function, Continuous function, Continuity and Compactness, Continuity and Connectedness, Discontinuity, Monotonic functions, Infinite limits and limits at infinity.

UNIT - IV:Differentiation: The derivative of real function, Mean value theorems, The continuity of derivatives, Derivatives of higher order, Taylor's theorem, Differentiation of vector valued functions.

REFERENCES:

1. W. Rudin: *Principles of Mathematical Analysis*, McGraw Hill, USA 1983.
2. H. L. Royden and P. M. Fitzpatrick: *Real Analysis*, Prentice Hall, India, 2010.
3. T. M. Apostol: *Mathematical Analysis*, Narosa Publishing House, New Delhi, India 2004.
4. S. L. Gupta & N. R. Gupta: *Principles of Real analysis*, second edition Pearson education, Delhi, India, 2003.
5. S. Goldberg: *Methods of Real Analysis*, Oxford & IBH, USA 1970.
6. W. R. Wade: *An introduction to analysis*, Second edition, Prentice Hall of India, 2000.
7. R. G. Bartle & D. R. Sherbert: *Introduction to real Analysis*, John Wiley & Sons, Inc, USA, 1982.
8. S. C. Malik and S. Arora: *Mathematical analysis*, New Age International, India, 1992.

Semester-I	Subject / Paper Code	Title of the Paper	Instruction Hrs/ Week	Marks			Credits	Examination duration (Hrs)
				Examination	Internal Assessment	Total Marks		
	HCT1.3	**Discrete Mathematics &C-Programming**	**4**	**80**	**20**	**100**	**4**	**3**

Course Objective(s):

- ➢ Students will learn to draw Finite Boolean lattice, Boolean expression, function and Boolean algebra to digital networks.
- ➢ Students will learn new concept of graph theory and its applications.
- ➢ Students will learn basic concepts of C-programming.
- ➢ Students will learn different type of arrays and functions.

Course Outcome(s):

Upon the successful completion of the course, students will be able to

- apply the Boolean algebra to digital networks and switching circuits.
- verify different graph structures based on their characteristics and chronology.
- construct a C- Programme for various operations and write the codes efficiently.
- construct build and run more complex program and calling a function and multidimensional array.

Syllabus

UNIT -I: Lattice Theory & Boolean Algebra: Partially ordered sets, Lattice, Distributive Lattice, Complements, Demorgan's Laws. Boolean Algebra: Boolean Lattice, Finite Boolean lattice, Boolean Expression and function, Conjunctive and disjunctive normal forms, Boolean algebra to digital networks and switching circuits.

UNIT -II: Graph Theory: Basic Concepts: Different types of graphs, subgraphs, walks and connectedness. Degree sequences, directed graphs, distances and self-complementary graphs. Blocks: Cut-points, bridges and blocks, block graphs and cut-point graphs.

UNIT -III: Introduction to 'C': Development of C, Features, Constants and Variables, Data types, Operators and Expressions, Library functions.I/O Statements:Formatted and Unformatted I/O, scanf(), printf(), getchar() and putchar() functions.Control Structures: Conditional and Unconditional, If, For, While and do-while, Switch, Break and Continue, Gotostatement.

UNIT -IV: Arrays and functions: One and Multidimensional arrays, Strings and String functions, Definition and declaration of a function, Different types, calling a function, Passing parameters, Local and Global variables, Recursive functions.

REFERENCES:

1. B. Kolman, R. C. Busby and S. Ross: *Discrete Mathematical structures*, Prentice Hall of India, New Delhi, 1998.
2. K. D. Joshi: *Foundations of Discrete Mathematics*, Wiley Eastern, USA, 1989.
3. J. A. Bonday and U.S.R. Murthy: *Graph Theory with Applications*, MacMillan, London, 1977.
4. V. Krishnamurthy:*Combinatorics, Theory and Applications*, Affiliated East-West Press Pvt. Ltd., India, 2008.
5. P.B.Kottor: *Introduction to computers and C-programming*, Sapna Book House (P) Ltd, India, 2011.
6. E. Balagurusamy: Programming in ANSI-C, Tata McGraw Hill Pub. Co., India, 1992.
7. B. W. Kernighan and D. M. Ritchie: The C- Programming Language, Prentice Hall, India, 1998.
8. S. Saha and S. Mukherjee: Basic Computation and Programming with C, 1st edition, Cambridge University Press, 2017.

Semester-I	Subject / Paper Code	Title of the Paper	Instruction Hrs/ Week	Marks			Credits	Examination duration (Hrs)
				Examination	Internal Assessment	Total Marks		
	HCT1.4	**Ordinary Differential Equations**	4	80	20	100	4	3

Course Objective(s):

- Recognize, classify and solve ordinary differential equations.
- Solve oscillatory and non-oscillatory differential equations.
- Solve power series solution of linear differential equations.
- Identify research problems where differential equations can be used to model the system.

Course Outcome(s):

After completing this course, the student will be able to:

- understand the concepts of existence and uniqueness of solutions.
- recognize certain basic types of first order ODEs for which exact solutions may be obtained and to apply the corresponding methods of solution.
- explore some of the basic theory of linear ODEs, gain ability to recognize certain basic types of higher-order linear ODEs for which exact solutions may be obtained, and to apply the corresponding methods of solution.
- introduced to the concept of the Frobenius method- Hermite, Laguerre, Chebyshev and Gauss Hypergeometric equations and their general solutions.

Syllabus

Unit-1: Higher Order Linear Differential Equations: Homogeneous equations and general solutions, Initial value problems, existence and uniqueness of solutions. Linear dependence and independence of solutions, solutions of non-homogeneous equations by method of variation of parameters. Non-homogeneous equations. Linear equations with variable coefficients, reduction of order of the equation.

Unit-2:Oscillations of Second Order Equations: Introduction, Oscillatory and non-Oscillatory differential equations and some theorems on it. Boundary value problems; Sturm Liouville theory; Green's function.

Unit-3: Solution in Terms of Power Series: Power series solution of linear differential equations - ordinary and singular points of differential equations, Classification into regular and irregular singular points; Series solution about an ordinary point and a regular singular point -Frobenius method- Hermite, Laguerre, Chebyshev and Gauss Hypergeometric equations and their general solutions. Generating function, Recurrence relations, Rodrigue's formula Orthogonality properties. Behavior of solution at irregular singular points and the point at infinity.

Unit-4: Successive Approximations Theory and System of First Order Equations: Introduction, solution by successive approximations, Lipschitz condition, Convergence of successive approximations, Existence and Uniqueness theorem (Picard's theorem), First order systems, Linear system of homogeneous and non-homogeneous equations (matrix method) Non-linear Equations-Autonomous Systems-Phase Plane-Critical points–stability-Liapunov direct method-Bifurcation of plane autonomous systems.

REFERENCES:

1. G.F. Simmons: *Differential Equations*, TMH Edition, New Delhi, 1974.
2. S.L. Ross: *Differential equations* (3rd edition), John Wiley & Sons, New York, 1984.
3. E.D. Rainville and P.E. Bedient: *Elementary Differential Equations*, McGraw Hill, NewYork, 1969.
4. E.A. Coddington and N. Levinson: *Theory of ordinary differential equations*, McGraw Hill, 1955.
5. A.C. King, J. Billingham & S.R. Otto: *Differential equations*, Cambridge University Press, 2006.
6. B. J. Gireesha, Rama S. R. Gorla, B. C. Prasannakumara, *Advanced Differential Equations*, Studerapress,New Delhi,2017.
7. E. Kreyszig, *Advanced Engineering Mathematics*, John Wieley and Sons, 2002.
8. F. Ayers, *Theory and problems of differential equations*, McGraw Hill, 1972.

SOFT CORE PAPER (ANY ONE)

Semester-IV	Subject / Paper Code	Title of the Paper	Instruction Hrs/ Week	Marks			Credits	Examination duration (Hrs)
				Examination	Internal Assessment	Total Marks		
	SCT 1.1	Operations Research	4	80	20	100	4	3

Course Objective(s):

- To enable the students understand several concepts of Operations Research and its applications
- To enable the students to solve LPPs through various methods such as, graphical method, simplex method etc.
- To enable the student's formulation of dual LPP and duality theorems.
- To enable the students to analysis and solve transportation and assignment problems, game theory and CPM - PERT methods.

Course Outcome(s):

Upon the successful completion of the course, students will be able to

- apply the knowledge of basic optimization techniques in order to get best possible results from a set of several possible solution of different problems viz. linear programming problems, transportation problem, assignment problem and unconstrained and constrained problems etc.
- formulate an optimization problem from its physical consideration.
- understand the ideas of transportation and assignment problems.
- analyze the ideas of CPM and PERT in Network analysis.

Syllabus

UNIT-1: Linear Programming: Introduction, Formulation of LPP, General mathematical model of LPP. Slack and Surplus variables, canonical and standard form of LPP, Graphical method, standard LPP and basic solution, fundamental theorem of LPP, Simplex Algorithm, Big-M method and Revised Simplex Algorithm.

UNIT-2: Concept of duality: Formulation of dual LPP, duality theorem, advantages of duality, dual simplex algorithm and sensitivity analysis.

UNIT-3: Transportation and Assignment Problem: Transportation problem - Introduction, transportation problem, loops in transportation table, methods for finding initial basic feasible solution, tests for optimality, unbounded transportation problem. Assignment problem - mathematical form of the assignment problem, methods of solving assignment problem, variations of the assignment problem.

UNIT-4: Game Theory and Queuing Theory: Introduction, 2x2 game, solution of game, network analysis by linear programming, Brow's Algorithm. Shortest route and maximal flow problems, CPM and PERT. Introduction to Stochastic process, Markov chain, t.p.m., c-k equations, poisson process, birth and death process, concept of queues, Kendall's notation, m/m/1, m/m/s queues and their variants.

REFERENCES:

1. H. M. Wagner, *Principles of Operations Research*, Prentice Hall
2. J. K. Sharma, *Operations Research* : Theory and Application, Mcmillan
3. Man Mohan, P. K. Gupta, SwarupKanti, *Operation Research*, S. Chand Sons
4. S. D. Sharma, Operations Research (Theory.Meth& App), KedarNath Publishers.

Semester-III	Subject / Paper Code	Title of the Paper	Instruction Hrs/ Week	Marks			Credits	Examination duration (Hrs)
				Examination	Internal Assessment	Total Marks		
	SCT 1.12 MATBCTL2	**Fuzzy Sets &Fuzzy Logic**	4	70	30	100	4	3

Course Objective(s):

- Students will learn fundamental concepts of Fuzzy sets.
- Students will learn operations on Fuzzy sets.
- Students will learn Fuzzy relations and its arithmetic.
- Students will learn Fuzzy topological spaces and its applications.

Course Outcome(s):

Upon the successful completion of the course, students will be able to

- know the definitions and some basics of fuzzy sets.
- do operations on fuzzy sets.
- know fuzzy relations and its operations.
- know a variety of examples and counter examples of fuzzy topology.

Syllabus

Unit I: Introduction: From classical Sets (crisp sets) to fuzzy sets, Basic definitions, basic operations on fuzzy sets, fuzzy sets induced by mappings, Types of fuzzy sets. **Fuzzy Sets Versus Crisp Sets:** The α - cuts, strong α - cuts, properties of cuts, representation of fuzzy sets, decomposition theorems, Zadeh's extension principle.

Unit II: Operations on Fuzzy Sets: Types of operations, fuzzy complements, fuzzy intersections, t – norms, fuzzy unions, t – conforms, combinations of operations, aggregation operations. **Fuzzy Arithmetic:** Fuzzy numbers, Linguistic variables, arithmetic operations on intervals and fuzzy numbers, fuzzy equations.

Unit III: Fuzzy Relations: Crisp and fuzzy relations, Projections and cylindric extensions, binary fuzzy relations, membership matrices and sagittal diagram, inverse and composition of fuzzy relations, binary fuzzy relation on a single set, fuzzy equivalence relation, fuzzy ordering relation, fuzzy morphisms, sup and inf compositions. **Fuzzy Logic:** An overview of classical logic. Multivalued logics, fuzzy propositions, fuzzy quantifiers, Linguistic hedges, inferences from conditional fuzzy propositions, qualified fuzzy propositions and quantified fuzzy propositions.

Unit IV: Fuzzy Topology: Change's and Lowen's definition of fuzzy topology. Continuity, open and closed maps. α - shading families, α - connectedness and α - compactness. **Applications:** Applications of fuzzy sets and fuzzy logic to various disciplines including Computer Science.

REFERENCES

1. G. J. Klir and B. Yuan: Fuzzy Sets and Fuzzy Logic; Theory and Applications, PHI (1997)
2. A. Kaufmann: Introduction to the theory of Fuzzy Subsets, Vol. – I, Academic Press (1975)
3. L. Y. Ming & L. M. Kung: Fuzzy Topology, World Scientific Pub. Co. (1997)
4. T. J. Ross: Fuzzy Logic with Engineering Applications, Tata McGraw Hill (1997)
5. S. V. Kartalopoulos: Understanding Neural Networks and Fuzzy Logic, PHI (2000)
6. H. J. Zimmermann: Fuzzy Set Theory and its Applications, Allied Pub. (1991)
7. N. Palaniappan: Fuzzy Topology, Narosa (2002)

PRACTICAL PAPER

Semester-I	Subject / Paper Code	Title of the Paper	Instruction Hrs/ Week	Marks			Credits	Examination duration (Hrs)
				Examination	Internal Assessment	Total Marks		
	SCP 1.1	Programming Lab - I	4	40	10	50	2	3

Course Objective(s)

- It enables the student to explore mathematical concepts and verify mathematical facts through the use of software.
- To enhances the skills in effective programming.
- To utilize the software knowledge for academic research.
- To solve problems in applied mathematics through programming

Course Outcome(s):

Upon the successful completion of the course, students will be able to

- show proficiency in using the software C-Programming.
- understand the use of various techniques of the software for effectively doing mathematics.
- obtain necessary skills in programming.
- understand the applications of mathematics through programming.

Syllabus

Problems from SCT 1.4 (Theory) may be solved with the help of C-Programming.

	Subject / Paper Code	Title of the Paper	Instruction Hrs/ Week	Marks			Credits	Examination duration (Hrs)
				Examination	Internal Assessment	Total Marks		
SEMESTER - II	**HARD CORE PAPERS**							
	HCT 2.1	Linear Algebra	**4**	**80**	**20**	**100**	**4**	**3**
	HCT 2.2	Real Analysis - II	**4**	**80**	**20**	**100**	**4**	**3**
	HCT 2.3	General Topology	**4**	**80**	**20**	**100**	**4**	**3**
	HCT 2.4	Partial Differential Equations	**4**	**80**	**20**	**100**	**4**	**3**
	SOFT CORE PAPER (ANY ONE)							
	SCT 2.1	Graph Theory Classical Mechanics	**4**	**80**	**20**	**100**	**4**	**3**
	PRACTICAL							
	HCP 2.1	Programming Lab - II	**4**	**40**	**10**	**50**	**2**	**3**
	OPEN ELECTIVE PAPER (ANY ONE)							
	OET 2.1	Foundations of Mathematics Financial and Business Mathematics	**2**	**40**	**10**	**50**	**2**	**3**
	Mandatory Credits: Computer Skill		**2**	**---**	**---**	**---**	**2**	**---**

HARD CORE PAPERS

Semester-II	Subject / Paper Code	Title of the Paper	Instruction Hrs/ Week	Marks			Credits	Examination duration (Hrs)
				Examination	Internal Assessment	Total Marks		
	HCT2.1	**Linear Algebra**	**4**	**80**	**20**	**100**	**4**	**3**

Course Objective(s):

- Students will learn definition and examples of vector spaces, subspaces and properties.
- Students will learn linear transformations and their representation as matrices.
- Students will learn eigenvalues and eigenvectors of a linear transformation, solutions of homogeneous systems of linear equations.
- Students will learn canonical forms – similarity of linear transformations.

Course Outcome(s):