**Programme Outcomes**:

Students are expected to know or able to do by the time of graduation. At the end of the programme, the students will be to:

| | |
|---|---|
| PO1 | Apply Knowledge in Mathematics in all the fields of learning including higher research and its extensions. |
| PO2 | Utilize Number Theory in the field of Cryptography that helps in hiding information and maintaining secrecy in military information, transmission, computer password and e-commerce. |
| PO3 | Facilitate the study of groups in crystallography in chemistry and Lie symmetry groups in physics. |
| PO4 | Ability to think, acquire knowledge and skills through logical reasoning and in culture the habit of self- learning throughout life. |
| PO5 | Inculcate critical thinking to carry out scientific investigation objectively. |
| PO6 | Equip the student with skills to analyse problems, formulate the hypothesis, evaluate and draw reasonable conclusions. |
| PO7 | Imbibe effective, scientific / technical communications in both oral and write. |
| PO8 | Demonstrate the high standards of ethical issues. |
| PO9 | Investigate and apply mathematical problems and solutions in a variety of contexts related to science, technology, business and industry. |
| PO10 | Illustrate solutions using numeric or graphical or programming methods. |
| PO11 | Investigate and solve unfamiliar math problems and allow to think on unsolved mathematical problems. |
| PO12 | Able to qualify Lectureship and fellowship exams approved by UGC like CSIR-NET, GATE and SET. |

**Program Outcomes are (PSOs):**

| | |
|---|---|
| PSO1 | To develop problem – solving skills and apply them independently to problems in pure and Mathematics. |
| PSO2 | To develop abstract mathematical thinking. |
| PSO3 | To improve own learning and performance. |

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## M.Sc. Mathematics

**Programme Objectives:**

To be a knowledge nerve center in Mathematics, Pure and Applied Research and industry requirements for creating sustainable infrastructure and enhancing quality of life MISSION

- To offer globally-relevant, industry-linked, research-focused, technology-enabled seamless education at the postgraduate and research levels in various areas of Mathematical sciences keeping in mind that the manpower so spawned is excellent in quality, is relevant to the global scientific and technological needs, is motivated to give its best and is committed to the growth of the Nation;
- To develop and conduct continuing education programs for Science graduates with a view to update their fundamental knowledge base and problem-solving capabilities in the various areas of core specialization of the University;
- To develop comprehensive linkages with premier academic and research institutions within the country and abroad for mutual benefit.
- The main objective of this program is to cultivate a mathematical aptitude and nurture the interests of the students towards problem solving aptitude. Further, it aims at motivating the young minds for research in mathematical sciences and to train computational scientists who can work on real life challenging problems.

- **Duration:** M.Sc. Mathematics is a postgraduate level program offered by the Department of Mathematics, Vikrama Simhapuri University College, Kavali Dist.Andhra Pradesh. This is a 2-years program, consisting of four semesters with two semesters per year.
- **Program Code:** MSCMAT(Master of Science in Mathematics)
- **Eligibility**: B.A./B.Sc. or equivalent from a recognized university with Mathematics as one of the major subjects with at least 40% marks in aggregate

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**Programme Structure with Course titles:**

| S. No. | Course code | Course/Subject | No. of credits | Internal Marks | External Marks | Total |
|---|---|---|---|---|---|---|
| **Semester – I** | | | | | | |
| 1 | 20RMSCMAT101 | Algebra | 5 | 20 | 100 | 120 |
| 2 | 20RMSCMAT102 | Real analysis | 5 | 20 | 100 | 120 |
| 3 | 20RMSCMAT103 | Ordinary differential equations | 5 | 20 | 100 | 120 |
| 4 | 20RMSCMAT104 | Discrete mathematics | 5 | 20 | 100 | 120 |
| 5 | 20RMSCMAT105 | Complex analysis | 5 | 20 | 100 | 120 |
| **Semester – II** | | | | | | |
| 1 | 20RMSCMAT201 | Operation research | 5 | 20 | 100 | 120 |
| 2 | 20RMSCMAT202 | Galios theory | 5 | 20 | 100 | 120 |
| 3 | 20RMSCMAT203 | Partial differential equations | 5 | 20 | 100 | 120 |
| 4 | 20RMSCMAT204 | Topology | 5 | 20 | 100 | 120 |
| 5 | 20RMSCMAT205 | Advanced complex analysis | 5 | 20 | 100 | 120 |
| **SEMESTER - III** | | | | | | |
| 1 | 20RMSCMAT301 | Linear algebra | 5 | 20 | 100 | 120 |
| 2 | 20RMSCMAT302 | Function abalysis | 5 | 20 | 100 | 120 |



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|---|---|---|---|---|---|---|
| 3 | 20RMSCMAT303 | Fdifferential geometry | 5 | 20 | 100 | 120 |
| 4 | 20RMSCMAT304A | Number theory | 5 | 20 | 100 | 120 |
| 5 | 20RMSCMAT304B | Programming and data structures | 5 | 20 | 100 | 120 |
| 6 | 20RMSCMAT304C | Non commutative rings | 5 | 20 | 100 | 120 |
| 7 | 20RMSCMAT305A | Classical mechanics | 5 | 20 | 100 | 120 |
| 8 | 20RMSCMAT305B | Algebraic topology | 5 | 20 | 100 | 120 |
| 9 | 20RMSCMAT305C | internet and html | 5 | 20 | 100 | 120 |
| **SEMESTER - IV** | | | | | | |
| 1 | 20RMSCMAT401 | Commutative algebra | 5 | 20 | 100 | 120 |
| 2 | 20RMSCMAT402 | Numerical analysis | 5 | 20 | 100 | 120 |
| 3 | 20RMSCMAT403 | Graph theory | 5 | 20 | 100 | 120 |
| 4 | 20RMSCMAT404A | Fuzzy sets and fuzzy logic | 5 | 20 | 100 | 120 |
| 5 | 20RMSCMAT404B | Approximation theory | 5 | 20 | 100 | 120 |
| 6 | 20RMSCMAT404 | Banach algebra | 5 | 20 | 100 | 120 |
| 7 | 20RMSCMAT405A | Mathematical statistics | 5 | 20 | 100 | 120 |
| 8 | 20RMSCMAT405B | Algebraic coding theory | 5 | 20 | 100 | 120 |
| 9 | 20RMSCMAT405C | Computer networks | 5 | 20 | 100 | 120 |

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# VIKRAMA SIMHAPURI UNIVERSITY::NELLORE
# DEPARTMENT OF MATHEMATICS

Syllabus for M.Sc. Mathematics (2 Year Course) for V.S. University College, Nellore under the jurisdiction of Vikrama Simhapuri University, Nellore with effect from the Academic Year 2020-21

| | | | |
|---|---|---|---|
| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | I |
| **COURSE CODE & TITLE** | **20RMSCMAT101: ALGEBRA** | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1. To introduce basic structures of algebra like groups, rings, fields and modules which are the main pillars of modern mathematics.<br>2. Introduction to the structure theory of groups, rings and fields.<br>3. To Practice given Sylow theorems; it is infinitely more useful to have a cyclic.<br>4. To understand the concept of ideals and Homomorphism.<br>5. To understand factorization domains and Euclidean domain.<br>6. To understand the concept of modules and R - Homomorphisms.<br>7. To analyse different types of modules and Algebra. | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | Structure Theory of Groups: Conjugacy and G – sets, Direct products, Finitely generated abelian groups. Invariants of finite abelian group, Sylow Theorems (Sections 4 of Chapter 5 Sections 1,2,3 and 4 of Chapters 8) | 15 |
| II | Ideals and Homomorphisms : Ideals – Homomorphisms-Sum and Direct sum of Ideals – Maximal and prime ideals – Nilpotent and nil ideals – Zorn's Lemma (Chapter 10) | 15 |
| III | Unique factorization domains and Euclidian domains; Unique factorization domains- Prinicipal idel domains- Euclidean domains-polynomial rings over UFD (Sections 1 to 4 of Chapter 11)3 | 15 |
| IV | Modules and Vector spaces; Definition and examples- Sub modules and direct sums- R-homomorphism's and quotient modules, Completely reducible modules, free modules. (Sections 1 to 5 of Chapter 14). | 15 |

**REFERENCES**


(1) Topics in Algebra, by I.N. Hierstein.
(2) Commutative algebra, by Zariski and Samuel, Affiliated East – West Press
(3) Abstract Algebra by John.B.Fraleigh
(4) Abstract Algebra by David S.Dummit and Richard M.Foote.


| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | **Knowledge** |
|---|---|---|
| | CO1 Classify groups in to G-Sets. Explain the concept of Sylow theorems. | K1,K2 |
| | CO2 Understand the concept of maximal and prime ideals | K3 |
| | CO3 Acquire Knowledge On Ideals and Homeomorphisms | K3,K4 |
| | CO4 Understand the Modules and quotient Modules. | K1 |

| **COs – POs** | **CO/ PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MAPPING** | CO1 | 1 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| | CO2 | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 | - |
| | CO3 | - | - | - | 1 | - | - | - | 1 | - | - | - | - | - | 3 | - |
| | CO4 | 2 | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - |
| | Low:1, Medium:2, High:3 | | | | | | | | | | | | | | | |

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|---|---|---|---|
| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | I |
| **COURSE CODE & TITLE** | **20RMSCMAT102: Real Analysis** | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1. To acquire knowledge on Riemann-Stieltjes Integration and Differentiation.<br>2. To know Integration of Vector Valued Functions, Rectifiable Curves.<br>3. To discuss Sequences and Series of Function.<br>4. To learn Uniform Convergence, Continuity, Integration and Differentiation. | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | The Riemann –Stieltijes Integral: Definition and Existence of the integral properties of the integral, integration and Differentiation, Integration of vector valued function, Rectifiable curves. | 15 |
| II | Sequence and series of functions : Discussions of main problem, uniform convergence, uniform convergence and continuity, Uniform convergence and Integration, Uniform convergence and Differentiation, Equicontinuous families of functions, The stone – Weierstrass theorem .<br>Scope and standard as in Chapters 6, sections 7.1 to 7.26 of chapter 7 of Walter Rudin" Principles of Mathematical Analysis" 3rd edition 1976, Nc. Graw hill International student edition. | 15 |
| III | Improper Integrals: Introduction, Integration of unbounded functions with finite limit of Integration, comparison tests for convergence at a $\propto$, infinite Range of Integration.<br>Fourier series: Trigonometrically series, some preliminary theorems, the Main theorem intervals other than - $[-\Pi, \Pi]$ | 15 |
| IV | Functions of Several Variables : Explicit and Implicit functions, Continuity, Partial derivations, differentiability, partial derivatives of higher order, differentials of higher order, function of functions, change of variables, Taylor's theorem, Extreme values, Maxima and Minima, functions of several variables.<br>Scope and standard as in chapters 11, 12 and 15 of **Mathematical Anlaysis by " S.C. Malik 1994" Wiley Eastern limited.** | 15 |

| | | |
|---|---|---|
| **REFERENCES** | 1. Mathematical Analysis- A modern Approach to Advanced Calculus Narosa Book Distributors Pvt LTD- New Delhi<br>2. Real Analysis - Golden Math Series By N.P. Bali.<br>3. A course of Mathematical Analysis by Shanti Narayan -.K. Mittal , S-Chand & Company LTD-New Delhi | |
| **COURSE** | **On the successful completion of course students will be** | **Knowledge** |



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|---|---|---|---|
| **OUTCOME** | **able to** | | |
| | CO1 | Understand the concepts of Riemann Integration and Differentiation. | |
| | CO2 | To learn the different types of Sequences and Series of Functions, Equicontinuous Families of Functions. | |
| | CO3 | Analyze the concept of functions of several variables. | |
| | CO4 | Study the applications of Integration and Differential forms. | |

**COs – POs MAPPING**

| CO/ PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | - | - | - | - | - | - | - | - | - | - | - | - | - | 2 | - |
| CO3 | - | - | - | 1 | - | - | - | 1 | - | - | - | - | - | 3 | - |
| CO4 | 2 | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - |

Low:1, Medium:2, High:3

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|---|---|---|---|
| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | I |
| **COURSE CODE & TITLE** | **20RMSCMAT103: ORDINARY DIFFERENTIAL EQUATIONS** | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1. To study linear equations with regular singular points.<br>2. To provide knowledge on Legendre polynomials and properties of Bessel functions<br>3. To know the existence and uniqueness of solutions.<br>4. To Study surfaces and curves in 3-D space. | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | Oscillation Theory and boundary value problems: Qualitative properties of solutions –The Sturm comparison theorem-Eigen values, Eigen functions and the vibrating string. | 15 |
| II | Power series solutions: Series solutions of first order equations – Second order linear equations-Ordinary points-Regular singular points- Gauss's hyper geometric equation. | 15 |
| III | Some special functions of Mathematical Physics :Legender polynomials – properties of Legender polynomials –Bessel functions –The gamma function- Properties of Bessel functions. | 15 |
| IV | The existence and uniqueness of solutions: The method of successive approximations-Picard's theorem-systems. The second order linear equations. | 15 |

**REFERENCES**


1. Advanced Differential Equations, M.D. Raisinghania , S. Chand Publications
2. Differential Equations" Ross, Shepley L Wieley India Pvt LTD.
3. Engineering Mathematics y Bali NP, SatyanarayanaBhavanari, kelkar, University Science Press, New Delhi 2012.
4. An introduction to O.D.E by Earl.A.Coddington , Prentice Hall of India Private Limited, New Delhi 1991.
5. Theory of ODE by Sam Sundaram, Narosa Publications


| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | **Knowledge** |
|---|---|---|
| | CO1 Recognize and classify O.D.Es. | |
| | CO2 Learn boundary value problems, Eigen values and Eigen functions | |
| | CO3 Apply knowledge on special functions of Mathematical Physics | |
| | CO4 Understand the method of successive approximation and solve the second order linear questions. | |

| COs – POs | CO/ | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MAPPING** | CO1 | 1 | - | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| | CO2 | - | 3 | - | - | - | - | - | - | - | - | 2 | - | - | - | 2 |
| | CO3 | 1 | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - |
| | CO4 | 1 | - | - | - | - | - | - | - | - | 1 | - | - | - | 3 | - |
| | Low:1, Medium:2, High:3 | | | | | | | | | | | | | | | |

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|---|---|---|---|
| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | I |
| **COURSE CODE & TITLE** | **20RMSCMAT104: DISCRETE MATHEMATICS** | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1. To study the mathematical structures that are countable or distinct and separable.<br>2. To learn sets, functions, logic, calculus and analysis.<br>3. To study the Algebraic systems such as Lattices ,Boolean Algebra and Boolean functions<br>4. To introduce basic concepts of graph theory | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | Normal Forms-Disjunctive-Conjunctive Principal Disjunctive, Principal Conjunctive Normal Forms –Ordering and Uniqueness of Normal Forms. The theory of Inference for the statement Calculus-Rules of inferences – Consistency of Premises-Automatic Theorem proving( Sections 1.3 and 1.4 of Chapter 1) | 15 |
| II | The predicate calculus-Inference Theory of the Predicate Calculus( Sections 1.5 and 1.6 of Chapter 1) | 15 |
| III | Lattices and Boolean Functions: Lattices as partially Ordered sets-Lattices as Algebraic Systems –Boolean Algebra-Boolean Functions-Minimization. (Sections 4.1 , 4.2,4.3 and 4.4 of Chapter 4) | 15 |
| IV | Finite – State Machines-Basic Concepts of Graph Theory –Basic Definitions-Paths-Reach ability, and Connectedness-Matrix Representation of Graphs-Trees (Section 4.6 of Chapter 4 and Section 5.1 of Chapter) | 15 |

**REFERENCES**

| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | **Knowledge** |
|---|---|---|
| | CO1 Use standard notaions of propositional logic. | |
| | CO2 Determine if a logical argument is valid or invalid. | |
| | CO3 Understand the truth tables for expressions involving nagation, conjuction, and disjunction | |
| | CO4 Find concepts and notations from discrete mathematics are useful in studying Automata theory, Number theory and mathematical cryptography. | |

**COs – POs MAPPING**

| CO/ PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L | - | L | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | - | - | H | - | - | - | - | - | - | - | - | - | - | - | L |



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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CO3 | L | - | - | - | - | - | - | - | L | - | - | - | - | M | - |
| | CO4 | M | - | - | - | - | - | - | - | - | - | L | - | - | L | - |
| | Low:1, Medium:2, High:3 | | | | | | | | | | | | | | | |

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|---|---|---|---|
| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | I |
| **COURSE CODE & TITLE** | **20RMSCMAT105: COMPLEX ANALYSIS** | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1. To define analytic functions and derivative rules of complex functions.<br>2. To introduce Mobius transformations and explain its applications.<br>3. To evaluate definite integrals using Cauchy integral formula.<br>**4.** To understand power series and expansion of analytic function. | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | Differentiation: Analytic Functions : Derivative Rules for Differentiating Complex Functions- The Cauchy-Riemann Equations –Analytic Functions-Geometrical Interpretation of Arg $f^1(z)$ and $\|f^1(z)\|$ - Conformal Mapping –The Mapping w $= \frac{az+b}{cz+d}$ -Conformal Mapping of the Extended Plane. | 15 |
| II | Mobius Transformations: The Group Property of Mobius Transformations – The Circle –Preserving Property of Mobius Transformations-Fixed points of a Mobius Transformation - Invariance of Cross Ratio-Mapping of a circle onto a Circle – Symmetry Transformations. | 15 |
| III | Complex Integrals: Cauchy Integral Theorem: Rectifiable Curves-Complex Integrals-The Case of Smooth Curves-Cauchy's Integral Theorem-The Key Lemma proof of Cauchy's Integral Theorem-Application to the Evaluation of Definite Integrals Cauchy's Integral Theorem for a system of Contours. Cauchy's Integral Formula – Morera's Theorem – Cauchy's Inequalities. | 15 |
| IV | Power Series: The Cauchy-Hadamard Theorem – Taylor Series. The Uniqueness Theorem for Power series-Expansion of an Analytic Function in a power series –Liouvill'es Theorem. The Uniqueness Theorem for Analytic functions-A Points and Zeros-Weirstrass' Double Series Theorem-Substitution of One Power Series into Another- Division of Power series. | 15 |

| | | |
|---|---|---|
| **REFERENCES** | 1. Scope and Standard as in Chapters 3,5,7,8 and 10 of " Introductory Complex Analysis" by Richard A. Silverman Dover Publications, Inc. (1972). New York.<br>2. Complex Variables - . Schaum outline series, 2/E by Speigel<br>3. An Introductions to Complex Analysis, by C.L. Siegel :North Holland. | |
| **COURSE** | **On the successful completion of course students will be** | **Knowledge** |

| | | | |
|---|---|---|---|
| **OUTCOME** | **able to** | | |
| | CO1 | Identify curves and regions in the complex plane defined by simple expressions. | |
| | CO2 | Describe conformal mappings between various plane regions. | |
| | CO3 | Describe basic properties of complex integration and having the ability to compute such integrals. | |
| | CO4 | Apply the concepts of Complex Analysis in many branches of mathematics, including algebraic geometry, number theory, analytic combinatorics, Mathematics; as well as in physics, including the branches of hydrodynamics, thermodynamicsand particularly quantum mechanics. | |

**COs – POs MAPPING**

| CO/ PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | - | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| CO2 | - | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | - | - | - | - | - | - | - | 1 | - | - | - | - | 2 | - |
| CO4 | - | - | - | - | 1 | - | - | - | - | - | - | 2 | - | 1 | - |

Low:1, Medium:2, High:3

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|---|---|---|---|
| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | II |
| **COURSE CODE & TITLE** | **20RMSCMAT201: OPERATIONS RESEARCH** | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1.Importance of linear programming technique and its applications,<br>2.Solution methods to solve linear programming problem, algorithms, artificial variables and their use<br>3.Transportation problem and its objective, LP formulation, transportation table , procedure of solving transportation problem<br>4.Assignment problem and its objective, solution methods of assignment problem, different types of assignment problems and the procedure of solving them.<br>5.Definition of sequencing, general sequencing problem, basic terms used in sequencing,<br>6. processing n jobs through 2 machines , processing n jobs through k machines , processing 2 jobs through k machines<br>7.Network scheduling technique and its uses, basic components of network, network construction, Critical path method, Program evaluation and review technique | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | ***LINEAR PROGRAMMING PROBLEM:***<br>***Mathematical Formulation:*** Introduction-Mathematical Formulation of the Problem<br>**Graphical Solution_:** Introduction- Graphical Solution Method – Some Exceptional Cases<br>**Simplex Method :-** The Computational Procedure – Use of Artificial Variables. | 15 |
| II | ***Transportation Problem_:*** Introduction – General Transportation Problem – The Transportation Table – Duality in Transportation Problem –Loops in Transportation Tables- LP Formulation of the Transportation Problem – Solution of a Transportation Problem – Finding an Intial Basic Feasible Solution | 15 |
| III | ***Assignment Problem_:*** Introduction – Mathematical Formulation of the problem – The Assignment Method – Special cases in Assignment problems – A Typical Assignment problems – The Travelling Salesman Problem. | 15 |
| IV | ***Sequencing Problem_:*** Introduction, Problem of sequencing and assumptions of a sequencing problem, Basic terms used in sequencing, processing, n Jobs Through two machines, processing n Jobs through k Machines, processing 2 jobs through k Machines.<br>***Network Scheduling by PERT/CPM_:*** Introduction – Network and basic components – Logical sequencing - Rules of Network construction – Crosscurrent Activities – Critical path method (CPM) | 15 |



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|---|---|---|
| | – Probability considerations in PERT – Distinction between PERT and CPM. | |
| **REFERENCES** | S.D. Sharma, "Operations Research"<br>2. H.A Taha, "Operations Research – An Introduction".<br>3. "Operation Research" By Pannerselvam R, Published by Prentice Hall of India New Delhi , 2002 | |
| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | **Knowledge** |
| | CO1 Understand applications of OR techniques in real life and gain the capacity to solve real life problems using these techniques .Understand components and assumptions of linear programming problems and its mathematical formulation. | K1,K2 |
| | CO2 Learn Graphical solution method, simplex method, use of artificial variables and methods to solve LP problems containing artificial variables. Understand the application of transportation problem in real life problems, representation of transportation problem in tabular form, duality in TP. | K3,K4 |
| | CO3 Understand the application of transportation problem in real life problems, representation of transportation problem in tabular form, duality in TP. | K1,K3 |
| | CO4 Understand the purpose of introducing of assignment problem, | K1,K3 |

**COs – POs MAPPING**

| CO/ PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | - | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO2 | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO3 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | | - |
| CO4 | 1 | - | - | - | - | - | - | - | - | - | - | 3 | - | | - |

Low:1, Medium:2, High:3

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|---|---|---|---|
| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | II |
| **COURSE CODE & TITLE** | **20RMSCMAT202: GALOIS THEORY** | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1.Introduction to the Irreducible polynomials and Eisensteins Criterion<br>2.To Practice the Adjunction of roots.<br>3. To understating the concept of algebraically closed fields.<br>4.To Study the Splitting fields and Normal extensions.<br>5.To analyse the multiple roots, finite fields and separable extension<br>6.To state fundamental theorem of Galois's theory and Fundamental theorem of Algebra.<br>7.To construct roots of unity and cyclotomic Polynomials.<br>8.Discuss about extension fields and Roots of polynomials. | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | Algebraic Extensions of Fields: Irreducible Polynomials and Eisenstein's Criterion – Adjunction of roots, Algebraic Extensions, Algebraically closed fields. (Sections 15.1, 15.2, 15.3 and 15.4 of chapter 15 of Ref (1)) | 15 |
| II | Normal and Separable Extensions: Splitting fields, Normal extensions, multiple foots, finite fields, separable Extensions (Section 16.1, 16.2, 16.3, 16.4 and 16.5 of chapter 16 of Ref.(1). | 15 |
| III | Galois's Theory: Automorphic groups and fixed fields, Fundamental theorem of Galois's Theory, Fundamental Theorem of Algebra (Sections 17.1, 17.2 and 17.3 of Chapter 17 of Chapter (1)) | 15 |
| IV | Applications: Roots of Unity and Cyclotomic Polynomials Solvabic radical Ruler and compass constructions (Section 18.1, 18.3 and 18.5 of Chapter 18 of Ref (1)). | 15 |

| | | | |
|---|---|---|---|
| **REFERENCES** | (1) Basic Algebra by P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Cambridge University press, Reprint 1997<br>(2) Topic in Algebra by I.N. Hertein. | | |
| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | | **Knowledge** |
| | CO1 | Knowledge gained solving polynomial equations using formulas for roots, How to test if a Polynomial is irreducible finite field (Galois fields). | K1 |
| | CO2 | Understand the roots of polynomial equation it the same has degree less than five. | K2 |
| | CO3 | Realize the facility in working with finite fields Apply the concept of a field extension to various mathematical problems including geometric constructions and perfect division of a circle into n parts. | K3,K4 |
| | CO4 | Apply mathematical methods to the real –life | K3,K5,K6 |

| | | | | problems including cryptography | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COs – POs MAPPING** | **CO/ PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| | CO1 | 2 | - | | - | - | - | - | - | - | - | - | - | 3 | - | - |
| | CO2 | - | | - | - | 3 | - | - | - | - | - | - | - | - | - | 1 |
| | CO3 | | - | - | - | - | - | - | - | 1 | - | - | - | - | 2 | - |
| | CO4 | | - | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| | Low:1, Medium:2, High:3 | | | | | | | | | | | | | | | |

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|---|---|---|---|
| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | II |
| **COURSE CODE & TITLE** | **20RMSCMAT203: PARTIAL DIFFERENTIAL EQUATIONS** | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1. To provide the students various methods to find solutions of O.D.Es and P.D.Es<br>2. To introduce orthogonal trajectories in 3D space<br>3. To explain methods to solve Linear P.D.Es with constant and Variable coefficients.<br>4. To discuss the boundary value problems and Laplace Equation | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | Differential Equations in more than two variables : Methods of solutions of dx/P =dy/Q = dz/R-Orthogonal trajectories of a system of curves on surface-Pfaffian differential forms and equations in Three variables . (Sections 3,4,5 and of Chapter 1) | |
| II | Partial Differential Equations of the First order: Partial Differential equations-Origins of first order partial differential equations-Cauchy's problems for first order equations-Linear equations of first order-Integral surfaces passing through a given curve –Surfaces orthogonal to a given system of surfaces-Charpit's method.(Sections 1,2,3, 4,5,6 and 10 of Chapter 2) | |
| III | Partial Differential Equations of the Second order: The Origin of second order equations –Linear partial differential with constant coefficients-Equations with variable coefficients.(Sections 1,4 and 5 of Chapter 3) | |
| IV | Laplace's Equations : Elementary solution of Laplace's equation-Families of equipotential surfaces-Boundary value problems – Separation of variables.( Sections 2,3,4 and 5 of Chapter 4) | |

**REFERENCES**

| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | **Knowledge** |
|---|---|---|
| | CO1 Identify linear and nonlinear PDE and solve nonlinear PDE by Charpit's method. | K2,K3 |
| | CO2 Apply Variables separable methods to solve Laplace Equation in cylindrical or spherical coordinates. | K3,K4 |
| | CO3 Obtain equipotential surfaces using Laplace's equation | K2,K5 |
| | CO4 Understand the importance of partial differential equations in geometry, physics and other subjects. | K2,K3,K4 |

| **COs – POs MAPPING** | **CO/ PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CO1 | 3 | - | 3 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| | CO2 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | CO3 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | 2 | - |
| | CO4 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - |
| | Low:1, Medium:2, High:3 | | | | | | | | | | | | | | | |

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|---|---|---|---|
| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | II |
| **COURSE CODE & TITLE** | **20RMSCMAT204: TOPOLOGY** | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1. This course aims to teach the fundamentals of point set topology and constitute an awareness of need for the topology in Mathematics.<br>2. Introduce the basic definitions and standard examples of topological spaces.<br>3. Define and illustrate a variety of topological properties such as compactness, connectedness and separation axioms.<br>4. Explain the idea of topological equivalence and define homeomorphisms. | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | **Metric spaces**:-open sets-closed sets- convergence-completeness and Baire's theorem-Continuous mappings – Cauchy's Inequality and MinKowskisInequality- Euclidean and Unitary Spaces | 15 |
| II | Topological Spaces, definition & examples-open bases and open sub bases- compact spaces | 15 |
| III | Product of spaces-Trychonoff's theorem and loally compact spaces-compactness for Metric spaces. | 15 |
| IV | Separation $-T^1$ space and Hausdorff spaces –completely regular spaces and Normal spaces –Urysohn's lemma- Tietze extension theorem-Urysohn's imbedding theorem –<br>Connected spaces. | 15 |

**REFERENCES**


1. 'Topology' by K.ChandraSekharaRao, Narosa Publications
2. "Topology" by J.P. Chauhan, J.N. Sharma, Krishna Publications
3. "General Topology" by M.G. Murdeshwar, new age International publications


| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | **Knowledge** |
|---|---|---|
| | CO1 Understand to construct topological spaces from metric spaces and using general properties of neighbourhoods, open sets, closed sets, basic and sub-basis. | K2 |
| | CO2 Apply the properties of open sets, closed sets, interior points, accumulation points and derived sets in deriving the proofs of various theorems. | K2,K3 |
| | CO3 They know what we mean by connectedness, compactness, and hausdorf property and their general characteristics. | K4,K5 |
| | CO4 Understand the classical theorems such as the Uryshon lemma, the Tietze extension theorem. | K4,K5,K6 |

| **COs – POs MAPPING** | **CO/ PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CO1 | - | - | | - | 3 | - | - | - | - | - | - | - | 1 | - | - |
| | CO2 | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | 3 |
| | CO3 | - | - | - | 1 | - | - | - | - | - | - | - | - | - | 3 | - |
| | CO4 | - | 3 | - | - | - | - | - | - | - | - | - | - | - | 1 | - |
| | Low:1, Medium:2, High:3 | | | | | | | | | | | | | | | |

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# VIKRAMA SIMHAPURI UNIVERSITY::NELLORE
## DEPARTMENT OF MATHEMATICS

Syllabus for M.Sc. Mathematics (2 Year Course) for V.S. University College, Nellore under the jurisdiction of Vikrama Simhapuri University, Nellore with effect from the Academic Year 2020-21

| | | | |
|---|---|---|---|
| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | II |
| **COURSE CODE & TITLE** | **20RMSCMAT205: ADVANCED COMPLEX ANALYSIS** | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1. To introduce some topics of contemporary Advanced complex analysis.<br>2. To explain Laurent Series, poles and singular points.<br>3. To understand Residue theorem and its applications.<br>4. To discuss Laplace's equation, Harmonic functions and Dirichlet problem.<br>5. To analyse various methods to solve problems in day to day life. | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | Laurent Series-Singular Points: Laurent Series-Laurent's Theorem-Poles and Essential Singular points-Behavior at an Essential Singular point. Picard's Theorem-Behavior at infinity. | 15 |
| II | The Residue Theorem and its Applications: The Residue Theorem-Residues at infinity-Jordan's Lemma-Evaluation of Definite Integrals – The Argument principal-The Theorems of Rouche and Hurwitz-Local Behavior of Analytic Mappings-The Maximum Modulus principle and Schwarz's Lemma. | 15 |
| III | Harmonic Functions: Laplace's Equations-Conjugate Harmonic Functions-Poisson's integral. Schwartz's Formula-The Dirichlet problem.<br>Conformal Mapping: General Principles of Conformal Mapping – Mapping of the Upper Half-Plane onto a Rectangle –The Schwarz-Christoffel Transformation. | 15 |
| IV | Infinite product and Partial Fraction Expansions: Preliminary Results- Infinite Products-Weierstrass' Theorem –Mittage – Leffer's Theorem – The gamma Functions –Cauchy's Theorem on Partial Fraction Expansions. | 15 |

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|---|---|---|---|
| **REFERENCES** | 1. Fundamentals of Complex Analysis- Edward B. Saff, Arthur David Snider, Pearson Education<br>2. Foundations of Comlex Analysis by S. Ponnusamy- Narosa Publications. | | |
| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | | **Knowledge** |
| | CO1 | Learn topics of contemporary Advanced complex analysis in particular spaces of holomorphic functions, entire functions, harmonic functions and conformal mapping functions. | |
| | CO2 | Apply advanced techniques to evaluate definite integrals and differential equations in applied areas. | |
| | CO3 | Explain general principles of conformal mapping | |



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| | | CO4 | | Compute the residue of a function and use the Residue Theory to evaluate a contour integral or an integral over the real line | | | | | | | | | | | | |
| **COs – POs MAPPING** | **CO/ PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| | CO1 | - | - | | - | 1 | - | - | - | - | - | - | - | 1 | - | - |
| | CO2 | - | 2 | - | - | - | 2 | - | - | - | - | - | - | - | - | 1 |
| | CO3 | | - | - | - | 1 | - | - | - | - | - | - | - | - | 2 | - |
| | CO4 | | - | - | - | - | - | - | 2 | - | - | - | - | - | 3 | - |
| | Low:1, Medium:2, High:3 | | | | | | | | | | | | | | | |

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|---|---|---|---|
| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | III |
| **COURSE CODE & TITLE** | **20RMSCMAT301:** LINEAR ALGEBRA | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1. To understand the concept of characteristic values, Subspaces, Simultaneous Triangulation; Simultaneous Diagonalization.<br>2. To study the concept of Direct-Sum Decompositions, Invariant Direct Sums.<br>3. To illustrate the concept of The Jordan Form, Computation of Invariant Factors, Summary; Semi-Simple Operators<br>4. To understand the concept of Bilinear Forms, Symmetric Bilinear Forms | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | Introduction, Characteristic Values, Annihilating Polynomials, Invariant Subspaces, Simultaneous Triangulation; Simultaneous Diagonalization. **(Sections 6.1 - 6.5 of Chapter 6 in the Prescribed Text Book)** | 15 |
| II | Direct-Sum Decompositions, Invariant Direct Sums, The Primary Decomposition Theorem.<br>Cyclic Subspaces and Annihilators, Cyclic Decompositions and Rational form.<br>**(Sections 6.6 - 6.8 of Chapter 6 and sections 7.1 - 7.2 of Chapter 7 in the Prescribed Text Book)** | 15 |
| III | The Jordan Form, Computation of Invariant Factors, Summary; Semi-Simple Operators<br>**(Sections 7.3 - 7.5 of Chapter 7 in the Prescribed Text Book)** | 15 |
| IV | Bilinear Forms, Symmetric Bilinear Forms, Skew-Symmetric Bilinear Forms, Groups Preserving Bilinear Forms. **(Sections 10.1 - 10.4 of Chapter 10 in the Prescribed Text Book)** | 15 |

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|---|---|---|---|
| **REFERENCES** | Linear Algebra by Kenneth Hoffman and Ray Kunze, prentice- Hall India Pvt. Ltd, 2nd Edition, New Delhi | | |
| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | | **Knowledge** |
| | CO1 | Know the concept of characteristic values, Subspaces, Simultaneous Triangulation; Simultaneous Diagonalization. | K2 |
| | CO2 | Understand concept of Direct-Sum Decompositions, Invariant Direct Sums | K2,K4 |
| | CO3 | .Demonstrate the Jordan Form, Computation of Invariant Factors, Summary; Semi-Simple Operators | K3,K4 |
| | CO4 | Know the Concept of Bilinear Forms, Symmetric Bilinear Forms | K2,K5 |

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| COs – POs MAPPING | CO/ PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CO1 | - | - | - | - | - | - | - | - | 3 | - | - | - | | 2 | - |
| | CO2 | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | 1 |
| | CO3 | - | - | - | - | - | - | 1 | - | - | - | - | - | 2 | - | - |
| | CO4 | - | - | - | 2 | - | - | - | - | - | - | - | - | - | 1 | - |
| | Low:1, Medium:2, High:3 | | | | | | | | | | | | | | | |

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|---|---|---|---|
| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | III |
| **COURSE CODE & TITLE** | **20RMSCMAT302: FUNCTIONAL ANALYSIS** | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1. Define and illustrate several normed spaces.<br>2. Introduce linear operators and derive their properties.<br>3. Elaborate basic theorems like open and closed mapping theorem, implicit function theorem and spectral theorem | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | The definitions and some examples –continuous –linear transformations-the Hahn-Banach Theorem. | 15 |
| II | Natural imbedding of N in N**-Open mapping theorem –Conjugate of an Operator. | 15 |
| III | Definition and Simple Properties –Orthogonal Complements-Orthonormal sets –Conjugate spaces-Adjoint of an Operator. | 15 |
| IV | Self adjoint operators –Normal and Unitary Operators-Projection – Spectral theorem. | 15 |

**REFERENCES**

1. " Foundations of Functional Analysis" by S. Ponnyusamy-Narosa Publications
2. " Text book of Functional Analysis – A Problem oriented Approach" by V.K. Krishnan-Prentice Halls of India Publishers.
3. " Functional Analysis" by B.V. Limaye New age International Publications

| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | **Knowledge** |
|---|---|---|
| | CO1 They can work with different distance metrics and normed spaces. Understand continuous linear transformations and the Hahn-Banach Theorem. | K3,K4 |
| | CO2 Comprehend the Open mapping theorem and Closed graph theorem | K1,K2 |
| | CO3 Understand the relevance of self-adjoint operators, normal, unitary operators and projections. | K2,K5 |
| | CO4 Comprehend the ideas of determinants and the spectrum of an operator. | K5,K6 |

**COs – POs MAPPING**

| CO/ PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | | 1 | - | - | - | - | - | - | - | - | 2 | - | - |
| CO2 | - | | - | - | 3 | - | - | - | - | - | - | - | - | - | 2 |
| CO3 | | - | - | - | - | - | 2 | - | - | - | - | - | L | - | - |

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| | CO4 | | - | - | - | - | - | - | - | - | - | L | - | - | L | - |
| | Low:1, Medium:2, High:3 | | | | | | | | | | | | | | | |

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| PROGRAMME | M.Sc. Mathematics | SEMESTER | III |
|---|---|---|---|
| COURSE CODE & TITLE | 20RMSCMAT303: DIFFERENTIAL GEOMETRY | | |
| NUMBER OF CREDITS | 5 | HOURS/WEEK | 5 |
| COURSE OBJECTIVES | 1. Define the equivalance of two curves.<br>2. Find the derivative map of an isometry.<br>3. Analyse the equivalence of two curves by applying some theorems.<br>4. Defines surfaces and their properties<br>5. Express definition and parametrization of surfaces.<br>6. Express tangent spaces of surfaces.<br>7. Explain differential maps between surfaces and find derivatives of such maps.<br>8. Integrate differential forms on surfaces. | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | The Theory Space Curves: Introductory remarks about space curves – Definitions –Arc length-Tangent, normal, and binormal –Curvature and torsion of a curve given as the intersection of two surfaces – Contact between curves and surfaces-Tangent surface, involutes and evolutes.( Sections 1 to 7 of Chapter 1). | 15 |
| II | The Metric: Local Intrinsic Properties of a Surface: Definitions of a Surface- Curves on a surface-Surfaces of revolution –Helicoids-Metric-Direction Coefficients-Families of curves –Isometric correspondence –Intrinsic properties. ( Sections 1 to 9 of Chapter 11). | 15 |
| III | Geodesics-Canonical Geodesic Equations-Normal Property of geodesics –Existence theorems-Geodesic parallels-Geodesic curvature-Gauss-Bonnet theorem –Gaussian curvature-Surfaces of constant curvature –Conformal mapping-Geodesic mapping (Sections 10 to 20 of Chapter 11). | 15 |
| IV | The second Fundamental Form: Local non – intrinsic properties of a surface: The second fundamental form-principal curvatures –Lines of curvature -Developables associated with space curves-Developables associated with curves on surfaces –Minimal surfaces-Ruled surfaces-The fundamental equations of surface theory –Parallel surfaces. ( Sections 1 to 10 Chapter III). | 15 |

| REFERENCES | A first course in Differential Geometry- D. Soma sundaram – Narosa Publication | |
|---|---|---|
| COURSE OUTCOME | **On the successful completion of course students will be able to** | **Knowledge** |
| | CO1 Determine and calculate curvature of curves in different coordinate systems. | K1,K2 |
| | CO2 Treat geodesic curves and parallel translation. | K2 |
| | CO3 Calculate and analyse curvature of surfaces in | K2 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | different settings. | | | | | | | | | | | | | |
| | | CO4 | Know the concept of tensor and recognize tensors that are used in mechanics, image processing and theory of relativity. | | | | | | | | | | | | | K3,K4,K5 |
| **COs – POs MAPPING** | **CO/ PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| | **CO1** | - | - | - | - | - | - | 2 | - | - | - | - | - | 1 | - | - |
| | **CO2** | - | | 2 | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | **CO3** | - | - | - | - | - | - | - | - | - | - | 1 | - | - | 1 | - |
| | **CO4** | - | - | - | - | 3 | - | - | - | - | - | - | - | - | 2 | - |
| | Low:1, Medium:2, High:3 | | | | | | | | | | | | | | | |

| PROGRAMME | M.Sc. Mathematics | SEMESTER | III |
|---|---|---|---|
| COURSE CODE & TITLE | 20RMSCMAT304A: NUMBER THEORY | | |
| NUMBER OF CREDITS | 5 | HOURS/WEEK | 5 |
| COURSE OBJECTIVES | 1. Identify and apply various properties of and relating to the integers including the Well-Ordering Principle, primes, unique factorization, the division algorithm and greatest common divisors.<br>2. Identify certain number theoretic functions and their properties.<br>3. Understand the concept of a congruence and use various results related to Congruence including the Chinese Remainder Theorem.<br>4. Solve certain types of Diophantine equations.<br>5. Identify how number theory is related to and used in cryptography. | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | Arithmetical Functions and Dirichlet Multiplication: Introduction- The Mobius function $\mu$ (n)-The Euler totient function $\emptyset$ (n) –A relation connection $\emptyset$ and $\mu$ -A product formula for $\emptyset$ (n) - The Dirichlet product of arithmetical functions –Dirichlet inverses and the Mobius inversion formula-The Mangoldt function $\Lambda(n)$ – Multiplicative functions-Multiplicative functions and Dirichlet multiplication-The inverse of a completely multiplicative function-Liouville's Function $\lambda(n)$-the divisor functions $\sigma_\alpha(n)$ – Generalized convolutions –Formal power series –The Bell series of an arithmetical function –Bell series and Dirichlet multiplications – Derivatives of arithmetical functions-The Selberg identity . | 15 |
| II | Averages of Arithmetical Functions : Introduction –The big oh notation Asymptotic equality of functions-Euler's summation formula –Some elementary asymptotic formulas-The average order of d(n)-The average order of the divisor functions $\sigma_\alpha(n)$-The average order of $\emptyset$ (n) -An application to the distribution of lattice points visible from the origin-The average order of $\mu$ (n) and of $\Lambda(n)$ - Another identity for the partial sums of a Dirichlet product. | 15 |
| III | Congruences: Definition and basic properties of congruences-Residue classes and complete residue systems-Linear congruences – Reduced residue systems and the Euler-Fermat theorem- Polynomial congruences modulo p.Langranage's theorem-Applications of Lagarange's theorem-Simultaneous linear congruences – The Chinese remainder theorem –Applications of the Chinese remainder theorem –Polynomial congruences with prime power moduli- The Principle of cross-classification- A decomposition property of reduced residue systems. | 15 |
| IV | Quadratic Residues and the Quadratic Reciprocity Law: Quadratic residues-Lengendre's symbol and its properties –Evaluation of (-1\|p) | 15 |

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| | and (2\|p) –Gauss' lemma-The quadratic reciprocity law – Applications of the reciprocity law –The Jacobi symbol<br>Primitive Roots: The exponent of a number mod m. Primitive roots – Primitive roots and reduced residue systems –The nonexistence of primitive roots mod $2^{\alpha}$ for $\alpha \geq 3$. | |

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| **REFERENCES** | Scope and Standard as in chapter 2, Chapter 3, Chapter 5, Sections 9.1 to 9.7 of Chapter 9 and Sections 10.1 to 10.3 of chapter 10 by **Tom. M. Apostal , " Introduction to Analytical Number Theory" Springer International Student Edition .** | |
| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | **Knowledge** |
| | CO1 | Find quotients and remainders from integer division Apply Euclid's algorithm and backwards substitution | K2,K3 |
| | CO2 | Understand the definitions of congruences, residue classes and least residues | K2,K5 |
| | CO3 | Add and subtract integers, modulo n, multiply integers and calculate powers, modulo n | K2,K3,K4 |
| | CO4 | Determine multiplicative inverses, modulo n and use to solve linear congruence. | K4,K5 |

**COs – POs MAPPING**

| CO/ PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | - | - | - | - | - | - | 2 | - | - | - | 1 | - | - |
| CO2 | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - | 3 |
| CO3 | - | - | 2 | - | - | - | - | - | - | - | - | - | - | 1 | - |
| CO4 | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - |

Low:1, Medium:2, High:3

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|---|---|---|---|
| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | III |
| **COURSE CODE & TITLE** | **20RMSCMAT304B: PROGRAMMING AND DATA STRUCTURES** | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1. To understand the language of C<br>2. To provide knowledge on theoretical concept of decision making<br>3. To know the existence and uniqueness of solutions.<br>4. To Study the structures and functions | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | **Theoretical concepts:** Introduction and basic concepts of 'C' language.<br>**Introducing decision making**: Branching and Looping- Decision Making with IF, IF- ELSE, Nesting of IF- ELSE, ELSE-IF Ladder& switch statement- WHILE- DO- FOR loops.<br>**Arrays**: Introduction- Array Initialization- Definition of Array- Characteristics of Array- One Dimensional Array- Two dimensional Array.<br>**Strings**: Declaration and Initialization of Strings-Display of Strings with Different Formats-Strings Standard Functions.<br>**Pointers**: Introduction-Features of Pointer-Pointer Declaration-Arithmetic Operations with Pointers-Array of pointer-Pointers to pointers-Void Pointers. | 15 |
| II | **Functions**: introduction-Definition of Function-Declaration of Function and function Prototypes-The Return Statement-Types of functions-Call by value and Reference-Function Returning More Values –Function as an Argument-Function with Operators-Function and Loop Statements- Function with Array and Pointers-Recursion-Pointer to Function.<br>**Structure and Union**: Introduction-Features of Structures-Declaration and Initialization of Structure and Union-Structure with Structure-Array of Structures-Pointer to Structure- Structure and Function- Union of Structures | 15 |
| III | **Linear data structures-** Linear lists- operations on linear lists sequential allocation and linked allocation linked lists- single linked lists- double linked lists- insertion and deletion operations- simple applications of linked lists - Circular Linked Lists. | 15 |
| IV | **Stacks** - Stack operations- array and pointer implementations of stacks- **Queues** - Queue operations- array and pointer implementation of queues- circular queues- insertion and deletion operations on circular queues.<br>**Searching** - Linear search- binary search- **sorting** - Bubble sort- selection sort- insertion sort- merge sort- Time and Space complexity-definition- time complexity of simple algorithms. | 15 |



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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **REFERENCES** | Scope as in Computer programming and data structures by E Balaguruswamy , Tata McGraw hill | | | | | | | | | | | | | | | |
| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | | | | | | | | | | | | | | **Knowledge** | |
| | CO1 | | | | | | | | | | | | | | | |
| | CO2 | | | | | | | | | | | | | | | |
| | CO3 | | | | | | | | | | | | | | | |
| | CO4 | | | | | | | | | | | | | | | |
| **COs – POs MAPPING** | **CO/ PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| | **CO1** | - | - | - | - | - | - | - | 2 | - | - | - | - | - | - | 2 |
| | **CO2** | - | - | - | - | - | - | - | - | - | - | 2 | - | - | 2 | - |
| | **CO3** | - | - | - | - | - | 1 | - | - | - | - | - | - | 1 | - | - |
| | **CO4** | - | - | 2 | - | - | - | - | - | - | - | - | - | - | 1 | - |
| | Low:1, Medium:2, High:3 | | | | | | | | | | | | | | | |

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| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | III |
| **COURSE CODE & TITLE** | **20RMSCMAT305A: CLASSICAL MECHANICS** | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1. This course is intended to provide a treatment of basic knowledge in mechanics used in deriving a range of important results and problems related to rigid bodies.<br>2. The objective is to provide the student the classical mechanics approach to solve a mechanical problem.<br>3. To enable the students to acquire knowledge of Mechanics. Also to understand the concepts of Lagrange's Equation and Hamiltonian Principle. | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | D'Alembert's Principle and Lagrange's Equations: Some Definitions-Classification of Dynamical System-Some Examples of Constraints Virtual Displacement-Principle of Virtual Work – Generalised Force in Holonomic System-Mathematical Expression for the principle of Virtual work-D'Alember's principle-Lagrange's Equations for a Holonomic system-Velocity-dependent potential – Lagrange's Equations of Motion for conservative , Non-holonomic system-physcial Significance of 1 –Harmonic Oscillator. | 15 |
| II | Variational Principle and Lagrange's Equations:Variational Principle-Calculus of Variations-Hamilton Principle-Derivation of Hamilton's Principle from Lagrange's Equations-Derivation of Lagrange's Equations from Hamilton's Principle –Extension of Hamilton's Principle –Hamilton's Principle for Non-conservative, Non-holonomic System –Generlised Force in Dynamic system-Hamilton Principle for Conservative-Non holonomic System - Lagrange's Equations for Non –conservative –Holonomic System – Cyclic or Ignorable Coordinates –Conservation Theorem-Conservation of Linear Momentum in Lagrangian Formulation-Conservation of Angular Momentum in Lagrangian Formulation – Conservation of Angular Momentum –Conservation of Energy in Lagrangian Formulation. | 15 |
| III | Hamilton's Equations of Motion: Derivation of Hamilton's Equations of Motion (using Lagrange's Equations)-Routh's Procedure-Equations of Motion-Derivation of Hamilton's Equations from Hamilton's Principle –Principle of Least Action-Distinction between Hamilton's Principle and Principle of Least Action. | 15 |
| IV | Canonical Transformations: Canonical Coordinates and Canonical Transformations –The necessary and Sufficient Condition for a Transformation to be Canonical –Examples of Canonical Transformations-Properties of Canonical Transformulations- | 15 |

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| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | III |
| **COURSE CODE & TITLE** | **20RMSCMAT304C:** NON COMMUTATIVE RINGS | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1. To introduce the concepts of Primitive ideals and modules<br>2. To provide knowledge on Noetherian rings and their properties.<br>3. To understand decompostion theorem and uniqueness theorem.<br>4. To explain Tensor product of Modules | | |

| **UNIT** | **CONTENT** | **NO. OF HOURS** |
|---|---|---|
| I | Primitive Rings, radicals completely reducible modules. [Sections 3.1,3.2 ,3.3 of Chapter 3] | |
| II | Completely reducible rings, Artinian and Noetherian rings, on lifting idempotents, local and semi perfect rings. [Sections 3.4, 3.5, 3.6, 3.7 of Chapter 3] | |
| III | Projective modules , Injective modules , the complete ring of quotients, rings of endomorphism's of injective modules.[Sections 4.1,4.2,4.3,4.4of Chapter 4] | |
| IV | Tensor products of modules, Hom and functors exact sequences. [Sections 5.1,5.2,5.3 of Chapter 5] | |

**REFERENCES**

| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | **Knowledge** |
|---|---|---|
| | CO1 Understand the concept of Primitive Rings and radicals | K2 |
| | CO2 Able to understand the concept of Notherian rings | K2,K3 |
| | CO3 Acquire Knowledge On Ideals and Homeomorphisms | K2,K4 |
| | CO4 Understand the Modules and Tensor product Modules. | K2,K5 |

**COs – POs MAPPING**

| **CO/ PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | | | | | | | | | | |
| **CO2** | | | | | | | | | | | | | | | |
| **CO3** | | | | | | | | | | | | | | | |
| **CO4** | | | | | | | | | | | | | | | |

Low:1, Medium:2, High:3

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|---|---|---|---|
| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | III |
| **COURSE CODE & TITLE** | **20RMSCMAT305B:** ALGEBRAIC TOPOLOGY | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1. This course aims to teach the fundamentals of point set topology and constitute an awareness of need for the topology in Mathematics.<br>2. Introduce the basic definitions and standard examples of topological spaces.<br>3. Define and illustrate a variety of topological properties such as compactness, connectedness and separation axioms.<br>4. Explain the idea of topological equivalence and define homeomorphisms | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | TWO : Dimensional Manifolds: Introduction – Definition and examples of n- manifolds – Orientable vs non orientable manifolds – Examples of compact, connected 2- manifolds Statement of the classification theorem for compact surfaces – Triangulations of compact surfaces – proof of classification theorem for compact surfaces – The Euler Characteristic of a surface – Manifolds with boundary. The classification of compact, connected 2- manifolds with boundary . The classification of compact, connected 2-manifolds with boundary. The Euler characteristic of a bordered surface – Models of compact bordered surfaces in Euclidean 3 space – Remarks on non compact surfaces. | 15 |
| II | The Fundamental Group: Introduction- Basic notation and terminology – Definition of the fundamental group of a space- The effect of continuous mapping on the fundamental group – The fundamental group of a circle is infinite cyclic – Application: The Brouwer fixed – point theorem in dimension 2 – The fundamental group of product space – Homotopy type and homotopy equivalence of spaces. | 15 |
| III | Free Groups and Free Products of Groups: Introduction – The weak product of abelian groups – Free products of groups – free groups – The presentations of groups by generators and relations – Universal mapping problems. | 15 |
| IV | Seifert and Van Kampen Theorem on the Fundamental Group of the Union of Two spaces Applications: Introduction – Statement and Proof of the theorem of Seifert and Van Kampen- First application of Seifert and Van Theorem – Second application of Seifert and Van kampen Theorem – Structure of the Fundamental group of compact surface Application to knot theory.<br>Syllabus and Treatment as in the Chapters 1 to 4 of the Book, "Algebraic Topology, An Introduction" by William S. Massey (1967) | 15 |
| **REFERENCES** | | |

| | | |
|---|---|---|
| | Infinitesimal Contact Transformation-Relation between Infinitesimal Contact Transformation and Poissson's Bracket-Hamilton Jacob Theory –Hamilton-Jacobi equations for Hamilton's Principle Function. | |

| | | | |
|---|---|---|---|
| **REFERENCES** | 1. Classical Mechanics by Goldstein Herbert, Charles P Poole, John safiko- Pearson India<br>2. Introduction to Classical Mechanics by Takwale R. Puranik P, Mc. GrawHill Education | | |
| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | | **Knowledge** |
| | CO1 | Understand D' Alembert's Principle and simple applications of the Lagrangian Formulation. Derive the Lagrange's Equation from Hamilton's Principle | |
| | CO2 | Study the concept of the Equations of Motion and the Equivalent One-Dimensional Problems. | |
| | CO3 | Distinguish the concept of the Hamilton Equations of Motion and the Principle of Least Action. | |
| | CO4 | Get familiar with canonical transformations, conditions of cononicity of a transformation in terms of Lagrange and Poisson brackets. | |

**COs – POs MAPPING**

| CO/ PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | - | - | - | - | - | 1 | - | - | - | - | 1 | - | - |
| CO2 | - | - | - | - | - | 2 | - | - | - | - | - | - | - | - | 2 |
| CO3 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - |
| CO4 | - | - | - | 1 | - | - | - | - | - | - | - | - | - | 3 | - |

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| PROGRAMME | M.Sc. Mathematics | SEMESTER | III |
|---|---|---|---|
| COURSE CODE & TITLE | 20RMSCMAT305C: INTERNET AND HTML | | |
| NUMBER OF CREDITS | 5 | HOURS/WEEK | 5 |
| COURSE OBJECTIVES | 1. Introduce basic concepts of Internet,Advantage &Disadvantages<br>2. Discuss the concept of E mail . Advantage &Disadvantages<br>3. Explain the concept of HTML and advanced HTML | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | Introduction to Internet : Definition of Internet – History of Internet – Advantages & disadvantages of Internet – Tools of internet - How internet works. Introduction to WWW: Definition of WWW –WWW tools - Web Terminology –web browser – web server<br>E-Mail : Definition of e-mail – advantages & disadvantages of e-mail – how to work with e- mail accounts – message components – message composition – features of e-mail. | 15 |
| II | Introduction to HTML: Basic HTML – HTML document structure – HTML tags – Basefont tag – title tag – body tag – Text formatting tags – Character tags - Character entities<br>HTML Lists : Ordered List , Unordered List & Definition List – Using colors – Using Images | 15 |
| III | Horizontal Rule Tag - HTML Tables – Nested Tables - Hyperlinks: Textual, Graphical Links to sections – Multimedia Objects – Frames – Nested Frames – Forms – Form Controls : textbox, password, checkbox, radio button, select, text area - Processing of forms | 15 |
| IV | Advanced HTML : Cascading Style Sheets: Introduction – Using Styles: As an attribute, tag & external file – Defining Your own styles – Properties and values : properties related to Fonts , Backgrounds & colors, text , boxes & borders - Formatting blocks of information : Classes - Divisions – Spans - Layers with suitable examples. | 15 |

| REFERENCES | |
|---|---|
| | 1. Paul S.Wang Sanda S. Katila, An Introduction to Web Design Plus Programming,Thomson.<br>2. Robert W.Sebesta, Programming the World Wide Web, Third Edition, Pearson Education.<br>3. Joel Sklar, Principles of Web Design, Thomson.<br>4. Raj Kamal, Internet and Web Technologies, Tata McGraw Hill.<br>5. Gopalan & Akilandeswari, Web Technology: A Developer"s Perspective, PHI. |

| COURSE OUTCOME | On the successful completion of course students will be able to | | Knowledge |
|---|---|---|---|
| | CO1 | Explain the concept of Internet and Email illustrations & occurrence | |

| COURSE OUTCOME | On the successful completion of course students will be able to | | Knowledge |
|---|---|---|---|
| | CO1 | Classify the dimensional Manifolds and The Euler Characteristic of a surface | K1,K2 |
| | CO2 | Understand the concept of maximal and prime ideals | K2 |
| | CO3 | Acquire Knowledge groups and Product of Groups | K3,K4 |
| | CO4 | Seifert and Van Kampen Theorem on the Fundamental Group of the Union of Two spaces Applications | K4,K5 |

| COs – POs MAPPING | CO/ PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CO1 | 1 | - | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| | CO2 | - | 2 | - | - | - | - | - | - | - | 1 | - | - | - | - | 1 |
| | CO3 | 2 | - | - | - | - | - | - | - | - | - | - | 2 | - | 2 | - |
| | CO4 | 3 | - | - | - | - | - | - | - | - | - | - | - | - | 2 | - |
| | Low:1, Medium:2, High:3 | | | | | | | | | | | | | | | |

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| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | IV |
| **COURSE CODE & TITLE** | **20RMSCMAT401: COMMUTATIVE ALGEBRA** | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1. To introduce the concepts of A.C.C and D.C.C in ideals and modules<br>2. To provide knowledge on Noetherian rings and their properties.<br>3. To understand decompostion theorem and uniqueness theorem.<br>4. To explain alternative methods for studying the rings with D.C.C. | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | Ideals and Modules, Operation on sub modules, the isomorphism theorem s. ring homomorphism and residue class rings. The order of a subset of a module operations on ideals, prime and maximal ideals and primary ideals. | 15 |
| II | Finite conditions, composition series and direct sums. | 15 |
| III | **Noetherian rings**: Definitions, the Hillbert basis theorem, Ring with descending chain conditions, primary rings and Alternative method for studying the rings with d.e.c. | 15 |
| IV | The Lasker – Noetherian decomposition theorem, Uniqueness theorems. Applications to zero – divisors and nilpotent elements and applications to the intersection of the powers of an ideal. | 15 |

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| **REFERENCES** | Standard and treatment as in section 1 to 12 of Chapter III and Section 1 to 7 Chapter IV of the text book "COMMUTATIVE ALGEBRA" by Zariski and Samuel D.Van Nostrand Co.inc Princeton | | |
| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | | **Knowledge** |
| | CO1 | To learn the structures of composition series with ACC and DCC | K2,K5 |
| | CO2 | Understand the concept of Direct sum in Modules | K2 |
| | CO3 | To study the theoretical properties of Noetherian rings. To study the theoretical properties of Noetherian rings<br>Explain Hlbert's basis theorem and decomposition theorem | K2,K4,K5 |
| | CO4 | To develop applications in the different fields. | K5,K6 |

| **COs – POs MAPPING** | **CO/ PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CO1 | - | - | - | - | 2 | - | - | - | 2 | - | - | - | 1 | - | - |
| | CO2 | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | 2 |
| | CO3 | - | - | - | 1 | - | - | - | - | - | - | - | - | - | 1 | - |
| | CO4 | - | - | - | - | - | 3 | - | - | - | - | - | - | - | 1 | - |

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|---|---|---|---|
| | CO2 | Apply the theory of Internet and E mail concepts in our routine life | |
| | CO3 | Explaining the concept of HTML | |
| | CO4 | Able tounderstand Cascading Style Sheets | |

| COs – POs MAPPING | CO/ PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CO1 | - | - | - | - | - | - | - | 1 | - | - | - | 3 | - | 2 | - |
| | CO2 | 3 | - | - | - | - | - | 2 | - | - | - | - | - | - | - | - |
| | CO3 | - | - | 2 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| | CO4 | - | - | - | - | 3 | - | - | - | - | - | - | - | - | - | 2 |
| | Low:1, Medium:2, High:3 | | | | | | | | | | | | | | | |

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| PROGRAMME | M.Sc. Mathematics | SEMESTER | IV |
|---|---|---|---|
| COURSE CODE & TITLE | 20RMSCMAT402: NUMERICAL ANALYSIS | | |
| NUMBER OF CREDITS | 5 | HOURS/WEEK | 5 |
| COURSE OBJECTIVES | 1. To provide suitable and effective methods called Numerical Methods, for obtaining approximate representative numerical results of the problems<br>2. To make the students familiarize with the ways of solving complicated mathematical problems numerically. | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | Solutions of Algebraic and Transcendental Equations: Introduction - Bisection method – Method of False position - Newton Raphson – method solutions of non linear equations – Method of iteration.<br>[Above topics are from 2.1 to 2.7, 2.12 of Chapter-2 of the Text Book] | 15 |
| II | Interpolation And Approximation: Introduction - Lagrange Interpolation - Newton Divided Differences - Finite Difference Operators - Interpolating Polynomials using finite differences- Gregory- Newton forward difference interpolation- Backward difference interpolation - Stirling and Bessel interpolation - Spline interpolation – cubic splines. Finite differences- newton's formulae for interpolation- central interpolation formulae –gauss central difference formulae- strilling formula- bessels formula – legrange's interpolation formula.<br>[Above topics are from 3.1, 3.3, 3.6 ,3.7, 3.7.3,3.9.1,3.10, 3.13 of Chapter-3 of the Text Book] | 15 |
| III | Direct methods – matrix inversion method -Gauss Elimination Method - Gauss – Jordan Method – eigen value problems –Iterative Methods<br>[Above topics are from 6.3.1 to 6.3.4 , 6.3.7 and 6.4 of Chapter-6 of the Text Book] | 15 |
| IV | Numerical integration: Trapezoidal rule- Simpsons rules – numerical solution of ODEs by Picard – Euler - Modified Euler – Runge-Kutta methods.<br>[Above topics are from.4.1 to 5.4.3 of Chapter- 5 and 7.1 to 7.5 of Chapter- 7of the Text Book] | 15 |

| REFERENCES | |
|---|---|
| | 1. An Introduction to Numerical Analysis by Kendall E. Atkinson.<br>2. Information Technology and Numerical methods fot Atul Kahate<br>3. Theory and problems in Numerical Methods with programs in C and C++.<br>4. Numerical Methods and computing by Ward Cheney and David Kincaid<br>5. Numerical Methods for Scientific and Engineering Computation by |

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| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | IV |
| **COURSE CODE & TITLE** | **20RMSCMAT403: GRAPH THEORY** | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1. To introduce the fundamental concepts of graph theory<br>2. To Study the properties of Trees and Connectivity.<br>3. To explain Eulerian graphs and Hamiltonian graphs<br>4. To apply graph theory in diversified fields such as Electrical Engineering computers science and communication networks etc | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | Graphs &Subgraphs: Graphs and simple Graphs-Isomorphism-Incidence and adjacency Matrices-Sub graphs-Vertex Degrees-Paths ad connection –Cyles-Shortest path-Problem-Sperner's Lemma | 15 |
| II | Trees: Trees-Edges and Bonds-Cut vertices, cayley's Formula – Applications-Connected problem | 15 |
| III | Connectivity-Connectivity –Blocks-Application Construction of Reliable communications Networks. | 15 |
| IV | Euler Tours and Hamiltonian Cycles: Euler Tours – Hamilton cycles Application –Chinese Postman Problem –Travelling Salesman Problem . | 15 |

**REFERENCES**

1. Discrete Mathematics & Graph Theory, by SatyanarayanaBhavanari, K. Syam Prasad, PHI Pvt Ltd, New Delhi Second Edition,2014
2. Mathematical Foundation of Computer Science by SatyanarayanaBhavanari, T. V. Pradeep Kumar, Sk. Mohiddin Shaw, BS Publications, Hyderabad,2016.
3. Graph Theory with applications to Engineering and Computer Science NarsinghDeo
4. First look at Graph Theory- John Clark Derek Allaw Holton.
5. Introduction to Graph Theory- Robin . J. Wilson
6. Introduction to Graph Theory- Douglas B. West
7. Graph theory with applications to engineering and computer science by Narsing Deo, PHI
8. Discrete mathematics for computer scientists and Mathematics by J.L.Mott, A.Kandel and T.P.Baker, Prentice Hall of India

| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | **Knowledge** |
|---|---|---|
| | CO1 Able to define basic concepts of graphs Understand the properties of trees and use of connectivity | K2 |
| | CO2 Apply Cayley's formula to find number of spanning trees | K3,K5 |
| | CO3 Identify Eulerian and Hamiltonian graphs. | K1,K3,K4 |
| | CO4 Understand the concepts of practical problems like Chinese postman problem and travelling salesman | K2,K5,K6 |

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|---|---|---|---|
| | M. K. Jain, S. R. K. Iyengar, R. K. Jain, New Age International (p) Limited, Publishers, 5th Edition | | |
| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | | **Knowledge** |
| | CO1 | solve Algebraic and Transcendental polynomial equations | K2,K3 |
| | CO2 | Learn how to apply the Numerical method for various Mathematical operations and tasks | K2,K3 |
| | CO3 | Understand Interpolation,Differentiation,Integration,the solution of Differential Equations | K2 |
| | CO4 | Analyse and evaluate the accuracy of common Numerical methods | K4,K5 |

**COs – POs MAPPING**

| CO/ PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | - | 2 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| CO2 | - | 2 | - | - | - | - | - | 2 | - | - | - | - | - | - | 1 |
| CO3 | - | - | - | - | 3 | - | - | - | - | - | - | - | - | 1 | - |
| CO4 | - | - | - | - | - | - | - | - | - | 1 | - | - | - | 2 | - |

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| PROGRAMME | M.Sc. Mathematics | SEMESTER | IV |
|---|---|---|---|
| COURSE CODE & TITLE | 20RMSCMAT404A: FUZZY SETS AND FUZZY LOGIC | | |
| NUMBER OF CREDITS | 5 | HOURS/WEEK | 5 |
| COURSE OBJECTIVES | 1. Gain the main subject of fuzzy sets<br>2. Gain the methods of fuzzy logic.<br>3. Use the fuzzy set theory on the statistical method which is given.<br>4. Gain the knowledge on the cdoncept of Possibility theory | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | **Fuzzy Sets** : An overview –Basic Types and Concepts-Characteristics and significance of the Paradigm-Properties of –Cuts-Representation of Fuzzy sets-Extension Principle for Fuzzy Sets. | 15 |
| II | **Operations on Fuzzy Sets:** Types of Operations –Fuzzy complements –t-norms-conorms-Combinations of operations-Aggregation of Operations-Fuzzy Arithmetic – Fuzzy Numbers-Linguistic Variables-Arithmetic Operations on Intervals-Arithmetic Operations on Fuzzy Numbers-Lattice of Fuzzy Numbers –Fuzzy Equations. | 15 |
| III | **Fuzzy Relations** : Crisp versus Fuzzy Relations –Projections and Cylindrical Extensions-Binary Fuzzy Relations-Binary Relations on a Single Set-Fuzzy Compatibility Relations –Fuzzy Ordering Relations – Fuzzy Morphisms-Sup – Compositions of Fuzzy Relations –inf-wi Compositions of Fuzzy Relations – Fuzzy Relation Equations – General Discussion –Problem partifining-Solution Method-Fuzzy Relation Equations Based on sup-i Compositions Fuzzy Relation Equations Based on inf –wi Compositions –Approximate Solutions – The use of Neural Networks. | 15 |
| IV | Possibility Theory –Fuzzy Measures-Evidence Theory –Possibility Theory-Fuzzy sets and possibility Theory Versus-Probability Theory-Fuzzy logic –Classical Logic-Multivalued Logics- Fuzzy propositions – Fuzzy Quantifiers –Linguistic Hedges-Inference from Conditional Fuzzy Propositions – Inference from quantified propositions. | 15 |

| REFERENCES | |
|---|---|
| | 1. Introduction to Fuzzy sets and Fuzzy Logic –M. Ganesh –Phi Learning Pvt Ltd.<br>2. Fuzzy logic with Engineering Applications , Timothy J. Ross Wieley students Edition |

| COURSE OUTCOME | On the successful completion of course students will be able to | | Knowledge |
|---|---|---|---|
| | CO1 | Learn crips and fuzzy set theory | |
| | CO2 | Decide the difference between crips set and fuzzy set theory | |
| | CO3 | Make calculation on fuzy set theory. | |

| | | | | problem | | | | | | | | | | | | |
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| **COs – POs MAPPING** | **CO/ PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| | **CO1** | 3 | - | 1 | - | - | - | - | - | - | - | - | - | - | 2 | - |
| | **CO2** | - | 1 | - | - | - | - | - | 3 | - | - | - | - | - | - | 3 |
| | **CO3** | 2 | - | - | - | - | - | 3 | - | - | - | - | - | 1 | - | - |
| | **CO4** | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 |
| | Low:1, Medium:2, High:3 | | | | | | | | | | | | | | | |

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Department of Mathematics
V.S. University P.G. Centre
KAVALI 524 201

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| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | IV |
| **COURSE CODE & TITLE** | **20RMSCMAT404B: APPROXIMATION THEORY** | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1. To introduce basic concepts of Nomenclature of Normed linear space<br>2. To know the Existence and Unicity of Best approximation<br>3. To describe the polys algorithm and General linear families | | |

| **UNIT** | **CONTENT** | **NO. OF HOURS** |
|---|---|---|
| I | Nomenclature-Metric spaces-Normed linear space-Inner product spaces-convexity | 15 |
| II | Existence and Unicity of Best approximation-Convex functions-System of Equations with one unknown –Characterization of the solution –The special case n=n+1. | 15 |
| III | Polya's Algorithm-Ascent Algorithm –Descent Algorithm – Interpolation-Weierstrass Theorem. | 15 |
| IV | General linear Families –The Unicity Problem –Discretization Errors: General and Algebraic Polynomials-Markoff and Bernstein inequalities –Remes Algorithm. Scope and standard as in sections 1 to 7 of chapter 1, sections 1 to 8 of chapter 2, sections 1 to 8 of chapter 3 of " Introduction to Approximation Theory, E.W. Cheney, "McGraw Hill Book Company. | 15 |

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|---|---|
| **REFERENCES** | 1. Fundamentals of Approximation Theory by H.N. Mhaskar-Narosa Publications<br>2. Approximation theory and methods, M.j.d. Powell , Cambridge University Pres |

| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | **Knowledge** |
|---|---|---|
| | CO1 Understand the concept of Nomenclature | |
| | CO2 Understand the Existence and Unicity of Best approximation | |
| | CO3 Understand and apply algorithms in applications like sending messages without errors. | |
| | CO4 Understand the concept of General linear forms | |

| **COs – POs MAPPING** | **CO/ PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CO1 | 1 | - | - | - | - | - | - | 3 | - | - | - | - | - | - | 2 |
| | CO2 | - | - | - | - | - | 1 | - | - | - | 2 | - | - | - | 1 | - |
| | CO3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | CO4 | - | - | - | - | - | - | - | 3 | - | - | - | - | 2 | - | - |

| | | CO4 | | Recognize fuzzy logic fuzzy inference system | | | | | | | | | | | |
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| **COs – POs MAPPING** | **CO/ PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| | **CO1** | - | - | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| | **CO2** | - | 1 | - | - | - | - | - | - | 3 | - | - | - | - | - | 1 |
| | **CO3** | 1 | - | - | - | - | - | - | - | - | - | 3 | - | - | 2 | - |
| | **CO4** | 3 | - | - | - | - | - | - | - | - | - | - | - | - | 2 | - |
| | Low:1, Medium:2, High:3 | | | | | | | | | | | | | | | |

| PROGRAMME | M.Sc. Mathematics | SEMESTER | IV |
|---|---|---|---|
| COURSE CODE & TITLE | 20RMSCMAT404C: BANACH ALGEBRA | | |
| NUMBER OF CREDITS | 5 | HOURS/WEEK | 5 |
| COURSE OBJECTIVES | 1. To study Algebraic, Topological fields and the structure of Banach Algebra.<br>2. To discuss properties of Gelfand mapping.<br>3. To emphasize on applications of commutative C*-algebras.<br>4. To study the fixed point theorem and its applications. | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | Definition and some examples –Regular and Singular elements-Topological divisors of zeros. Spectrum –formula for the spectral radius –Radical and Semi-simplicity | 15 |
| II | Gelfand mapping – Applications of the formula r(x) = lim $\|x^n\|^{1/n}$ –Involutions in Bnach algebras –GelfandNeumark Theorem. | 15 |
| III | Ideals in C (X) and Banach stone theorem –Stone $C^{\wedge}$ ech compactification- Commutative$C^*$ algebras.Connectivity –Blocks-Application Construction of Reliable communications Networks. | 15 |
| IV | Fixed points theorems and some applications to analysis –Boolean algebras, Boolean Rings, and Stone's theorem. | 15 |

**REFERENCES**

(1) W. Arveson, introduction to C algebras, springs-Verlay 1976
(2) KehezhuAn introduction to Operator Algebras, CRC Press Inc. 1993
(3) T.W. Padmer, Banch Algebra Vol 1, Cambridge University Press 1994

| COURSE OUTCOME | On the successful completion of course students will be able to | Knowledge |
|---|---|---|
| | CO1 Understand different types of Banach Algebras with examples. | K2 |
| | CO2 Define ideals, radicals and properties of semi simple Banach Algebras. | K2,K4 |
| | CO3 Know the essence of Gelfand mapping. | K2,K5 |
| | CO4 Derive the applications of Banach Algebra in analysis, Fourier series,Boolean Algebras and other significant areas of mathematics. | K4,K5 |

**COs – POs MAPPING**

| CO/ PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | - | - | - | - | 1 | - | - | - | 1 | - | 1 | - | - |
| CO2 | 3 | - | - | 2 | - | - | - | - | - | - | - | - | - | - | 1 |
| CO3 | - | - | - | - | - | - | - | - | - | 3 | - | - | - | 2 | - |
| CO4 | - | - | - | - | - | 1 | - | - | - | - | - | - | - | 3 | - |

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| | Low:1, Medium:2, High:3 |

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| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | IV |
| **COURSE CODE & TITLE** | **20RMSCMAT405A: MATHEMATICAL STATISTICS** | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1. Elaborately illustrate the concept of distributive functions<br>2. Understand the notion of probability mass function and probability density function<br>3. Understand the meaning of the term corelatio0n and significance of its study<br>4. Compute and interprete Karl pearson correlation coefficient<br>5. Derive important properties of correlation coefficient<br>6. Understand the meaning and utility of sampling in Statistics<br>7. Know about various types of samplings | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | Distribution function, Discrete Random variables, Continuous random variables, Mathematical Expectation, Expected value of function of a random variable, Properties of Expectation, Properties of variance, Covariance, [Section5.2 to 5.4, Page no: 5.2 to 5.31, Section 6.2 to 6.6, Page no: 6.1 to 6.22, | 15 |
| II | Moment Generating Function, Characteristic function, Binomial Distribution, Poisson Distribution, Normal Distribution, Uniform Distribution. Section 7.1, 7.3(7.3.1&7.3.2 only),<br>. Page no: 7.2 to 7.6, Page no: 7.9 to 7.15, Section 8.4, 8.5, Page no: 8.4 to 8.47, Section 9.2.1 to 9.2.11 and 9.2.14, 9.3, Page no: 9.2 to 9.12, 9.14 to 9.28, and 9.30 to 9.37] | 15 |
| III | Correlation: Introduction, meaning of correlation, scatter diagram, Karl Pearson's Coefficient of Correlation, Rank Correlation, Linear and Curvilinear Regression: Introduction, linear regression, curvilinear regression. [Section 10.1 to 10.4(10.4.1, 10.4.2 only & in 10.7 –10.7.1 only), Page no: 10.1 to 10.16 and 10.23 – 10.25, Section 11.1 to 11.3, Page no: 11.1 to 11.19] | 15 |
| IV | Large Sampling theory: Introduction, types of sampling, parameters and statistic, tests of significance, null hypothesis, alternative hypothesis, critical region, power of the test, Neyman pearsons lemma, procedure for testing of hypothesis, tests of significance for large samples, Test of significance for single Proportion, Test of significance for Difference of Proportions.[Section 14.1 – 14.7.1, 14.7.2, Page no: 14.1 to 14.22] | 15 |

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|---|---|
| **REFERENCES** | 1. Mathematical Statistics by J.N.Kapur, H.C.Saxena - S. Chand publications<br>2. Introduction to Mathematical Statistics Robert V Hogg, Allencraig, Josep Mekean , Pearson Publishers<br>3. Fundamentals of Statistics by S.C.Gupta |

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| | Low:1, Medium:2, High:3 |

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| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | IV |
| **COURSE CODE & TITLE** | **20RMSCMAT405B:** ALGEBRAIC CODING THEORY | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1. To develop the knowledge among students about coding and decoding.<br>2. Explain the algorithms and error correcting and detecting patterns.<br>3. Introduce linear block codes and cyclic codes.<br>4. Discuss Hamming distances using other algebraic structures like Groups & vector spaces. | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | Introduction to Coding Theory: Introduction, Basic assumptions correcting and Detecting error patterns, Information Rate, The Effects of error Correction and Detection, finding the most likely code word transmitted some basic algebra, Weight and Distance, Maximum likelihood decoding Reliability of MLD, error detecting Codes, error – correcting Codes. (Chapter I). | 15 |
| II | Linear Codes : Linear Codes , Two important subspaces, Independence, Basics Dimension, Matrices, Bases for C=<S> and C, Generating Matrices and Encoding, Parity – Check Matrices, Equivalent Codes, Distance of a Linear Code, Cosets, MLD for Linear Codes Reliability of MLD for Linear Codes. (Chapter 2) | 15 |
| III | Perfect and Related Codes: Some bounds for Code, Perfect Codes, Hamming Codes, Extended Codes, The extended Golay Code, Decoding of the extended Golay Code, the Golay code, Reed- Mullar Codes, Fast decoding for RM (1,m). (Chapter 3). | 15 |
| IV | Cyclic Linear Codes: Polynomials and Words, Introduction to Cyclic codes, Polynomials encoding and decoding, Finding Cyclic Codes, Dual Cyclic Codes. (Chapter 4). | 15 |

**REFERENCES**

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| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | | **Knowledge** |
| | CO1 | Analyse Error detecting and error correcting codes. | K2,K4 |
| | CO2 | Understand and apply algorithms in applications like sending messages without errors. | K2 |
| | CO3 | Use bounds for different types of codes. | K3,K4,K5 |
| | CO4 | Understand the polynomial encoding and decoding. | K2,K5 |

| **COs – PO MAPPING** | **CO/ PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
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| | CO1 | | | | | | | | | | | | | | | |
| | CO2 | | | | | | | | | | | | | | | |

| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | | **Knowledge** |
|---|---|---|---|
| | CO1 | Extensive knowledge on Distributive functions and Mathematical expectation Demonstrate MGF and Characteristic functions | |
| | CO2 | Acquire knowledge on Distributions like Binomial,Poission and Normal | |
| | CO3 | Distinguish between karl pearson correlation coefficient and spearman"s rank correlation coefficient. To know the properties of Karl pearson coefficient | |
| | CO4 | Demonstrate the concept of parameter, static,sampling distribution of a static and its standard error,and their utility in Large sample test | |

| **COs – PO MAPPING** | **CO/ PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **CO1** | 1 | - | - | - | 2 | - | - | - | - | 3 | - | - | - | 1 | - |
| | **CO2** | - | 3 | - | - | - | - | - | 3 | - | - | - | - | - | - | 1 |
| | **CO3** | - | - | 1 | - | - | - | - | - | - | - | - | - | 2 | - | - |
| | **CO4** | - | 2 | - | - | - | - | - | - | - | - | 2 | - | - | - | 1 |
| | Low:1, Medium:2, High:3 | | | | | | | | | | | | | | | |

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| **PROGRAMME** | M.Sc. Mathematics | **SEMESTER** | IV |
| **COURSE CODE & TITLE** | **20RMSCMAT405C: COMPUTER NETWORKS** | | |
| **NUMBER OF CREDITS** | 5 | **HOURS/WEEK** | 5 |
| **COURSE OBJECTIVES** | 1. Introduce basic concepts of Networks ,and Internet models<br>2. Discuss the concept of Data Link Layer,Wired LANS and Wireless LANS<br>3. Explain the concept of Network Layer and Name space,Internet Electronic Mail etc…. | | |

| UNIT | CONTENT | NO. OF HOURS |
|---|---|---|
| I | Definition, Advantages of Networks, Network topologies, Types of Networks, Network models– Internet model, OSI model.<br>**Physical Layer:** Digital Transmission – Coding, Sampling, Analog Transmission - Modulation of digital and analog signals, Guided media | 15 |
| II | **Data Link Layer:** Error detection and correction, Data link Protocols - Stop and wait, Go-back-n, Selective repeat.<br>Wired LANS – Traditional Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LAN"s | 15 |
| III | **Network Layer**: Inter-networks, Addressing, Network layer Protocols – ARP, IPv4, IPv6, Transport Layer: Process- to- Process delivery, Congestion and Control, Quality of service (QOS) and techniques to improve QOS. | 15 |
| IV | Domain Name System-domain name space, distribution of name space, DNS in Internet Electronic mail, SMTP, File Transfer, FTP, HTTP, World Wide Web. | 15 |

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| **REFERENCES** | 1. Andrew S. Tanenbaum, "Computer Networks", Fourth Edition, 2003<br>2. Computer Networks by BhushanTrivedi,Oxford University Press<br>3. James F. Kuross, Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", Third Edition, Addison Wesley, 2004.<br>4. 4.Nader F. Mir, "Computer and Communication Networks", Pearson Education, 2007 5.Comer, "Computer Networks and Internets with Internet Applications", Fourth<br>5. Edition, Pearson Education, 2003.<br>6. William Stallings, "Data and Computer Communication", Sixth Edition, Pearson |

| **COURSE OUTCOME** | **On the successful completion of course students will be able to** | **Knowledge** |
|---|---|---|
| | CO1 Analyse Error detecting and error correcting codes. | |
| | CO2 Understand and apply algorithms in applications like sending messages without errors. | |
| | CO3 Use bounds for different types of codes | |

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| | CO3 | | | | | | | | | | | | | | | |
| | CO4 | | | | | | | | | | | | | | | |
| | Low:1, Medium:2, High:3 | | | | | | | | | | | | | | | |

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| | | CO4 | | Understand the concept of Domain Name System | | | | | | | | | | | | |
| **COs – PO MAPPING** | **CO/ PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| | **CO1** | 1 | - | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| | **CO2** | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | 1 |
| | **CO3** | 2 | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - |
| | **CO4** | 3 | - | - | - | - | - | - | - | - | - | - | - | - | 2 | - |
| | Low:1, Medium:2, High:3 | | | | | | | | | | | | | | | |

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