HINDI MAHAVIDYALAYA

(AUTONOMOUS & NAAC RE-ACCREDITED)

(Affiliated to Osmania University)

Nallakunta, Hyderabad-44

BOARD OF STUDIES

DEPARTMENT OF MATHEMATICS

M.Sc. Mathematics

1ST YEAR

2019-2020

HINDI MAHAVIDYALAYA

(AUTONOMOUS & NAAC RE-ACCREDITED)
(Affiliated to Osmania University)
Nallakunta, Hyderabad-44

DEPARTMENT OF MATHEMATICS
M.Sc. Mathematics

(BOS – MEETING ON 30-08-2019 at 11 AM)

SYLLABUS, MODEL PAPER
PANEL OF EXAMINERS etc...

For the Academic Year

2019-2020

HINDI MAHAVIDYALAYA

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3. Shri Thirupathaiah
   Lecturer
   Department of Mathematics
   Hindi Mahavidyalaya
   Nallakunta, Hyderabad

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Nallakunta, Hyderabad-44

DEPARTMENT OF MATHEMATICS

M.Sc. MATHEMATICS

SCHEME OF INSTRUCTION
AND
EXAMINATION
(THEORY AND SEMINARS)

HINDI MAHAVIDYALAYA

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DEPARTMENT OF MATHEMATICS

M.Sc. MATHEMATICS

FIRST YEAR

With effect from batch of students admitted from the Academic Year

2019-2020

under CBCS semester system

HINDI MAHAVIDYALAYA

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BOARD OF STUDIES

DEPARTMENT OF MATHEMATICS

(M.Sc. Mathematics)

AGENDA OF THE MEETING

1.1. Welcome address by the chair.

1.2. Details of choice base credit system.

1.3. Discussion on Syllabus of Semester I & II.

1.4. Marks allotted for Internal and End Semester exams.

1.5. Discussion on Semester Exam Model Paper & Internal Exam Model Paper of Semester I & II.

1.6. Discussion on Practical Exam Model Paper of Semester I & II.

1.7. Panel of Examiners

1.8. Any other matter

1.9. Vote of Thanks

Chairperson

University Nominee

Dr. N. KISHAN
M.Sc., Ph.D.
Professor & chairperson B.O.S.
Dept.of. Mathematics
Osmania University,Hyderabad-500 007

Members

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Principal

HINDI MAHAVIDYALAYA

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BOARD OF STUDIES

DEPARTMENT OF MATHEMATICS

ACADEMIC YEAR – 2019-20

MINUTES OF BOARD OF STUDIES MEETING

BOS meeting of the Department of ~~APPLIED STATISTICS~~ MATHEMATICS was held on 30TH August 2019 at 11:00 AM.

The following members were present

Mrs. Sree Vani	-	Chairperson
Prof. N.Kishan	-	University Nominee
Prof. M. Srinivas	-	Member
Mrs. Sharada	-	Member
Mr. T. Thirupathaiah	-	Member

1.1 Welcome address by the chair

The chair welcomed the University Nominee, Ex-officio member BOS, O.U. Department of Mathematics and Members of B.O.S.

1.2 Details of choice based credit system.

Members were informed that TSCHE has referred that from the academic year 2016-17 autonomous institutions have to follow CBCS i.e. From the Academic Year 2016-17 Osmania University has instructed all the Degree colleges including Autonomous Degree colleges to follow CBCS under which after passing the exam student will get the Grade in the Final Result. 5 Credits are given for theory paper and each semester and 1 Credit for seminar in each subject.

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Dr. N. KISHAN
M.Sc., Ph.D.
Professor & chairperson B.O.S.

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1.3 **Discussion and Distribution of Common Core Syllabus.**

i. Members were informed by the chair that Department of Mathematics, Hindi Mahavidyalaya is following syllabus prescribed by Osmania University for.

iii. We are aadopting Osmani University same syllabus of each semester as it is without any changes.

Syllabus copy for Ist Year both the semesters is enclosed.
Syllabus was approved by the Members of BOS.

1.4 **Marks allotted for Internal and End Semester exams (I & II).**

1. Internal assessment is of 15 marks. In each semester two internal assessments of 15 Marks will be conducted and an average of both the internal assessments will be added in the marks of theory exam and one ne assignment is of 5 Marks, total of 20 Marks.
2. Theory Question paper is of 80 marks.
3. Total allotted marks are 100.

The distribution of marks was approved by the Members of BOS.

1.5 **Discussion on Pattern and Model Paper of Semester exam and Model Paper of Internal Exam**

1. Each Semester Two Internal exams will be conducted for 15 marks. The internal assessment will have three sections.

Section – A 10 Multiple choice questions each carries ½ marks (10x ½ = 5M),
Section – B 10 Fill in the blanks each carries ½ marks (10x ½ = 5M) and
Section – C 5 short notes each 1mark (5x1=5)

Average of marks of these two internal exams will be taken.

2. Semester exam will be conducted as per the Almanac which will be provided by the exam branch. Internal exam duration will be 30Mnts and Semester exam duration will be of 3 hrs.
3. Model Question paper for Semester I and Semester II was discussed. Theory paper for each Semester will have 2 sections.

(i) Section A contains 8 short Questions (2 questions from each unit) . Each Question carries 4 Marks (8X4=32 Marks)

(ii) Section B contains 4 Essay type Questions with internal choice. Each Question carries 12 Marks (4X12=48 Marks)

- Pattern of Model Theory Question Papers for Semester I & II are approved.

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1.6 **Panel of Examiners**

The panel of examiners was approved by the members.

- List is enclosed

1.7 **Any other matter.**

1. The syllabus for the batch (2019-20) is also approved by the members.
2. It is resolved to follow from 2019-20 batch that the practical examination held for MSc. I[st] Year will have pattern of 100 marks scheme and 5 credits with 3 hrs duration.

1.8 **Vote of Thanks**

Meeting concluded with the Vote of Thanks by Mrs. Sree Vani

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	Dr. N. KISHAN M.Sc., Ph.D. Professor & chairperson B.O.S. Dept.of. Mathematics Osmania University.Hyderabad-500 007	1. 2. 3.	

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Nallakunta, Hyderabad-44

M.SC. MATHEMATICS

Choice Based Credit System(CBCS)

Semester - I

S.No.	Code No	Paper	Paper Title	Hrs/ Week	Theory	T*	Continuous Evaluation	Semester End Exam	Total Marks	Credits
	Theory						Internal Assessment			
1	MM 101	I	Abstract Algebra	6	5	1	20	80	100	5
2	MM 102	II	Mathematical Analysis	6	5	1	20	80	100	5
3	MM 103	III	Ordinary and Partial Differential Equations	6	5	1	20	80	100	5
4	MM 104	IV	Elementary Number Theory	6	5	1	20	80	100	5
5	MM 105	V	Discrete Mathematics	5	4	1	20	80	100	4
6			Seminar	2	2		5	20	25	1
			Total	31					525	25

T*-Tutorial Class for problems solving session.

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M.SC. MATHEMATICS

Choice Based Credit System(CBCS)

Semester - II

S.No.	Code No	Paper	Paper Title	Hrs/ Week	Theory	T*	Continuous Evaluation	Semester End Exam	Total Marks	Credits
	Theory						Internal Assessment			
1	MM 201	I	Galois Theory	6	5	1	20	80	100	5
2	MM 202	II	Lebesgue measure & Integration	6	5	1	20	80	100	5
3	MM 203	III	Complex Analysis	6	5	1	20	80	100	5
4	MM 204	IV	Topology	6	5	1	20	80	100	5
5	MM 205	V	Theory of Ordinary Differential Equations	5	4	1	20	80	100	4
6			Seminar	2	2		5	20	25	1
			Total	31					525	25

T*-Tutorial Class for problems solving session.

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DEPARTMENT OF MATHEMATICS

M.Sc. Mathematics

Semester I

SYLLABUS

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M.SC. MATHEMATICS

MM 101
HPW:6

SEMESTER – I
C/L/T: 5/5/1

PAPER – I : ABSTRACT ALGEBRA

Objective:

- *It is one of the basic pillars of modern mathematics.*
- *The focus of the course will be the study of certain structures called groups, rings, fields and some related structures.*
- *It gives to student a good mathematical maturity and enables to build mathematical thinking.*

Unit-I

Automorphisms - Conjugacy and G - sets - Normal series Solvable groups - Nilpotent groups. (Pages 104 to 128 of [1])

Unit-II

Structure theorems of groups: Direct product - Finitely generated abelian groups - Invariants of a finite abelian group - Sylow's theorems - Groups of orders p2, pq . (Pages 138 to 155)

Unit-III

Ideals and homomorphisms - Sum and direct sum of ideals, Maximal and prime ideals - Nilpotent and nil ideals - Zorn's lemma (Pages 179 to 211).

Unit-IV

Unique factorization domains - Principal ideal domains - Euclidean domains - Polynomial rings over UFD - Rings of Fractions.(Pages 212 to 228)

Text Book:

Basic Abstract Algebra by P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul and Topics in Algebra by I.N. Herstein.

Reference:

[1] Elements of Modern Algebra by Gibert& Gilbert.

[2] Abstract Algebra by Jeffrey Bergen.

[3] Basic Abstract Algebra by Robert B Ash.

Chairperson

University Nominee

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BOS-DEPARTMENT OF MATHEMATICS

M.SC. MATHEMATICS

MM 101
HPW:6

SEMESTER – I
C/L/T: 5/5/1

PAPER – I : ABSTRACT ALGEBRA

Course Outcomes:

- *To classify numbers into number sets.*
- *To combine polynomial by addition or subtraction.*
- *To solve problems of simple inequalities.*
- *Interpret basic absolute value expression*
- *To simplify algebraic expressions, using the commutative, associative and distributive properties.*

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M.SC. MATHEMATICS

MM 102
HPW:6

SEMESTER – I
C/L/T: 5/5/1

PAPER – II : MATHEMATICAL ANALYSIS

Objective:

- *Have the knowledge of basic properties of the field of real numbers.*
- *Have the knowledge of the series of real numbers and convergence.*
- *Studying Bolzano-Weirstrass theorem and Cauchy criteria.*
- *Studying the basic topological properties of the real numbers.*
- *Studying the notations of continuous functions and their properties.*
- *Studying the differentiability of real functions and related theorems.*

Unit-I
Metric spaces - Compact sets - Perfect sets - Connected sets.

Unit-II
Limits of functions - Continuous functions - Continuity and compactness, Continuity and connectedness - Discontinuities - Monotone functions.

Unit-III
Riemann-Steiltjes integral-Definition and Existence of the Integral-Properties of the integral-Integration of vector valued functions-Rectifiable curves.

Unit-IV
Sequences and series of functions: Uniform convergence - Uniform convergence and continuity Uniform convergence and integration-Uniform convergence and differentiation-Approximation of a continuous function by a sequence of polynomials.

Text Book:

Principles of Mathematical Analysis (3rd Edition) (Chapters 2, 4, 6) By Walter Rudin, Mc Graw - Hill Internation Edition and Mathematical Analysis Vol - I by D J H Garling.

References:

[1] The Real Numbers by John Stillwel.

[2] Real Analysis by Barry Simon

[3] Measure and Integral by Richard L.Wheeden and Antoni Zygmund.

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MM 102
HPW:6

SEMESTER – I
C/L/T: 5/5/1

PAPER – II : MATHEMATICAL ANALYSIS

Course Outcomes:

- *Describe fundamental properties of the real numbers that lead to the formal development of mathematical analysis.*
- *Comprehend regions arguments developing the theory underpinning mathematical analysis.*
- *Demonstrate an understanding of limits and how that are used in sequences, series and differentiation.*
- *Construct rigorous mathematical proofs of basic results in mathematical analysis.*

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MM 103
HPW:6

SEMESTER – I
C/L/T: 5/5/1

PAPER – III : ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

Objective:

- *Understand all of the concepts relan g to the order and linearity of ODE.*
- *Apply your understanding of the concept, formulas and problems solving procedures to thoroughly investigate relevant physical models.*
- *Explain the concepts of linear systems, ODE solutions methods and related ideas at a fundamental level as well as how and why we use the solution techniques that we use.*
- *To equip student's with the concepts of partial differential equations and how to solve linear PDE with different methods.*
- *Students also will be introduced to some physical problems in engineering models that results partial differential equations.*

Unit-I

Existence and Uniqueness of solution and problems there on. The method of successive approximations-Picard's theorem-Non-Linear PDE of order one - Charpit's method - Cauchy's method of Characteristics for solving non - linear partial differential equations - Linear Partial Differential Equations with constant coefficients.

Unit-II

Partial Differential Equations of order two with variable coefficients Canonical form Classification of second order Partial Differential Equations separation of variables method of solving the one dimensional Heat equation, Wave equation and Laplace equation Sturm Liouville's boundary value problem.

Unit-III

Power Series solution of O.D.E. Ordinary and Singular points - Series solution about an ordinary point Series solution about Singular point-Frobenius Method. **Lagendre Polynomials:** Legendre's equation and its solution Legendre Polynomial and its properties- Generating function-Orthogonal properties-Recurrance relations-Laplace's definite integrals for $P_n(x)$ Rodrigue's formula.

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M.SC. MATHEMATICS

MM 103 | SEMESTER – I
HPW:6 | C/L/T: 5/5/1

PAPER – III : ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

Unit-IV

Bessels Functions: Bessel's equation and its solution - Bessel function of the first kind and its properties - Recurrence Relations - Generating function - Orthogonality properties. **Hermite Polynomials:** Hermite's equation and its solution - Hermite polynomial and its properties - Generating function - Alternative expressions (Rodrigue's formula) - Orthogonality properties - Recurrence Relations.

Text Books:

[1] **Ordinary and Partial Differential Equations**, By M.D. Raisingania, S. Chand Company Ltd., New Delhi.

[2] **Text book of Ordinary Differential Equation**, By S.G.Deo, V. Lakshmi Kantham, V. Raghavendra, Tata Mc.Graw Hill Pub. Company Ltd.

[3] **Elements of Partial Differential Equations**, By Ian Sneddon, Mc.Graw - Hill International Edition.

Reference:

[1] Worldwide Differential equations by Robert McOwen .

[2] Differential Equations with Linear Algebra by Boelkins, Goldberg, Potter.

[3] Differential Equations By Paul Dawkins.

[4] Paper - IV: Elementary Number Theory

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M.SC. MATHEMATICS

MM 103
HPW:6

SEMESTER – I
C/L/T: 5/5/1

PAPER – III : ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

Course Outcomes:

- *Demonstrate familiarity with emerging mathematical techniques appropriate in banks and other financial institutions.*
- *Demonstrate an ability to select and apply numerical methods appropriate for the solution of financial problems.*
- *The principles of mathematical reasoning and their use in understanding analyzing and developing formal arguments.*
- *The connections between the mathematical series and other scientific and humoristic disciplines.*
- *Undertake a piece of directed in mathematical finance.*

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M.SC. MATHEMATICS

MM 104
HPW:6

SEMESTER – I
C/L/T: 5/5/1

PAPER – IV : ELEMENTARY NUMBER THEORY

Objective:

- *Elementary Number Theory is the study of the basic structure and properties of integers.*
- *Learning number theory helps improving one's ability of mathematical thinkings.*
- *The aim of the module is to introduce student to some of the basic ideas of number theory and to use this as a context in which to discuss the development of mathematics through examples, conjectures, theorems, proofs and applications.*

Unit-I

The Fundamental Theorem of arithmetic: Divisibility, GCD, Prime Numbers, Fundamental theorem of Arithemtic, the series of reciprocal of the Primes, The Euclidean Algorithm.

Unit-II

Arithmetic function and Dirichlet Multiplication, The functions $\varphi(n)$, $\mu(n)$ and a relation connecting them, Product formulae for $\varphi(n)$, Dirichlet Product, Dirichlet inverse and Mobius inversion formula and Mangoldt function $\Lambda(n)$, multiplication function, multiplication function and Dirichlet multiplication, Inverse of a completely multiplication function, Liouville's function $\lambda(n)$, the divisor function is $\sigma_\alpha(n)$

Unit-III

Congruences, Properties of congruences, Residue Classes and complete residue system, linear congruences conversion, reduced residue system and Euler Fermat theorem, polynomial congruence modulo P , Lagrange's theorem, Application of Lagrange's theorem, Chinese remainder theorem and its application, polynomial congruences with prime power moduli

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M.SC. MATHEMATICS

MM 104 SEMESTER – I

HPW:6 C/L/T: 5/5/1

PAPER – IV : ELEMENTARY NUMBER THEORY

Unit-IV

Quadratic residue and quadratic reciprocity law, Quadratic residues, Legendre's symbol and its properties, evaluation of $(-1/p)$ and $(2/p)$, Gauss Lemma, the quadratic reciprocity law and its applications.

Text Book:

Introduction to analytic Number Theory by Tom M. Apostol. Chapters 1, 2, 5, 9 and Theory of Numbers by K.Ramchandra.

References:

[1] Number Theory by Joseph H. Silverman.

[2] Elementary Number Theory by James K Strayer.

[3] Elementary Number Theory by James Tattusall.

Chairperson University Nominee Members Principal

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M.SC. MATHEMATICS

MM 104
HPW:6

SEMESTER – I
C/L/T: 5/5/1

PAPER – IV : ELEMENTARY NUMBER THEORY

Course Outcomes:

- *Prove results involving divisibility and greatest common divisors.*
- *Solve systems of linear congruences.*
- *Find integral solutions to specified linear Diophantine Equations.*
- *Apply Euler-Fermat's Theorem to prove relations involving prime numbrs.*
- *Apply the Wilson's theorem.*

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BOS-DEPARTMENT OF MATHEMATICS
M.SC. MATHEMATICS

MM 105 | SEMESTER – I
HPW:5 | C/L/T: 4/4/1

PAPER – V : DISCRETE MATHEMATICS

Objective:

- *Simplify and evaluate basic logic statements including compound statements implications, inverse, converses and contrapositives using truth tables and the properties of logic.*
- *Apply the operations of sets and use Venn diagrams to solve applied problems.*
- *Determine if a given graph is simple or a mulg raph, directed or undirected, cyclic or acyclic and determine the connectivity of a graph.*
- *Determine of a graph has an Euler or a Hamilton path or circuit.*
- *Perform tree traversals using preorder, inorder and post order traversals and apply these traversals to application problems. Use binary search trees or decision trees to solve.*

Unit-I

Mathematical Logic: Propositional logic, Propositional equivalences, Predicates and Quantifiers, Rule of inference, direct proofs, proof by contraposition, proof by contradiction. **Boolean Algebra:** Boolean functions and its representation, logic gates, minimizations of circuits by using Boolean identities and K - map.

Unit-II

Basic Structures: Sets representations, Set operations, Functions, Sequences and Summations. Division algorithm, Modular arithmetic, Solving congruences, applications of congruences. **Recursion:** Proofs by mathematical induction, recursive definitions, structural induction, generalized induction, recursive algorithms.

Unit-III

Counting: Basic counting principle, inclusion - exclusion for two sets, pigeonhole principle, permutations and combinations, Binomial coefficient and identities, generalized permutations and combinations. **Recurrence Relations:** introduction, solving linear recurrence relations, generating functions, principle of inclusion - exclusion, applications of inclusion - exclusion. **Relations:** relations and their properties, representing relations, closures of relations, equivalence relations, partial orderings.

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M.SC. MATHEMATICS

MM 105
HPW:5

SEMESTER – I
C/L/T: 4/4/1

PAPER – V : DISCRETE MATHEMATICS

Unit-IV

Graphs: Graphs definitions, graph terminology, types of graphs, representing graphs, graph isomorphism, connectivity of graphs, Euler and Hamilton paths and circuits, Dijkstras algorithm to find shortest path, planar graphs Eulers formula and its applications, graph coloring and its applications. **Trees:** Trees definitions properties of trees, applications of trees BST, Haffman Coding, tree traversals: preorder, inorder, postorder, prefix, infix, postfix notations, spanning tress DFS, BFS, Prims, Kruskals algorithms.

Text Book:

Discrete Mathematics and its Applications by Kenneth H. Rosen and **Discrete Mathematical Structures with Applications to Computer Science** by J.P. Tremblay,R. Manohar.

References:

[1] **Discrete and Combinatorial Mathematics** by Ralph P. Grimaldi

[2] **Discrete Mathematics for Computer Scientists** by Stein, Drysdale, Bogart

[3] **Discrete Mathematics for Computer Scientists and Mathematicians** by Joe L. Mott, Abraham Kandel, Theoder P. Baker

Chairperson

University Nominee

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M.SC. MATHEMATICS

MM 105
HPW:5

SEMESTER – I
C/L/T: 4/4/1

PAPER – V : DISCRETE MATHEMATICS

Course Outcomes:

- *Understand the basic principles of sets and operations in sets.*
- *Apply counting principles to determine probabilities*
- *Demonstrate different traversal methods for trees and graphs.*
- *Write model problems in computer science using tree and graphs.*
- *Write an argument using logical notation and determine if the argument is or is not valid.*
- *Determine when a function is one-one and onto.*
- *Prove basic set qualities.*
- *Demonstrate the ability to write and evaluate a proof.*

Chairperson

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Nallakunta, Hyderabad-44

DEPARTMENT OF MATHEMATICS

M.Sc. Mathematics

Semester II

SYLLABUS

HINDI MAHAVIDYALAYA, NALLAKUNTA, HYDERABAD
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BOS-DEPARTMENT OF MATHEMATICS
M.SC. MATHEMATICS

MM 201
HPW:6

SEMESTER – II
C/L/T: 5/5/1

PAPER – I : GALOIS THEORY

Objective:

- *Galois theory gives a connection of the theory of polynomial equations and group theory.*
- *To have understood the fundamental theorem of Galois theory and how together with some results of group theory, this sheds light to solubility of polynomial equations.*

Unit-I

Algebraic extensions of ftelds: Irreducible polynomials and Eisenstein criterion - Adjunction of roots - Algebraic extensions - Algebraically closed fields (Pages 281 to 299).

Unit-II

Normal and separable extensions: Splitting fields - Normal extensions - Multiple roots - Finite fields - Separable extensions (Pages 300 to 321).

Unit-III

Galois theory: Automorphism groups and fixed fields - Fundamental theorem of Galois theory - Fundamental theorem of Algebra (Pages 322 to 339).

Unit-IV

Applications of Galois theory to classical problems: Roots of unity and cyclotomic polynomials - Cyclic extensions - Polynomials solvable by radicals - Ruler and Compass constructions. (Pages 340 - 364).

Text Book:

Basic Abstract Algebra by S.K. Jain, P.B. Bhattacharya, S.R. Nagpaul and **Topics in Algebra** by I.N. Herstein.

References:

[1] **Elements of Modern Algebra** by Gibert& Gilbert.

[2] **Abstract Algebra** by Jeffrey Bergen.

[3] **Basic Abstract Algebra** by Robert B Ash.

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M.SC. MATHEMATICS

MM 201
HPW:6

SEMESTER – II
C/L/T: 5/5/1

PAPER – I : GALOIS THEORY

Course Outcomes:

- *Explain the fundamental concepts of Galois Theory and their role in modern mathematics and applied contexts.*
- *Explain Demonstrate accurate and efficient use of advanced algebraic techniques.*
- *Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from advanced algebra.*
- *Apply problem solving using Galois Theory techniques applied to diverse situations in physics, engineering and other mathematical finance.*

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M.SC. MATHEMATICS

MM 202 SEMESTER – II

HPW:6 C/L/T: 5/5/1

PAPER – II : LEBESGUE MEASURE & INTEGRATION

Objective:

- *Measure theory formalizes and generalizes the notion of integration.*
- *It is fundamental to many areas of mathematics and probability and has applications in other fields such as physics and economics.*
- *Students will be introduced to Lebesgue measure and integration, the Hahn-Jordan decomposition, conditional expectation, Borel Sets and standard Borel spaces, product measures.*

Unit-I

Algebra of sets-Borel sets-Outer measure-Measurable sets and Lebesgue measure-A non-measurable set-Measurable function-Littlewood three principles.

Unit-II

The Riemann integral-The Lebesgue integral of a bounded function over a set of finite measure-The integral of a non-negative function-The general Lebesgue integral.

Unit-III

Convergence in measure - Differentiation of a monotone functions - Functions of bounded variation.

Unit-IV

Differentiation of an integral - Absolute continuity - The Lp - spaces - The Minkowski and Holders inequalities Convergence and completeness.

Text Book:

Real Analysis (3rd Edition)(Chapters 3, 4, 5) by H. L. Royden Pearson Education (Low Price Edition) and **Measure and Integral** by Richard L.Wheeden, Anotoni Zygmund.

References:

[1] **Lebesgue measure and Integrao n** by G.de Barra.

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M.SC. MATHEMATICS

MMA 202 — SEMESTER – II
MPMC8 — C/L/T: 5/5/1

PAPER – II : LEBESGUE MEASURE & INTEGRATION

Course Outcomes:

- Read, analyze and write logical arguments to prove mathematical concepts.
- Communicate mathematical ideas with clarity and coherence both written and verbally.
- Fundamental objects, techniques and theorems in the mathematical sciences including the basis of analysis.
- Master the object material in the four required core course that forms the academic pillars of the program.
- Demonstrate a competence in formulating, analyzing and solving problems in several core areas of mathematics at a detailed level, including analysis.

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MM 203 | **SEMESTER – II**

HPW:6 | **C/L/T: 5/5/1**

PAPER – III : COMPLEX ANALYSIS

Objective:

- This course is aimed to provide an introduction to the theories for functions of a complex variables.
- It begins with exploration of the algebraic, geometric and topological structures of the complex number fields.
- The concepts of analyticity , Couchy-Riemann relations and Harmonic functions are then introduced.
- We then discuss the classification of isolated singularities and examine the theory and illustrate the applications of the calculus of residues in the evaluation of integrals.
- In particular student will acquire the skill of contour integration to evaluate complicated real integrals via residue calculus.

Unit-I

Regions in the Complex Plane - Functions of a Complex Variable - Mappings - Mappings by the Exponential Function - Limits - Limits Involving the Point at Infinity - Continuity - Derivatives - Cauchy Riemann Equations - Sufficient Conditions for Differentiability - Analytic Functions - Harmonic Functions - Uniquely Determined Analytic Functions - Reflection Principle - The Exponential Function - The Logarithmic Function - Some Identities Involving Logarithms - Complex Exponents - Trigonometric Functions - Hyperbolic Functions

Unit-II

Derivatives of Functions $w(t)$ - Definite Integrals of Functions $w(t)$ - Contours - Contour Integrals - Some Examples - Examples with Branch Cuts - Upper Bounds for Moduli of Contour Integrals Anti derivatives - Cauchy Goursat Theorem - Simply Connected Domains - Multiply Connected Domains - Cauchy Integral Formula - An Extension of the Cauchy Integral Formula - Liouville's Theorem and the Fundamental Theorem of Algebra - Maximum Modulus Principle.

Unit-III

Convergence of Sequences - Convergence of Series - Taylor Series - Laurent Series - Absolute and Uniform Convergence of Power Series - Continuity of Sums of Power Series - Integration and Differentiation of Power Series - Uniqueness of Series Representations - Isolated Singular Points - Residues - Cauchy's Residue Theorem - Residue at Infinity - The Three Types of Isolated Singular Points - Residues at Poles - Examples - Zeros of Analytic Functions - Zeros and Poles - Behavior of Functions Near Isolated Singular Points.

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M.SC. MATHEMATICS

MM 203 | SEMESTER – II
HPW:6 | C/L/T: 5/5/1

PAPER – III : COMPLEX ANALYSIS

Unit-IV

Evaluation of Improper Integrals - Improper Integrals from Fourier Analysis - Jordan's Lemma - Indented Paths - Definite Integrals Involving Sines and Cosines - Argument Principle - Rouche's Theorem - Linear Transformations - The Transformation $w = 1/z$ - Mappings by $1/z$ - Linear Fractional Transformations - An Implicit Form - Mappings of the Upper Half Plane.

Text Book:

Complex Variables with applications by James Ward Brown, Ruel V Churchill and Complex Variables with Applications by S.Ponnusamy, Herb Silverman.

References:

[1] Complex Analysis by Dennis G.Zill.

[2] Complex Variables by Stevan G. Krantz.

[3] Complex Analysis by Joseph Bak, Donald J. Newman.

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M.SC. MATHEMATICS

MM 203
HPW:6

SEMESTER – II
C/L/T: 5/5/1

PAPER – III : COMPLEX ANALYSIS

Course Outcomes:

- *Justify the need for a Complex Number System and explain how is related to other existing number systems*
- *Define a function of complex variable and carry out basic mathematical operations with complex numbers.*
- *know the condition(s) for a complex variable function to be analyc and/or harmonic .*
- *State and prove the Cauchy Riemann Equation and use it to show that a function is analyc .*
- *define singularities of a function, know the different types of singularie s, and be able to determine the points of singularities of a function*
- *Explain the concept of transformation in a complex space (linear and non-linear) and sketch associated diagrams.*

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MM 204
HPW:6

SEMESTER – II
C/L/T: 5/5/1

PAPER – IV : TOPOLOGY

Objective:

- *To explain how to distinguish spaces by means of simple topological invariants (compactness, connectedness and the fundamental group).*
- *To explain how to construct spaces by gluing and to prove that in certain cases that the result is homeomorphic to a standard space.*
- *To construct simple examples of spaces with given properties (Eg. Compact but not connected or connected but not path connected).*

Unit-I
Topological Spaces: The Definition and examples - Elementary concepts - Open bases and open subbases Weak topologies.

Unit-II
Compactness: Compact spaces - Products of spaces - Tychonoff's theorem and locally compact spaces - Compactness for metric spaces - Ascoli's theorem.

Unit-III
Separation: $T1$ - spaces and Hausdorff spaces - Completely regular spaces and normal spaces - Urysohn's lemma and the Tietze extension theorem - The Urysohn imbedding theorem.

Unit-IV
Connectedness: Connected spaces - The components of a spaces - Totally disconnected spaces - Locally connected spaces.

Text Book:

Introduction to Topology and Modern Analysis (Chapters 3,4,5,6) By G.F. Simmon's Tata Mc Graw Hill Edition and Elementary Topology by Michael C. Gemignani.

References:

[1] Introductory Topology by Mohammed H. Mortad.

[2] Explorations in Topology by David Gay.

[3] Encyclopedia of General Topology by Hart, Nagata, Vanghan.

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MM 204 | **SEMESTER – II**

HPW:6 | **C/L/T: 5/5/1**

PAPER – IV : TOPOLOGY

Course Outcomes:

- *Topology uses to analyze complex networks.*
  Ex: Social networks, Biological networks, Internet etc.
- *It applies Differential Topology to probability to identify multivariate interactions. This was used in neuro science recently to deduce how neurons are interacting.*
- *This paper discusses using cell phones to actually map out the topology of indoor spaces.*
- *Another cool application is in the world of chemistry where one can discuss the shape of molecules by an analysis of the topology of a related graph.*
- *There is also an application for medical imaging software and technology.*

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MM 205
HPW:5

SEMESTER – II
C/L/T: 4/4/1

PAPER – V : THEORY OF ORDINARY DIFFERENTIAL EQUATIONS

Objective:

- *The general purpose of this course is to introduce basic concepts of theory of ordinary differential equations.*
- *To give several methods including the series methods for solving linear and non linear differential equations.*
- *To learn about existence and uniqueness of the solution to the non linear initial value problems.*
- *First order differential equations, linear differential equations of higher order, linear dependence and independence, wronskian.*

Unit-I

Linear differential equations of higher order: Introduction - Higher order equations-A Modelling problem Linear Independence - Equations with constant coefficients Equations with variable coefficients - Wronskian - Variation of parameters - Some Standard methods.

Unit-II

Existence and uniqueness of solutions: Introduction-Preliminaries-Successive approximations-Picards theorem - Continuation and dependence on intial conditions-existence of solutions in the large - existence and uniqueness of solutions of systems - fixed point method.

Unit-III

Analysis and methods of non - linear differential equations: Introduction - Existence theorem Extremal solutions - Upper and Lower solutions - Monotone iterative method and method of quasi linearization-Bihari's inequality, Application of Bihari's inequality.

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M.SC. MATHEMATICS

MM 205 | SEMESTER – II
HPW:5 | C/L/T: 4/4/1

PAPER – V : THEORY OF ORDINARY DIFFERENTIAL EQUATIONS

Unit-IV

Oscillation theory for linear Differential Equation of Second order: The adjoint equation - Self adjoint linear differential equation of second order - Abel's formula - the number of zeros in a finite interval - The sturm separation theorem - the strum comparison theorem the sturmpicone the Bocher Osgood theorem-A special pair of solution - Oscillation on half axis.

Text Book:

An Introduco n to Ordinary Die rena l Equao ns by Earl A Coddington and **Text book of Ordinary Differential Equation**, By S.G.Deo, V. Lakshmi Kantham, V. Raghavendra, Tata Mc.Graw Hill Pub. Company Ltd.

References:

[1] **Differential Equations** by Edward, Penny, Calvis.
[2] **Differential Equation** by Harry Hochstardt.

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M.SC. MATHEMATICS

MM 205
HPW:5

SEMESTER – II
C/L/T: 4/4/1

PAPER – V : THEORY OF ORDINARY DIFFERENTIAL EQUATIONS

Course Outcomes:

- *The study of Differential focuses on the existence and uniqueness of solutions and also emphansizes the rigorous justification of methods for approximating solutions in pure and applied mathematics.*
- *It plays an important role in modelling virtually every physically technical or biological process from celestial motion to bridge design to interactions between neurons.*
- *Theory of differential equations is widely used in formulating many fundamental laws of physics and chemistry.*
- *Theory of differential equation is used in economics and biology to model the behaviour of complex systems.*
- *Differential equations have a remarkable ability to predicts the world around us. They can describe exponential growth and decay population growth of species or change in investment return over time.*

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DEPARTMENT OF MATHEMATICS

M.Sc. Mathematics

Semester I & Semester II

PATTERN OF
INTERNAL ASSESSMENT QUESTION PAPER
AND
THEORY QUESTION PAPER

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The pattern of internal assessment test from the academic year 2018-2019 with the following specifications:

Two internal Assessment Tests of 15 Marks each (Average to taken)
One Assignment : 05 Marks
Total : 20 Marks

Internal Tests
I test to be conducted at the end of the 9th week of instruction (Covering 2/3 units of the syllabus).
II test to be conducted at the end of the 14th week of instruction (Covering the rest of the units).
Assignment
One Assignment (Topic to be assigned in the 6th week of instruction).
The assignment will consist of hand written (students own handwriting).

Definition /Explication of 20key concepts worth ¼ mark each. To be submitted for assessment in the 13th week of instruction.

Total marks for assignment 20 x ¼ =05 Marks

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INTERNAL ASSESSMENT MODEL (I-II SEMESTER)

Max. Marks :15

Model Paper of Internal assessment Examination

One is objective and other one internal assessment is descriptive.

Descriptive type Model Paper

Write any three questions out of five questions. Each question carrying 5 Marks.

Objective Type Model Paper

Note answer all the questions

Multiple choice questions — **10 x ½ =05 Marks**
Q1. – Q10.

Fill in the Blanks — **10 x ½ =05 Marks**
Q1. – Q10.

Short Answers type Questions — **5 x 1 =05 Marks**
Q1. – Q5.

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BOS-DEPARTMENT OF MATHEMATICS
M.SC. MATHEMATICS
MODEL PAPERS FOR SEMESTER EXAMINATION
(I-II SEMESTER)

Time: 3 Hours **Max. Marks :80**

SECTION-A

Marks : = 8 x 4 =32

Unit-I

1.
2.

Unit-II

3.
4.

Unit-III

5.
6.

Unit-IV

7.
8.

SECTION-B

Marks : = 4 x 12 =48

Unit-I

9. a) (OR) b)

Unit-II

10. a) (OR) b)

Unit-III

11. a) (OR) b)

Unit-IV

12. a) (OR) b)

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DEPARTMENT OF MATHEMATICS

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PANEL OF EXAMINERS

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M.Sc. Mathematics

PANEL OF EXAMINERS

SEMESTER I			
Subject With Code	Name of the Examiner	Institution Name	Contact No
ABSTRACT ALGEBRA M101	DR. V. NAGARAJU	Department of Mathematics Osmania University, Hyd	9440496134
	DR. V.SRINIVAS	Department of Mathematics University College of Science Saifabad, Hyd	9440378294
	V.VENKATESHWARULU	Department of Mathematics University College of Science Saifabad, Hyd	9130450583
	DR. ARUN JYOTHI	Department of Mathematics AMS College OU Road, Hyd	
MATHEMATICAL ANALYSIS M102	DR. V. KIRAN	Department of Mathematics Osmania University, Hyd	9912959615
	DR. K. PRUDVI	Department of Mathematics University College of Science Saifabad, Hyd	9947063988
	JAYASHREE	Department of Mathematics GDC for Women Begumpet, Hyd.	8686883627
ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS M103	DR. K SRIRAM REDDY	Department of Mathematics Osmania University, Hyd	9440581034
	DR. V. NAGARAJU	Department of Mathematics Osmania University, Hyd	9440496134
	V.VENKATESHWARULU	Department of Mathematics University College of Science Saifabad, Hyd	9130450583
	DR. K. PRUDVI	Department of Mathematics University College of Science Saifabad, Hyd	9947063988
	PHANEENDRA	Department of Mathematics University College of Science Saifabad, Hyd	9849712466

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PANEL OF EXAMINERS

SEMESTER - I

ELEMENTARY NUMBER THEORY M104	DR. G. KAMALA	Department of Mathematics Osmania University, Hyd	9848020397
	DR. V. KIRAN	Department of Mathematics Osmania University, Hyd	9912959615
	DR. ARUN JYOTHI	Department of Mathematics AMS College OU Road, Hyd	
	DR. K. PRUDVI	Department of Mathematics University College of Science Saifabad, Hyd	9947063988
	JAYASHREE	Department of Mathematics GDC for Women Begumpet, Hyd.	8686883627
DISCRETE MATHEMATICS M105	DR. J ANAND RAO	Department of Mathematics Osmania University, Hyd	9885576455
	DR. P.SARADA	Department of Mathematics AMS College OU Road, Hyd	9491129549

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PANEL OF EXAMINERS

SEMESTER - II

TOPOLOGY M204	DR. G. KAMALA	Department of Mathematics Osmania University, Hyd	9848020397
	V.VENKATESHWARULU	Department of Mathematics University College of Science Saifabad, Hyd	9130450583
THEORY OF ORDINARY DIFFERENTIAL EQUATIONS M205	DR. B. SURENDER REDDY	Department of Mathematics Osmania University, Hyd	9000070756
	DR. E RAMA	Department of Mathematics University College of Science Saifabad, Hyd	9989545301
	V.VENKATESHWARULU	Department of Mathematics University College of Science Saifabad, Hyd	9130450583

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PANEL OF EXAMINERS

SEMESTER II			
Subject With Code	Name of the Examiner	Institution Name	Contact No
GALOIS M201	DR. G. KAMALA	Department of Mathematics Osmania University, Hyd	9848020397
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LEBESGUE MEASURE & INTEGRATION M202	DR. B. KRISHNA REDDY	Department of Mathematics Osmania University, Hyd	9603620002
	DR. V.SRINIVAS	Department of Mathematics University College of Science Saifabad, Hyd	9440378294
	DR. K. PRUDVI	Department of Mathematics University College of Science Saifabad, Hyd	9947063988
COMPLEX ANALYSIS M203	DR. B. SURENDER REDDY	Department of Mathematics Osmania University, Hyd	9000070756
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	PHANEENDRA	Department of Mathematics University College of Science Saifabad, Hyd	9849712466

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