



ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

Programme: B.Sc. Honours Mathematics (Minor)

w.e.f. AY 2023-24

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
I	II	1	Differential Equations & Problem Solving Sessions	5	4
II	III	2	Group Theory & Problem Solving Sessions	5	4
	IV	3	Ring Theory & Problem Solving Sessions	5	4
		4	Introduction to Real Analysis & Problem Solving Sessions	5	4
III	V	5	Linear Algebra & Problem Solving Sessions	5	4
		6	Vector Calculus & Problem solving Sessions	5	4

COMMON MODEL PAPER FOR ALL PAPERS:

YOGI VEMANA UNIVERSITY
B.A/B.Sc/B.Com DEGREE EXAMINATIONS
MATHEMATICS
ALL PAPERS

Time: 3 Hrs

Max.marks:75

I. Answer any FIVE questions

5x5=25

1. From Unit – I of the syllabus
2. From Unit – I of the syllabus
3. From Unit – II of the syllabus
4. From Unit – II of the syllabus
5. From Unit – III of the syllabus
6. From Unit – III of the syllabus
7. From Unit – IV of the syllabus
8. From Unit – IV of the syllabus
9. From Unit – V of the syllabus
10. From Unit – V of the syllabus

II. Answer ALL questions

5x10=50

11.
[or] From Unit – I of the syllabus
- 12.
13.
[or] From Unit – II of the syllabus
- 14.
15.
[or] From Unit – III of the syllabus
- 16.
17.
[or] From Unit – IV of the syllabus
- 18.
19.
[or] From Unit – V of the syllabus
- 20.

SEMESTER-II

COURSE 1: DIFFERENTIAL EQUATIONS

Theory

Credits: 4

5 hrs/week

Unit – 1

Differential Equations of first order and first degree

Linear Differential Equations – Bernoulli's Equations - Exact Differential Equations –Integrating factors - Equations reducible to Exact Equations by Integrating Factors -

i) Inspection Method ii) $\frac{1}{Mx + Ny}$ iii) $\frac{1}{Mx - Ny}$

Unit – 2

Differential Equations of first order but not of first degree

Equations solvable for p , Equations solvable for y , Equations solvable for x – Clairaut's equation - **Orthogonal Trajectories:** Cartesian and Polar forms.

Unit – 3

Higher order linear differential equations

Solutions of homogeneous linear differential equations of order n with constant coefficients - Solutions of non-homogeneous linear differential equations with constant coefficients by means of polynomial operators

(i) $Q(x) = e^{ax}$ (ii) $Q(x) = \sin ax$ (or) $\cos ax$

Unit – 4

Higher order linear differential equations (continued.)

Solution to a non-homogeneous linear differential equation with constant coefficients

P.I. of $f(D)y = Q$ when $Q = bx^k$

P.I. of $f(D)y = Q$ when $Q = e^{ax}V$, where V is a function of x

P.I. of $f(D)y = Q$ when $Q = xV$, where V is a function of x

Unit – 5

Higher order linear differential equations with non-constant coefficients

Linear differential Equations with non-constant coefficients; Cauchy-Euler Equation; Legendre Equation; Method of variation of parameters

Text Book

Differential Equations and Their Applications by Zafar Ahsan, published by Prentice-Hall of India Pvt. Ltd, New Delhi-Second edition.

Reference Books

1. Ordinary and Partial Differential Equations by Dr. M.D. Raisinghania, published by S. Chand & Company, New Delhi.
2. Differential Equations with applications and programs – S. Balachandra Rao & HR Anuradha-Universities Press.
3. Differential Equations -Srinivas Vangala&Madhu Rajesh, published by Spectrum University Press.

SEMESTER-III

COURSE 2: GROUP THEORY

Theory

Credits: 4

5 hrs/week

Unit – 1

Groups

Binary Operation – Algebraic structure – semi group - monoid – Group definition and elementary properties Finite and Infinite groups – examples – order of a group, Composition tables with examples.

Unit – 2

Sub Groups

Complex Definition – Multiplication of two complexes Inverse of a complex-Subgroup definition-examples-criterion for a complex to be a subgroups; Criterion for the product of two subgroups to be a subgroup-union and Intersection of subgroups. Coset Definition – properties of Cosets – Index of a subgroups of a finite groups – Lagrange's Theorem.

Unit – 3

Normal Subgroups

Normal Subgroups: Definition of normal subgroup – proper and improper normal subgroup–Hamilton group- Criterion for a subgroup to be a normal subgroup – intersection of two normal subgroups Sub group of index 2 is a normal sub group

Unit-4

Homomorphisms

Quotient groups, Definition of homomorphism – Image of homomorphism elementary properties of homomorphism – Isomorphism – automorphism definitions and elementary properties–kernel of a homomorphism – fundamental theorem on Homomorphism and applications.

Unit – 5

Permutations and Cyclic Groups

Definition of permutation – permutation multiplication – Inverse of a permutation – cyclic permutations – transposition – even and odd permutations – Cayley's theorem.

Cyclic Groups - Definition of cyclic group – elementary properties – classification of cyclic groups.

Activities

Seminar/ Quiz/ Assignments/ Applications of Group Theory to Real life Problem /Problem Solving Sessions.

Text Book

Modern Algebra by A.R.Vasishtha and A.K.Vasishtha, KrishnaPrakashanMedia Pvt. Ltd., Meerut.

Reference Books

1. Abstract Algebra by J.B. Fraleigh, Published by Narosa publishing house.
2. Modern Algebra by M.L. Khanna, Jai Prakash and Co. Printing Press, Meerut
3. Rings and Linear Algebra by Pundir&Pundir, published by PragathiPrakashan

SEMESTER-IV

COURSE 3: RING THEORY

Theory

Credits: 4

5 hrs/week

Unit – 1

Rings and Fields

Definition of a ring and Examples – Basic properties – Boolean rings - Fields – Divisors of zero and Cancellation Laws – Integral Domains – Division ring - The Characteristic of a Ring, Integral domain and Field.

Unit – 2

Sub-rings and Ideals

Definition and examples of Subrings – Necessary and sufficient conditions for a subset to be a subring – Algebra of Subrings – left, right and two sided ideals – Algebra of ideals.

Unit - 3

Principal ideals and Quotient rings

Definition of a Principal ideal ring(Domain) – Every field is a PID – The ring of integers is a PID – Example of a ring which is not a PIR – Cosets – Algebra of cosets – Quotient rings – Construction of composition tables for finite quotient rings of the ring Z of integers and the ring Z_n of integers modulo n .

Unit-4

Homomorphism of Rings

Homomorphism of Rings – Definition and Elementary properties – Kernel of a homomorphism – Isomorphism – Fundamental theorem of homomorphism of rings.

Unit – 5

Rings of Polynomials

Polynomials in an indeterminate – The Evaluation homomorphism - The Division Algorithm in $F[x]$ – Irreducible Polynomials – Ideal Structure in $F[x]$ – Uniqueness of Factorization $F[x]$.

Activities

Seminar/ Quiz/ Assignments/ Applications of ring theory concepts to Real life Problem /Problem Solving Sessions.

Text book

Modern Algebra by A.R.Vasishta and A.K.Vasishta, Krishna Prakashan Media Pvt. Ltd.

Reference books

1. A First Course in Abstract Algebra by John. B. Farleigh, Narosa Publishing House.
2. Linear Algebra by Stephen. H. Friedberg and Others, Pearson Education India

SEMESTER-IV

COURSE 4: INTRODUCTION TO REAL ANALYSIS

Theory

Credits: 4

5 hrs/week

Unit – 1

REAL NUMBERS, REAL SEQUENCES

The algebraic and order properties of \mathbb{R} - Absolute value and Real line - Completeness property of \mathbb{R} - Applications of supremum property - intervals. Sequences and their limits, Range and Boundedness of Sequences, Limit of a sequence and Convergent sequence. **(No question is to be set from this portion).**

INFINITE SERIES

Introduction to series - convergence of series - Cauchy's general principle of convergence for series tests for convergence of series - Series of non-negative terms - P-test - Cauchy's n^{th} root test - D' - Alembert's Test - Alternating Series - Leibnitz Test.

Unit – 2

LIMIT & CONTINUITY

Real valued Functions - Boundedness of a function - Limits of functions - Some extensions of the limit concept - Infinite Limits - Limits at infinity **(No question is to be set from this portion)**. Continuous functions - Combinations of continuous functions - Continuous Functions on intervals - uniform continuity.

Unit – 3

DIFFERENTIATION AND MEAN VALUE THEOREMS

The derivability of a function at a point and on an interval - Derivability and continuity of a function - Mean Value Theorems - Rolle's Theorem, Lagrange's Theorem, Cauchy's Mean value Theorem

Unit – 4

RIEMANN INTEGRATION - I

Riemann Integral - Riemann integral functions - Darboux theorem - Necessary and sufficient condition for \mathbb{R} integrability

Unit – 5

RIEMANN INTEGRATION - II

Properties of integrable functions - Fundamental theorem of integral calculus - integral as the limit of a sum - Mean value Theorems.

Activities

Seminar/ Quiz/ Assignments/ Applications of Real Analysis to Real life Problem /Problem Solving Sessions.

Text Book

An Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, John Wiley and sons Pvt. Ltd

Reference Books

1. Elements of Real Analysis by Shanthi Narayan and Dr. M. D. Raisinghania, S. Chand & Company Pvt. Ltd., New Delhi.
2. Principles of Mathematical Analysis by Walter Rudin, McGraw-Hill Ltd.

SEMESTER-V

COURSE 5: LINEAR ALGEBRA

Theory

Credits: 4

5 hrs/week

UNIT – I

Vector Spaces-I

Vector Spaces - General properties of vector spaces - n-dimensional Vectors - addition and scalar multiplication of Vectors - internal and external composition - Null space - Vector subspaces -Algebra of subspaces - Linear Sum of two subspaces - linear combination of Vectors- Linear span Linear independence and Linear dependence of Vectors.

UNIT –II

Vector Spaces-II

Basis of Vector space - Finite dimensional Vector spaces - basis extension - co-ordinates- Dimension of a Vector space - Dimension of a subspace - Quotient space and Dimension of Quotient space.

UNIT –III

Linear Transformations

Linear transformations - linear operators- Properties of L.T- sum and product of L.Ts - Algebra of Linear Operators - Range and null space of linear transformation - Rank and Nullity of linear transformations - Rank- Nullity Theorem.

UNIT –IV

Matrices – I

Matrices, Elementary Properties of Matrices, Rank of Matrix, Normal form, Echelon form , Inverse of a matrix by using elementary operations.

UNIT –V

Matrices – II

Linear Equations: System of Homogeneous and non homogeneous Linear Equations. Characteristic equations, Characteristic Values & Vectors of a square matrix, Cayley – Hamilton Theorem and problems.

Text Books

- 1.Linear Algebra by J.N. Sharma and A.R. Vasishtha, published by Krishna Prakashan Media (P) Ltd.
- 2.Matrices by A.R.Vasishtha and A.K.Vasishtha published by Krishna Prakashan Media (P) Ltd.

Reference Books

1. Linear Algebra by Stephen H. Friedberg et. al. published by Prentice Hall of India Pvt. Ltd. 4th Edition, 2007
2. Linear Algebra by Kenneth Hoffman and Ray Kunze, published by Pearson education low priced edition), New Delhi.
3. Matrices by Shanti Narayana, published by S.Chand Publications

SEMESTER-V

COURSE 6: VECTOR CALCULUS

Theory

Credits: 4

5 hrs/week

Unit-1 Multiple Integrals

Introduction, Double integrals, Evaluation of double integrals, Properties of double integrals. Region of integration, double integration in Polar Co-ordinates, change of order of integration. Triple integral, region of integration, Evaluation of triple integrals.

Unit-2 Vector Differentiation-I

Vector differentiation, ordinary derivatives of vectors, partial differentiation. Gradient of a scalar point function, Directional derivative, Angle between two surfaces.

Unit-3 Vector differentiation -II

Divergence –Curl operators – Formulae involving these operators.

Unit-4 Vector integration

Line Integrals with examples - Surface Integral with examples – Volume integral with examples.

Unit-5 Vector integration applications

Gauss theorem and applications of Gauss theorem - Green's theorem in a plane and applications of Green's theorem - Stokes's theorem and applications of Stokes theorem.

Activities

Seminar/ Quiz/ Assignments/ Applications of Vector calculus to Real life Problems /Problem Solving Sessions.

Text Book

A text Book of Higher Engineering Mathematics by B.S.Grawal, Khanna Publishers, 43rd Edition

Reference Books

1. Vector Calculus by P.C.Matthews, Springer Verlag publications.
2. Vector Analysis by Murray Spiegel, Schaum Publishing Company, New York
