ANNEXURE-II

SEMESTER-III

COURSE 2: GROUP THEORY

Theory Credits-4 5hrs/week

Course Outcomes:

After successful completion of this course, the student will be able to

1. Acquire the basic knowledge and structure of groups.
2. Get the significance of the notation of a subgroup and co sets.
3. Understand the concept of normal subgroups and properties of normal subgroups.
4. study the homo morphisms and iso morphisms with applications
5. Understand the properties of permutation groups.

Course content:

UNIT-1: GROUPS

Binary Operations-Algebraic structure-semi group-monoid-Group definition and elementary properties-Finite and Infinite groups-examples -composition tables with examples.-Order of an element.

UNIT-2 SUB GROUPS

Complex Definition- Multiplication of two complexes- Inverse of a complex- subgroup definition-examples-criterion for a complex to be a subgroup-criterion for the product of two subgroups to be a subgroup-Union and Intersection of two subgroups-Co set definition-properties of co sets(statements only)-Index of a subgroup of a finite group-Lagrange’s Theorem.

UNIT-3 : NORMAL SUBGROUPS

Normal subgroups: Definition of a normal subgroup-Proper and improper normal subgroups-Hamilton group-Simple group-Criterion for a subgroup to be a normal subgroup-intersection of two normal subgroups-Subgroup of index 2 is a normal subgroup-simple group-every group of prime order is simple.-Quotient Group

UNIT-4: HOMO MORPHISMS

Definition of homomorphism-Homomorphic Image-Elementary properties of homomorphism-Isomorphism-auto morphism definitions and elementary properties-Kernel of a homomorphism-Fundamental theorem of Homomorphism and applications.

UNIT-5 : PERMUTATION GROUPS

Definition of permutation-permutation multiplication-Inverse of a permutation-Cyclic permutations-transposition-even and odd permutations-Cayley's theorem

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, Krishna Prakash Media 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 Pragathi Prakashan

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SEMESTER III

COURSE 2: GROUP THEORY

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Time: 2½ Hours   Max. Marks: 60

SECTION-A

Answer any FIVE of the following questions.   5x4=20 marks

1. From Unit 1
2. From Unit 1
3. From Unit 2
4. From Unit 2
5. From Unit 3
6. From Unit 3
7. From Unit 4
8. From Unit 5

SECTION-B

Answer the following Questions   5x8=40 marks

9. (a) From Unit 1

   OR

   (b) From Unit 1

10. (a) From Unit 2

    OR

    (b) From Unit 2

11. (a) From Unit 3

    OR

    (b) From Unit 3

12. (a) From Unit 4

    OR

    (b) From Unit 4

13. (a) From Unit 5

    OR

    (b) From Unit 5

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SEMESTER III

COURSE 2: GROUP THEORY

MODEL QUESTION PAPER

Time: 2½ Hours **Max. Marks: 60**

SECTION-A

Answer any five questions. Each question carries 4 marks. 5×4=20 M

1. In a group G, prove that the identity is unique.
2. Find the order of each element of the multiplicative group $\{1, -1, i, -i\}$
3. If H is a subgroup of a group G, then prove that $H^{-1} = H$
4. Prove that the intersection of two subgroups is a subgroup.
5. Prove that every subgroup of an abelian group is normal.
6. Prove that every group of prime order is simple.
7. Prove that every homomorphic image of a group is a group.
8. Find the regular permutation group isomorphic to the multiplicative group $\{1, \omega, \omega^2\}$

SECTION-B

Answer all questions. Each question carries 8 marks. $5\times 8 = 40\ M$

9. (a) Prove that a finite semigroup satisfying cancellation laws is a group.

OR

(b) Prove that the set of integers forms an abelian group w.r.to the operation $*$ defined as $a * b = a + b + 2 \ \forall \ a, b \in Z$

10. (a) Prove that a nonempty complex H of a group G is a subgroup of G if and only if

$$a, b \in H \implies ab^{-1} \in H$$

OR

(b) State and prove Lagrange's theorem.

11. (a) Prove that a subgroup H of a group G is normal if and only if $xHx^{-1} = H \ \forall x \in G$

OR

(b) If H is a normal subgroup of a group G, then prove that the set $\frac{G}{H}$ of all co sets of H in G is a group w.r.to co set multiplication

12. (a) If f : G→ G^1 is a homomorphism then prove that Ker f is a normal subgroup of the group G.

OR

(b) State and prove Fundamental Theorem of Homomorphism.

13. (a) State and prove Cayley's theorem.

OR

(b) Examine the following permutations are even (or) odd

(i) f = $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ 3 & 2 & 4 & 5 & 6 & 7 & 1 \end{pmatrix}$

(ii) g = = $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ 3 & 2 & 4 & 5 & 6 & 7 & 1 \end{pmatrix}$

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SEMESTER-IV

COURSE 3: RING THEORY

Theory Credits-4 5 hrs/week

Course Outcomes

After successful completion of the course, the student will be able to

1. Acquire the basic knowledge of rings, fields and integral domains.
2. Get the knowledge of subrings and ideals.
3. Construct composition tables for finite quotient rings
4. Study the homomorphism and isomorphism with applications.
5. Get the idea of division algorithm of polynomials over a field.

Course content

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-Characteristic of a Boolean ring –Characteristic of an Integral domain, Field

UNIT-2 : SUBRINGS AND IDEALS

Definition and examples of Subrings-Necessary and sufficient conditions for a subset to be a subring-Algebra of subrings-Centre of a ring- Ideals of a ring-algebra of Ideals.

UNIT-3 : PRINCIPAL IDEALS AND QUOTIENT RINGS

Definition of a Principal ideal ring- Every field is a Principal ideal ring-The ring of integers is a principal ideal ring-Co sets-Algebra of Co sets-Quotient Rings

UNIT-4 : HOMOMORPHISM OF RINGS

Homomorphism of Rings- Definition and elementary properties-Homomorphic image of a ring-Kernel of a homomorphism-Fundamental Theorem of homomorphism of rings.

UNIT-5 :RINGS OF POLYNOMIALS

Polynomials in an indeterminate- addition and multiplication of polynomials-The Division algorithm of polynomials-Ideal structure in F[x].

Activities

Seminar/Quiz/Assignments/Applications of Ring theory concepts to real life/ problem solving sessions

Text book

Modern Algebra by A.R. 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.

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SEMESTER IV

COURSE 3: RING THEORY

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UNIT	TOPIC	SAQ	EQ
Unit-1	Boolean Rings	1 theorem	1 theorem
	Special Types of rings	1 theorem	1 theorem
Unit-2	Subrings	1 theorem	1 theorem
	Ideals	1 theorem	1 theorem
Unit-3	Principal ideals & Quotient Rings	1 theorem	2 theorems
Unit-4	Homomorphism of rings	1 problem	2 theorems
Unit-5	Rings of Polynomials	2 problems	2 problems

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SEMESTER IV
COURSE 3: RING THEORY
MODEL QUESTION PAPER

Time: 2½ hrs Max.marks: 60

SECTION-A

Answer any FIVE questions. 5×4=20 M

1. Prove that Boolean ring is commutative.
2. Prove that every field is an integral domain.
3. If S and T are two subrings of a ring R then show that $S \cap T$ is also a subring of R.
4. Prove that a field has no proper ideals
5. Prove that every field is a principal ideal ring.
6. If Z is the ring of integers and f: $Z \longrightarrow 2Z$ is defined by $f(x) = 2x \ \forall \ x \in Z$ is not a homomorphism .
7. Find the sum and product of the polynomials $f(x) = 2x^3 + 4x^2 + 3x + 2$ and $g(x) = 3x^4 + 2x + 4$ over Z.
8. Solve the equation $x^2 \oplus 1 = 0$ in the field $(Z_5, \oplus, \odot)$.

SECTION-B

Answer ALL the questions. 5×8 = 40 M

9. (a) Prove that every finite integral domain is a field.

Or

(b) Prove that the characteristic of a Boolean ring is 2.

10. (a) Prove that a nonempty subset S of a ring R is a subring of R if and only if

$$a, b \in S \implies a - b \in S \quad and \quad ab \in S$$

Or

(b) If A and B are two ideals of a ring R then show that

$$A \cup B \text{ is an ideal of } R \text{ if and only if either } A \sqsubseteq B \text{ or } B \sqsubseteq A$$

11.(a) Show that Z is a principal ideal ring.

Or

(b) Let A be an ideal of a ring R. If addition and multiplication are defined in R/A as

(A + x) + (A + y) = A+ (x + y) , (A +x) (A +y) = A + $x\,y$ then prove that ($\frac{R}{A}$, + , **.**) is a Ring.

12. (a) State and Prove Fundamental theorem of homomorphism of rings.

Or

(b) If f is a homomorphism of a ring R into a ring R^1 then prove that Ker f is an ideal of R.

13. (a) If f(x) = $x^6 + 3x^5 + 4x^2 - 3x + 2$ and g(x) = $x^2 + 2x - 3$ are two polynomials in $Z_7[x]$ then find q(x) and r(x) in f(x) = q(x) g(x) + r(x)

Or

(b) Prove that f(x) = $x^4 - 22x^2 + 1$ is irreducible over Q.

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SEMESTER-IV

COURSE-4: INTRODUCTION TO REAL ANALYSIS

Theory Credits-4 Max.marks-60

Course Outcomes

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

1. Get clear idea about the real numbers and real valued functions.
2. Obtain the skills of analyzing the concepts and applying appropriate methods for testing convergence of a sequence/series
3. Test the continuity, differentiability and Riemann Integration of a function.
4. Know the geometrical interpretation of mean value theorems.
5. Know about the fundamental theorem of integral calculus.

Course content:

UNIT-1 REAL NUMBERS, REAL SEQUENCES

The algebraic and order properties of R-Absolute Value and Real line-Completeness property of R-Bounded functions-Monotonic functions-intervals-Limiting points-Bolzano–Weierstrass theorem on Real numbers (**No question to be set from this portion)**

Sequences and their limits-Range and boundedness of sequences-Limit of a sequence and Convergent sequence-The Cauchy's criterion- properly divergent sequences-Monotonic sequences-Necessary and sufficient condition for convergence of Monotonic sequence-Limit point of a Sequence(definition only)-Bolzano-Weierstrass theorem

UNIT-2 INFINITE SERIES

Introduction of series-convergence of series-Cauchy's general principle for convergence of series-Tests for convergence of series-Series of non-negative terms- Geometric series -P-Test - Limit comparison test-Cauchy's n^{th} root test- D'-Alembert's Ratio test.

UNIT-3 LIMITS & CONTINUITY

Real valued functions-Boundedness of a function-Limits of functions-Standard limits-Infinite limits-Limits at infinity **(No question is to be set from this portion)**

Continuous functions-Combinations of continuous functions-continuous functions on intervals-Boundedness property-Bolzano theorem-Intermediate Value theorem

UNIT-4 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-5 RIEMANN INTEGRATION

Riemann Integral-Riemann integrability of functions – Darboux theorem (statement on)- Necessary and sufficient condition for R integrability-properties of integrable functions- Fundamental theorem of Integral Calculus-Mean value theorems.

Activities

Seminar/Quiz/Assignments/Applications of Real Analysis to real life /problem solving sessions.

Text Book:

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

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Reference Books

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

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SEMESTER IV

COURSE 4: INTRODUCTION TO REAL ANALYSIS

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UNIT	TOPIC	SAQ	EQ
Unit-1	Real Numbers and Sequences	1 problem &1 theorem	1 problem & 1 theorem
Unit-2	Infinite Series	1 problem	2 theorems
Unit-3	Continuity	2 problems	1 problem & 1 theorem
Unit-4	Differentiation and Mean Value Theorems	2 problems	1 problem & 1 theorem
Unit-5	Riemann Integration	1 problem	2 theorems

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SEMESTER IV

COURSE 4: INTRODUCTION TO REAL ANALYSIS

MODEL QUESTION PAPER

Time: 2½ hrs Max. Marks: 60 M

SECTION-A

Answer any FIVE questions. $5\times 4 = 20$ M

1. If $S_n = \sqrt{n+1} - \sqrt{n}$ then show that Lim $S_n = 0$
2. Prove that every convergent sequence is bounded.
3. Test for convergence of $\sum_{n=1}^{\infty} \frac{1}{2^n+3^n}$
4. Show that the function f defined by f(x) = x^2 Sin $(\frac{1}{x})$, $x \neq 0$ *and* f(0) = 0 is continuous at x=0.
5. Discuss the continuity of f defined by $f(x) = \frac{e^{1/x}-1}{e^{1/x}+1}$, $x \neq 0$ and f (0)=1 at x=0.
6. Show that the function f(x) = | x | is not derivable at $x=0$
7. Find 'c ' of Cauchy's Mean Value Theorem for the functions f(x) = x^2 and g(x)=x^3 in [1,2]
8. If f(x) = x on [0,1] and P= $\{0, \frac{1}{3}, \frac{2}{3}, 1\}$ then find U(P, f) and L(P, f)

Section-B

Answer the following questions. 5×8 = 40 M

9. (a) If $S_n = \frac{1}{n+1} + \frac{1}{n+2} + \cdots \frac{1}{n+n}$ then show that $\{S_n\}$ converges.

Or

(b) State and prove Bolzano-Weierstrass theorem for sequences

10. (a) State and prove Limit Comparison Test

Or

(b) State and prove Cauchy's n^{th} Root Test.

11. (a) Examine for continuity of the function f defined by $f(x) = |x| + |x-1|$ at $x=0$ and $x=1$

Or

(b) If f is continuous on [a, b] then show that f is bounded on [a, b].

12. (a) State and prove Lagrange's Mean Value theorem.

Or

(b) Prove that $f(x) = x\left(\frac{e^{1/x}-1}{e^{1/x}+1}\right)$ if $x \neq 0$ and $f(0) = 0$ is continuous but not derivable at $x = 0$

13. (a) State and prove a necessary and sufficient condition for Riemann Integrablity

Or

(b) State and prove Fundamental Theorem of Integral Calculus.

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SEMESTER-V

COURSE 5: LINEAR ALGEBRA

Theory Credits: 4 5 hrs/week

Course Outcomes:

After successful completion of this course, the student will be able to

6. understand the concepts of vector spaces, subspaces
7. understand the concepts of basis, dimension and their properties
8. understand the concept of linear transformation and its properties
9. apply Cayley- Hamilton theorem to problems for finding the inverse of a matrix and higher powers of matrices without using routine methods
10. learn the properties of inner product spaces and determine orthogonality in inner product spaces.

Course Content:

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.

UNIT –II

Vector Spaces-II

Linear combination of Vectors - Linear independence and Linear dependence of Vectors - 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

Characteristic equation - Characteristic Values - Characteristic vectors of a square matrix - Cayley Hamilton Theorem – problems on Cayley Hamilton Theorem.

UNIT –V

Inner product space

Inner product spaces- Euclidean and unitary spaces- Norm or length of a Vector- Schwartz inequality- Triangle Inequality - Parallelogram law.

Activities :

Seminar/ Quiz/ Assignments/Applications of Linear Algebra in real life problems\ Problem Solving.

Text Books

Text Book of Mathematics published by S. Chand & Company.

Reference Books

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

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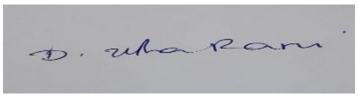

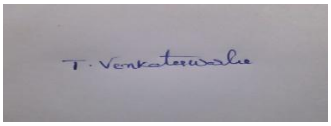

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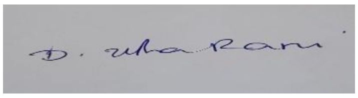
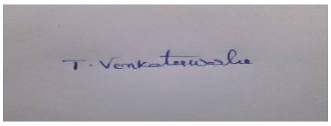
LINEAR ALGEBRA

UNIT	TOPICS	5 MARKS QUESTIONS	10 MARKS QUESTIONS
UNIT-1	Vector spaces-I	1 (problem) + 1(theorem)	1 (problem) + 1(theorem)
UNIT-2	Vector spaces-II	1(Problem)	1 (problem) + 1(theorem)
UNIT-3	linear transformation	1(Problem)	---
	Range, null space, rank	---	1 theorem + 1(problem)
UNIT-4	Characteristic Equation	1(problem)	---
	Eigen values and eigen vectors	1 (problem)	1 (problem)
	Problems and Cayley Hamilton Theorem	----	1 (problem)
UNIT-5	Inner product space	1 (problem) + 1(theorem)	2(theorems)



SEMESTER-V

COURSE 6: VECTOR CALCULUS

Theory	Credits: 4	5 hrs/week

Course Outcomes:

Students after successful completion of the course will be able to

1. Learn multiple integrals as a natural extension of definite integral to a function of two variables in the case of double integral /three variables in the case of triple integral.
2. Learn applications interms of finding surface area by double integral and volume by triple integral
3. Determine the gradient, divergence and curl of a vector and vector identities.
4. Evaluate line, surface and volume integrals.
5. Understand relation between surface and volume integrals (Gauss divergence theorem), relation between line integral and volume integral (Green's theorem), relation between line and surface integral (Stokes theorem)

Course Content:

Unit – 1
Multiple Integrals

Evaluation of double integral in different form - Evaluation of triple integral – Plane area, Surface area by double integral -Volume as a triple integral.

Unit – 2
Vector Differentiation

Vector differentiation – Ordinary – Derivatives of vectors – Differentiability – Gradient – Divergence - Curl operators – Formulae involving these operators.

Unit – 3
Vector Integration -1

Line Integrals with examples - Surface Integral with examples.

Unit – 4
Vector Integration -2

Volume integral with examples - Gauss Divergence theorem and applications of Gauss Divergence theorem.

Unit – 5
Vector Integration -3

Green's theorem in 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:

Text Book of Mathematics published by S. Chand & Company.

Reference Books:

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

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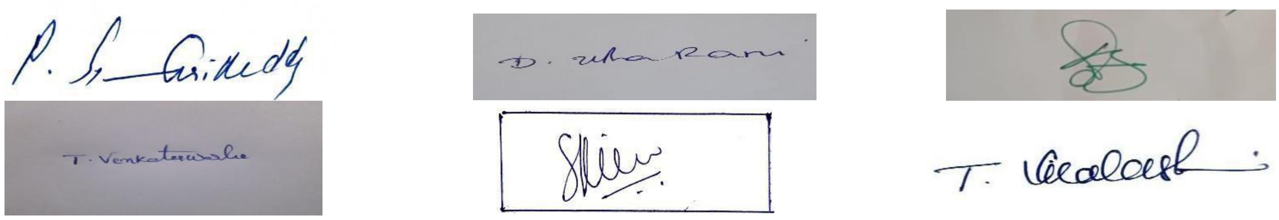
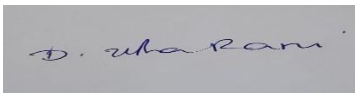
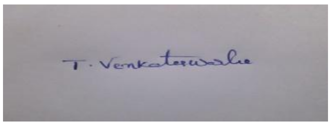


BLUE PRINT OF QUESTION PAPER
VECTOR CALCULUS

UNITS	TOPICS	5 MARKS QUESTIONS	10 MARKS QUESTIONS
UNIT-1	Multiple Integrals	2(Problems)	2(Problems)
UNIT-2	Vector Differentiation	2(Problems)	1(Problem) + 1 (theorem)
UNIT-3	Vector Integration 1	1(Problem)	2(Problems)
UNIT-4	Vector Integration 2	1(Problem)	1(Problem) + 1 (theorem)
UNIT-5	Vector Integration 3	1(Problem) + 1 (theorem)	1(Problem) + 1 (theorem)



VIKRAMA SIMHAPURI UNIVERSITY, NELLORE

B.A/BSC -MATHEMATICS

MODEL QUESTION PAPER

TIME: 3 Hours ***Max.Marks : 75***

PART – A

I. Answer any FIVE Questions: ***5 X 5 = 25M***

1.
2.
3.
4.
5.
6.
7.
8.

PART - B

Answer any FIVE of the following Questions. ***5 × 10 =50 Marks***

UNIT - I

9. (a).

OR

(b).

UNIT - II

10. (a).

OR

(b).

UNIT - III

11. (a).

OR

(b).

UNIT - IV

12. (a). **OR**

(b).

UNIT - V

13. (a).

OR

(b).