# SRI VENKATESWARA UNIVERSITY: TIRUPATI

## Programme: B.Sc. Honours in MATHEMATICS (Major)

## W.E.F. AY 2024-25

**COURSE STRUCTURE**

| Year | Semester | Course | Title of the Course | No. of Hrs /Week | No. of Credits |
|---|---|---|---|---|---|
| I | I | 1 | Essentials and Applications of Mathematical, Physical and Chemical Sciences | 5 | 4 |
| | | 2 | Advances in Mathematical, Physical and Chemical Sciences | 5 | 4 |
| | II | 3 | Differential Equations & Problem Solving Sessions | 5 | 4 |
| | | 4 | Analytical Solid Geometry & Problem Solving Sessions | 5 | 4 |
| II | III | 5 | Group Theory &Problem Solving Sessions | 5 | 4 |
| | | 6 | Numerical Methods & Problem Solving Sessions | 5 | 4 |
| | | 7 | Laplace Transforms & Problem Solving Sessions | 5 | 4 |
| | | 8 | Special Functions & Problem Solving Sessions | 5 | 4 |
| | IV | 9 | Ring Theory & Problem Solving Sessions | 5 | 4 |
| | | 10 | Introduction to Real Analysis & Problem Solving Sessions | 5 | 4 |
| | | 11 | Integral Transforms & Problem Solving Sessions | 5 | 4 |
| III | V | 12 | Linear Algebra &Problem Solving Sessions | 5 | 4 |
| | | 13 | Vector Calculus & Problem solving Sessions | 5 | 4 |
| | | 14 | Functions of a complex variables & Problem solving Sessions **(OR)** Advanced Numerical Methods & Problem Solving Sessions | 5 | 4 |
| | | 15 | Number Theory & Problem Solving Sessions (OR) Mathematical Statistics & Problem Solving Sessions | 5 | 4 |
| | VI | Semester Internship/Apprenticeship with 12 Credits | | | |
| IV | VII | 16 | Algebra (OR) Classical Mechanics | 5 | 4 |
| | | 17 | Real Analysis (OR) Discrete Mathematics | 5 | 4 |
| | | 18 | Basic Topology (OR) Cryptography | 5 | 4 |
| | | **SEC** | | | |
| | | 19 | Lattice Theory & Boolean Algebra | 5 | 4 |

| Year | Semester | Course | Title of the Course | No. of Hrs /Week | No. of Credits |
|---|---|---|---|---|---|
| | | | (OR) Finite Element Analysis | | |
| | | 20 | Graph Theory (OR) Mathematical Finance | 5 | 4 |
| | VIII | 21 | Advanced Algebra (OR) Elements of Elasticity & Fluid Dynamics | 5 | 4 |
| | | 22 | Advanced Analysis (OR) Advanced Linear Algebra | 5 | 4 |
| | | 23 | Advanced Topology (OR) Differential Geometry | 5 | 4 |
| | | **SEC** | | | |
| | | 24 | Ordinary Differential Equations (OR) Applications of Algebra | 5 | 4 |
| | | 25 | Operation Research (OR) Mathematical Modelling | 5 | 4 |

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**Programme: B.Sc. Honours in Mathematics (Major)**

**W.E.F. AY 2024-25**

**SEMESTER-IV**

**COURSE 9: RING THEORY**

**Theory** **Credits: 4** **5 hrs/week**

## Course Outcomes

**After successful completion of this 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 homomorphisms and isomorphisms 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 0 and Cancellation Laws – Integral Domains – Division ring - The Characteristic of a Ring, Integral domain and Field – Non Commutative Rings - Matrices over a field – The Quaternion ring.

**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 – left, right and two sided ideals – Algebra of ideals – Equivalence of a field and a commutative ring without proper 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 theorems of homomorphism of rings – Maximal and prime Ideals – Prime Fields

**Unit – 5**

**Rings of Polynomials**

Polynomials in an indeterminate – The Evaluation morphism -- The Division Algorithm in $[x]$ – 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


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**SEMESTER-IV**

## COURSE 10: INTRODUCTION TO REAL ANALYSIS

**Theory** **Credits: 4** **5 hrs/week**

# Course Outcomes

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

1. get clear idea about the real numbers and real valued functions.
2. obtaintheskillsofanalysingtheconceptsandapplyingappropriatemeth odsfortesting convergence of a sequence/ series.
3. Test the continuity and differentiability and Riemann integration of a function.
4. Know the geometrical interpretationofmeanvalue theorems.
5. know about the fundamental theorem of integral calculus

# Course Contents

**Unit – 1**

**REAL NUMBERS, REAL SEQUENCES**

The algebraic and order properties of R - Absolute value and Real line - Completeness property of R - Applications of supremum property - intervals. (No question is 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 - Monotone sequences - Necessary and Sufficient condition for Convergence of Monotone Sequence - Limit Point of Sequence –Subsequences and the Bolzano – weierstrass theorem – Cauchy Sequences – Cauchy's general principle of convergence.

**Unit – 2**

**INFINITIE 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 –3**

**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 – 4**

**DIFFERENTIATION ANDMEANVALUETHEORMS**

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**

**RIEMANNINTEGRATION**

Riemann Integral - Riemann integral functions - Darboux theorem - Necessary and sufficient condition for Rintegrability - 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 Donlad R. Sherbert, John Wiley and sonsPvt. Ltd**

## Reference Books


1. ElementsofRealAnalysis by ShanthiNarayan andDr.M.D.Raisinghania, 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 11: INTEGRAL TRANSFORMS WITH APPLICATIONS

**Theory** **Credits: 4** **5 hrs/week**

# Learning Outcomes

**Students after successful completion of the course will be able to**

1. understand the application of Laplace transforms to solve ODEs
2. understand the application of Laplace transforms to solve Simultaneous DEs
3. understand the application of Laplace transforms to Integral equations
4. basic knowledge of Fourier-Transformations
5. Comprehend the properties of Fourier transforms and solve problems related to finite Fourier transforms.

**COURSE CONTENT**

**Unit – 1**

**Application of Laplace Transform to solutions of Differential Equations**

Solutions of ordinary Differential Equations - Solutions of Differential Equations with constants coefficients - Solutions of Differential Equations with Variable coefficients.

**Unit – 2**

**Application of Laplace Transform to solutions of Differential Equations**

Solutions of Simultaneous Ordinary Differential equations - Solutions of Partial Differential Equations.

**Unit – 3**

**Application of Laplace Transforms to Integral Equations**

Definitions of Integral Equations - Abel's Integral Equation - Integral Equation of Convolution Type - Integral Differential Equations - Application of L.T. to Integral Equations.

**Unit – 4**

**Fourier Transforms - I**

Definition of Fourier Transform - Fourier sine Transform - Fourier cosine Transform - Linear Property of Fourier Transform - Change of Scale Property for Fourier Transform - sine Transform and cosine transform shifting property - Modulation theorem.

**Unit – 5**

**Fourier Transforms – II**

Definition of Convolution - Convolution theorem for Fourier transform - Parseval's Identity - Relationship between Fourier and Laplace transforms - problems related to Integral Equations -Finite Fourier Transforms - Finite Fourier Sine Transform - Finite Fourier Cosine Transform - Inversion formula for sine and cosine transforms only - statement and related problems.

**Activities**

**Seminar/ Quiz/ Assignments/Applications of Integral Transforms in real life problems /Problem Solving Sessions.**

**Text Book**

**B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.**

**Reference Book**


1. Fourier Series and Integral Transformations by Dr.S. Sreenadh and others, published by S.Chand and Co, New Delhi
2. E.M. Stein and R. Shakarchi, Fourier analysis: An introduction, (Princeton University Press, 2003).
3. R.S. Strichartz, A guide to Distribution theory and Fourier transforms, (World scientific, 2003).


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