ADIKAVI SRI MAHARSHI VALMIKI UNIVERSITY, RAICHUR

SYLLABUS

B.Sc. Three Year Degree Program for the Subject

Mathematics

With Effect from 2024-25

DISCIPLINE SPECIFIC CORE COURSE (DSC) FOR SEM I-IV, SKILL ENHANCEMENT COURSE (SEC) FOR SEM IV/V/VI and ELECTIVE COURSES FOR SEM V AND VI

AS PER N E P (Revised): 2024

B.Sc Mathematics III Semester

24MT-3-REAL ANALYSIS-I AND ORDINARY DIFFERENTIAL EQUATION	
Total Contact Hours: 4 hours/week (L:T:P- 4:0:0)	Credits: 4
Total Teaching Hours : 60 Hours Duration of Examination : 3 Hours	Max. Marks: 100 (Internal Assessment Marks: 20 Semester End Exam Marks: 80)

Course Learning Objectives:

➢ Convergence and Divergence: Determine whether a given sequence or series converges or diverges using various convergence tests.

➢ Sequence and Series Calculations: Calculate the sum of a given series, find the limit of a sequence, and determine the convergence or divergence of a series.

➢ Problem-Solving: Apply sequences and series to solve problems in mathematics, physics, engineering, and other fields.

➢ ODE Formulation: Formulate and analyse ODEs to model real-world phenomena, such as population growth, chemical reactions, and electrical circuits.

➢ Solution Methods: Apply various methods to solve ODEs, including separation of variables, integrating factor, undetermined coefficients, and numerical methods.

➢ Linear and Nonlinear ODEs: Solve linear and nonlinear ODEs, including first-order and higher-order equations.

Course Outcome(COs):

On successful completion of the course, the student will able to:

➢ Understand the concept of sequences and series

➢ Learn various types of sequences and series

➢ Understand and apply various convergence tests, including the ratio test, root test, and comparison test.

➢ Understand the concept of ODEs, including the order, degree, and linearity of ODEs.

➢ Apply different methods to solve ODEs, including separation of variables, integrating factor, and undetermined coefficients.

➢ Solve first-order and higher-order ODEs, including linear and nonlinear equations.

Units	Description	Hours
UNIT-I	**SEQUENCES**: Introduction, Bounded Sequences, Supremum and Infimum, Limit of a Sequence, Convergent, Divergent and Oscillatory Sequence, Algebra of convergent sequences, Monotonic Sequences, Convergence of monotonic sequences, limit superior and limit inferior for sequences, subsequence, sub sequential Limit, Cauchy Sequences, Cauchy's criterion of convergence.	12 hours
UNIT-II	**INFINITE SERIES:** Series, Partial Sum, Convergence, Divergence and Oscillation, Geometric Series, Harmonic Series (p-Series), Series of positive terms, Comparison test, De-Alembert's Ratio test(without proof), Raabe's test (without proof), Cauchy's root test, Alternating Series, Leibnitz test, Absolute convergence(without proof), Conditional convergence, Power Series, Exponential Series, Logarithmic Series, Binomial Series.	12 hours
UNIT-III	**DIFFERENTIAL EQUATIONS:** Basic Definitions, Differential Equations of first order and first degree, Equations in which variables are separable, Equations reducible to variable separable form, Homogeneous Equations, Equations reducible to homogeneous form, Exact Differential equations, Necessary and sufficient condition for the equation $Mdx + Ndy = 0$ to be exact, Equations reducible to exact form, Integrating factors. Linear and Bernoulli's equations.Differential equations of first order higher degree, Equations solvable for p, Equations solvable for x, Equations solvable for y. **Total Differential Equations: Necessary condition for the equation Pdx + Qdy + Rdz = 0 to integral problems there on, Solution of the equation of the form**	18 hours
UNIT-IV	Equations in Clairaut's form, Reducible to Clairaut's form, Linear Differential Equations with constant coefficients, Complementary functions and Particular integral, Homogeneous Linear differential equations, Simultaneous Linear differential equations with constant coefficients, Linear differential equations of second order with variable coefficients, Second and higher order ordinary linear differential equations with constant coefficients, Cauchy-Euler differential equation of order two. Solutions of ordinary second order linear differential equation:when a part of complementary function is given, Changing the independent variable, Changing the dependent variable, when first integral is given (Exact equation).	18 hours

References/Text books:

1. Elements of Real Analysis, Shanti Narayana, Dr. M. D. Raisinghania, S. Chand

2. Sequences and Series by Murray H. Protter (Springer)

4. Introduction to Analysis by Edward D. Gaughan (Brooks Cole)

5. Real and Complex Analysis by Walter Rudin (McGraw-Hill)

6. Differential Equations and Dynamical Systems by Lawrence Perko (Springer)

7. Differential Equations: An Introduction to Modern Methods and Applications by James C. Robinson (John Wiley & Sons)

8. Elementary Differential Equations by Charles Henry Edwards and David E. Penney

9. Differential Equations with Applications and Historical Notes by George F. Simmons

10. Introduction to Differential Equations by Richard K. Miller and Anthony N. Michel

PRACTICAL PAPER

24MP-3- MATHEMATICS LAB-III

Total Contact Hours: 4 hours/week (L:T:P- 0:0:4)	Credits: 2
Total Teaching Hours : 60 Hours Duration of Examination : 3 Hours	Max. Marks: 50 (Internal Assessment Marks: 10 Semester End Exam Marks: 40)

Course Learning Objectives:

➢ Develops foundational skills in programming concepts and methodologies.

➢ Enhances understanding of mathematical concepts through interactive software-based experiments.

➢ Strengthens programming fundamentals and logical thinking.

➢ Develops understanding of how algebra and calculus are used in practical scenarios through hands-on experiences with FOSS.

Course Outcome:

On successful completion of the course, the student will able to:

➢ Acquire knowledge of FOSS tools and their applications in computer programming.

➢ Develop and improve coding skills using Programming Language.

➢ Develop skills in applying software tools to mathematical concepts.

➢ Build a strong foundation in programming principles and practices.

➢ Understand the impact of mathematics on science, technology, engineering, and mathematics (STEM) fields.

➢ Build a strong foundation for future learning and exploration across multiple disciplines.

Syllabus: Problems from 24MT-3 (Theory) may be solved with the help of programming.

Suggested Software's: **Maxima/Scilab/Phython.**

List of Programs (Suggested):

Recapitulation of Maxima/SciLab / **Phython**Commands related to the Topic

1. Examining the convergence of sequences
2. Convergence of sequence using the $\lim_{n \to \infty}(1 + \frac{1}{n})^n$
3. Convergence of the p-series
4. Comparison test for series of positive terms
5. Ratio test for series of positive terms
6. Raabe's test for series of positive terms
7. Cauchy's root test for series of positive terms
8. Convergence of alternating series by Leibnitz theorem
9. Solution of differential equations solvable for p
10. Solution of differential equations solvable for x
11. Solution of differential equations solvable for y
12. Solution of differential equations in the Clairaut's form
13. Finding the C. F. of linear differential equations with constant coefficients
14. Finding the P. I. of differential equations up to second order (with e^{ax} on RHS)
15. Finding the P. I. of differential equations up to second order (with $\sin ax \ or \cos ax$ on RHS)
16. Finding the P. I. of differential equations up to second order (with algebraic functions on RHS)
17. Finding the P. I. of differential equations up to second order (with $e^{ax}V$ on RHS)

NOTE: Use the MAXIMA/SciLab/Python Software to execute the practical problems and verify manually