RAICHUR UNIVERSITY, RAICHUR

Under Graduate Curriculum for Degree of
Bachelor of Science (B.Sc) in

Mathematics
(I & II Semester)

As per Revised NEP 2024
With Effect from the Academic year from
2024-25 and onwards

24MT-1: ALGEBRA – I AND CALCULUS – I

Course Learning Objectives:

a) **To understand the concept of matrices thoroughly with its role in solving system of equations.**
b) **To understand the concept of binary operation, semigroups, Monoids and groups with examples.**
c) **To understand the concept of successive differentiation, Limits and continuity.**
d) **To understand the concept of mean value theorems.**

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

a) **Solve the system of linear equations; find the Eigen values and Eigen vectors of a square matrix.**
b) **Differentiate – semi-groups, Monoids and groups with suitable examples and applications.**
c) **Understand the importance of Rolle's theorem, Lagrange's theorem and Cauchy's mean value theorem.**
d) **Use Leibnitz's rule to evaluate derivatives of higher order.**
e) **Acquire basic principles of algebra and calculus.**

UNITI: MATRICES

Elementary transformations; Row reduced Echelon form; Rank of a matrix; Inverse and Normal form of a matrix by elementaryOperations; Solution of system of linear equations; Criteria for existence of trivial and non-trivialsolutions of homogeneous and non-homogeneous system of linear equations; Eigen values and Eigen vectors of square matrices; Cayley- Hamilton theorem (without proof) and related problems.

UNITII: Group Theory - I

Binary operation on sets - properties, theorems and examples; Semigroup and Monoid - properties, theorems and examples; Definition of a Group - properties, theorems and examples; Order of a group; Modulo groups; Subgroups definition, Lagranges theorem (without proof) and its consequences, criteria for subgroups, intersection and union of subgroups.

UNITIII: SUCCESSIVE DIFFERENTIATION

Derivative of a function; Derivatives of higher order – nth derivatives of the functions : $e^{ax}, (ax + b)^n, log(ax + b), sin(ax + b), cos(ax + b), e^{ax}sin(bx+ c), e^{ax}cos(bx + c)$ with problems; Leibnitz theorem (without proof) and its applications.

Limits, continuity and bounds of a function, Algebra of a continuous functions, Theorems on continuous functions (Every continuous function is bounded, Intermediate value theorem)

UNIT IV: DIFFERENTIABILITY OF FUNCTIONS

Differentiability of functions: Standard theorems (Every differentiable function is continuous but not conversely), Rolle's theorem - statement and problems; Lagrange's mean value theorem; Cauchy's mean value theorem with proof and examples. Taylor's theorem, Maclaurin's series and related examples. Indeterminate forms with examples.

Suggested References/Text books:

1. I N Herstain, Topics in Algebra, Wiley Eastern Ltd., New Delhi.

2. Bernard & Child, Higher algebra, Arihant, ISBN: 9350943199/ 9789350943199.

3. Sharma and Vasishta, Modern Algebra, Krishna Prakashan Mandir, Meerut, U.P.

4. Shanti Narayan, P. K. Mittal, Differential Calculus, S. Chand & Company, New Delhi.

5. Vijay K Khanna and S K Bhambri, A Course in Abstract Algebra, Vikas Publications.

6. G K Ranganath, Text Book of B.Sc. Mathematics, S Chand & Company.

7. N.P. Bali. 9. Golden algebra. First Edition Edition - 1 January 2018.

(4 hours/ week per batch of not more than 15 students)

Course Learning Objectives:
 a) **Foundation for introducing to programming.**
 b) **Enables the student to explore mathematical concepts and verify mathematical facts through the use of software**
 c) **Enhances the skills in programming.**
 d) **Acquire knowledge of practical applications of algebra and calculus through FOSS.**

 Course Outcome: On successful completion of the course, the student will able to:
 a) **Learn Free and Open Source Software (FOSS) tools for computer programming.**
 b) **show proficiency in using the software C-Programming.**
 c) **understand the use of various techniques of the software for effectively doing mathematics.**
 d) **obtain necessary skills in programming.**
 e) **understand the applications of mathematics**
 f) **explore and grasp concepts for the future across a wealth of disciplines.**

 Syllabus: Problems from 24MT 1 (Theory) may be solved with the help of programming.

 Suggested Softwares: Maxima/Scilab/Phython.

List of Programs (Suggested):

1. **Introduction to Scilab and Maxima with basic commands.**
2. **Algebra of Matrices. (Addition, subtraction, Multiplication, Transpose of a Matrix).**
3. **Computation of Rank of matrix and Row reduced Echelon form and Normal form of a matrix.**
4. **Solving the system of homogeneous and non-homogeneous linear algebraic equations.**
5. **Finding the Eigen Values and Eigen Vectors of a matrix.**
6. **Computation of Inverse of a Matrix using Cayley-Hamilton theorem.**
7. **Verification of binary operations.**
8. **Verification of Commutative and Associative Laws.**
9. **Find the identity element and inverse of an element.**
10. **Finding the nth derivative using Leibnitz rule.**
11. **Verification of Cauchy's mean value theorem.**
12. **Verification of Lagrange's mean value theorem.**
13. **Problems on Taylor's and Maclaurin's series.**
14. **Evaluation of limits using L-Hospital rule.**