

DEPARTMENT OF MATHEMATICS
SREE AYYAPPA COLLEGE, ERAMALLIKKARA

LEARNING OUTCOMES

B. Sc Mathematics Programme

PROGRAMME SPECIFIC OUTCOMES

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

- Demonstrate an understanding of the foundations and history of mathematics.
- Develop familiarity with the depth of modern mathematics, by successful completion of a range of advanced courses.
- Communicate mathematics effectively in writing.
- Utilize technology to address mathematical ideas.
- Understand the broad background of Mathematics and develop an appreciation of how its various sub disciplines are related.
- Recognize and appreciate the connections between theory and applications.
- Recognize the importance and value of mathematical and statistical thinking, training, and approach to problem solving.
- Develop an in-depth knowledge about topics chosen from those offered through the university.
- Engage in an independent mathematical project.
- Develop understanding of career opportunities in Mathematics and use mathematics in their careers.
- Build up strong foundations for higher studies in Mathematics.
- Formulate and analyze mathematical models of real life situations.
- Join teaching profession in primary and secondary schools.

COURSE OUTCOMES

FIRST SEMESTER

MM 1141 METHODS OF MATHEMATICS

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

- Take limits of algebraic and trigonometric expressions including limits that go to infinity, limits that don't exist and limits that are finite.
- Differentiate all polynomial, rational, radical, and trigonometric functions and compositions of those functions and apply it for optimization and for solving problems in Physics and economics
- Compute indefinite integrals and find antiderivatives, including finding constants of integration given initial conditions.
- Apply the definite integral to compute area between two curves, volumes of solids of revolutions, arc length, surface area for surfaces of revolution and work problems.

SECOND SEMESTER

MM 1221 FOUNDATIONS OF MATHEMATICS

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

- Understand the concept of complex numbers and hyperbolic functions
- Perform basic operations of complex numbers and to represent complex numbers in polar forms
- Develop understanding about the difference between total and partial derivatives and to perform both operations.
- Evaluate multiple integrals and apply it in relevant situations.
- Perform basic vector computations, as well as dot and cross products of two vectors and projection of one vector onto another vector.

THIRD SEMESTER

MM 1341 ELEMENTARY NUMBER THEORY AND CALCULUS - I

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

- Develop knowledge of basic concepts in Number Theory
- Analyze vector functions to find derivatives, tangent lines, integrals, arc length, and curvature etc.
- Apply derivative concepts to find tangent lines to level curves and to solve optimization problems.
- Find tangent lines to intersections of surfaces, extrema of multivariate functions and Lagrange multipliers to solve extremum problems with constraints.

FOURTH SEMESTER

MM 1441 ELEMENTARY NUMBER THEORY AND CALCULUS - II

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

- Gain knowledge in the fundamental facts in Elementary Number theory.
- Perform operations in connection with congruence relations and its properties.
- Understand about Mahavira's puzzle, modular inverses and polar Rho factoring method, Wilson's theorem, Fermat's little theorem and Euler's theorem.
- Evaluate double integrals and triple integrals in both Cartesian and polar coordinates and apply it to find areas and volumes under curves.
- Define and evaluate surface integrals and apply it to solve problems by making use of the divergence theorem, Gauss's law & Stoke's theorem.

FIFTH SEMESTER

MM 1541 REAL ANALYSIS - I

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

- Describe fundamental properties of the real numbers that lead to the formal development of Real Analysis.
- Interpret ideas in Real Analysis geometrically as well as algebraically.
- Approximate irrational numbers by rational numbers.
- Define neighborhood, absolute value, completeness of a set, countability etc.
- Develop an understanding of limits and how they are used in sequences, series, differentiation and integration.
- Illustrate Dedekind's property, Completeness property, Supremum property etc using examples.
- Use plotting softwares such as GeoGebra to plot various functions.

MM 1542 COMPLEX ANALYSIS - I

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

- Develop understanding of the basic concepts underlying complex analysis.
- Perform basic operations on complex numbers.
- Define uniform convergence, analyticity of functions, power series etc.
- Evaluate power series expansions of exponential functions and the sine and cosine functions.
- Describe integral of a function along a curve as a limit of Reimann sum.
- Illustrate the use of complex numbers in Number theory & Geometry.

MM 1543 DIFFERENTIAL EQUATIONS

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

- Recall the concepts in differential and integral calculus.
- Understand various methods to solve first order differential equations and second order linear equations.
- Solve various physical problems using differential equations.
- Find solutions of exact differential equations.
- Describe integration from the viewpoint of differential equations.

MM 1544 VECTOR ANALYSIS

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

- Define directional derivatives, vector fields, del and Laplacian operators etc.
- Evaluate line integrals.
- Describe conservative vector field.
- Prove Green's theorem and apply the theorem in relevant situations.
- Use Gauss's theorem to evaluate surface integrals.
- Apply Stoke's theorem to interpret integrals as anti-derivatives.

MM 1545 ABSTRACT ALGEBRA - I

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

- Recall the basic concepts of set theory.
- Recognize the concept of binary operations.
- Understand the well-definedness and closedness of a set under a binary operation. ➤ Define group, subgroup, cyclic groups, permutations, direct products, cosets etc.
- Prove Lagrange's theorem and apply the theorem in relevant situations. ➤ Write proofs and do problems based on axioms.

MM 1551 OPEN COURSE - OPERATIONS RESEARCH

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

- Formulate linear programming models and the graphical solutions of linear programs in two variables.
- Express linear programs in standard forms.
- Find solution of a linear programming problem using simplex method.
- Solve transportations problems using Vogel's approximation method. ➤ Understand project management and assignment problems.

SIXTH SEMESTER

MM 1641 REAL ANALYSIS - II

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

- Recall the basic concepts in Real Analysis.
- Understand the History of development of calculus.
- Interpret the notion continuity geometrically as an unbroken curve.
- Explain the connection between continuity and existence of limits. ➤ View differentiation from a conceptual point of view.
- Understand the difference between anti-differentiation and Reimann's theory of integration.
- Apply Reimann's theory of integration.

MM 1642 LINEAR ALGEBRA

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

- Recall the basic concepts of matrices.
- Understand the geometrical aspects of linear algebra.
- Describe the two dimensional aspects of analytic geometry, solutions of simultaneous equations in two variables and the theory of 2X2 matrices.

- Extend the concepts in two dimension to three dimension.
- Extend the concepts in two & three dimensions into arbitrary dimensions.

MM 1643 COMPLEX ANALYSIS - II

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

- Recall the basic concepts in complex analysis
- Understand the properties of functions analytic in a disc or on a punctured disc.
- Define singularity, residues, contour integral etc.
- Apply contour integral methods to evaluate and estimate sums.
- Represent analytic functions as power series.
- Apply Residue theorem to evaluate integrals.

MM 1644 ABSTRACT ALGEBRA - II

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

- Recall the basic concepts in group theory.
- Familiarize with detailed study on group theory.
- Understand the basic concepts of ring theory.
- Assess properties implied by the definitions of groups and rings.
- Define homomorphism of groups, factor groups etc.
- Analyze examples of rings, factor groups etc.

MM 1645 COMPUTER PROGRAMMING (PRACTICAL)

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

- Prepare document in computers using the LATEX typesetting program ➤ Understand the basics of computer programming using Python.
- Understand the fundamentals of GNU/Linux operating system.
- Identify the Linux directory structure and the advantages of keeping their files in well structured directories.

MM 1651 ELECTIVE COURSE – GRAPH THEORY

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

- Understand the basic concepts of graphs, directed graphs etc
- Represent graphs by matrices
- Understand the properties of trees and to find the centre, radius and diameter of trees ➤
Determine whether a graph is planar or non planar
- Define walks, paths, circuits, connected graphs, bipartite graphs etc.
- Understand the concept of Euler graph and apply it to describe the Konigsberg problem, utility problem, seating problem etc.

MM 1646 PROJECT

After the successful completion of project, the student will be able to:

- Demonstrate library research skills in the area of Mathematics.
- Develop communication and teamwork skills.
- Produce a mature oral presentation of a non-trivial mathematical topic.

STATISTICS COMPLEMENTARY COURSE FOR MATHEMATICS

FIRST SEMESTER

ST 1131.1 DESCRIPTIVE STATISTICS

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

- Understand the characteristics of data and will get acquainted with describing data through illustrating examples and exercises.
- Collect, organize and summarize data.
- Create and interpret simple graphs.
- Compute appropriate summary statistics.

SECOND SEMESTER

ST 1231.1 PROBABILITY AND RANDOM VARIABLES

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

- Understand the ideas of probability and random variables in both univariate and bivariate cases.

THIRD SEMESTER

ST 1331.1 STATISTICAL DISTRIBUTIONS

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

- Understand the ideas of standard probability distributions, limit theorems and sampling distributions and its applications.

FOURTH SEMESTER

ST 1431.1 STATISTICAL INFERENCE

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

- Understand point estimation, interval estimation, testing of hypothesis and design of experiments.

ST 1432.1 PRACTICAL USING EXCEL

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

- Use statistical tools available in Excel
- Have hands on training in Data Analysis