DEPARTMENT OF MATHEMATICS

B. Sc. Mathematics

PROGRAM SPECIFIC OUTCOMES

After the successful completion of this course, the student will: ·

- Be able to explain the core ideas and the techniques of mathematics at the college level.
- Understand the applications of Mathematics in other disciplines and basic concepts and tools of mathematical logic , set theory , methods of proof, geometry , calculus, abstract structures and analysis.
- Be able to setup mathematical models of real world problems and obtain solutions in structured and analytical approaches with independent judgement.
- Be able to carry out objective analysis and prediction of quantitative information with independent judgment.
- Be able to communicate effectively about mathematics to both lay and expert audiences utilizing appropriate information and communication technology.
- Develop logical, computational and typesetting skills and implement them practically.
- Be able to recognize the importance of compliance with the ethics of science and being a responsible citizen towards their community and a sustainable environment.
- Be able to cultivate a mathematical attitude and nurture the interests.

COURSE OUTCOMES

FIRST SEMESTER MM1CRT01: FOUNDATION OF MATHEMATICS

On completion of this course, successful students will be able to:

- prove statements about sets and functions;
- Develop knowledge in basic concepts of Mathematics.
- Construct simple proofs
- Understand the concepts of mathematical logic, sets, functions, relations and partial orderings.
- Apply proof techniques to prove simple theorems.
- Determine the solution of polynomial equation upto 4th degree.

SECOND SEMESTER MM2CRT02: ANALYTIC GEOMETRY, TRIGONOMETRY AND DIFFERENTIAL CALCULUS

On completion of this course, successful students will be able to:

- find the equation to tangent, normal at a point on a conic;
- find the polar equation of a line, circle, tangent and normal to conics
- familiarize real and imaginary parts of a circular and hyperbolic functions of a complex variable
- Factorization of special type of polynomial functions
- Find the higher order derivative of the product of two functions
- familiarize indeterminate forms

THIRD SEMESTER MM3CRT03: CALCULUS

- After completing this course the learner should be able to

- Expand a function using Taylor's and Maclaurin's series.
- Conceive the concept of asymptotes and obtain their equations.
- Understand curvature, involutes ,evolutes, envelopes
- Learn about partial derivatives and its applications.
- Find the area under a given curve, length of an arc of a curve when the equations are given in parametric and polar form.
- Find the area and volume by applying the techniques of double and triple integrals

FOURTH SEMESTER

MM2CRT04: VECTOR CALCULUS, THEORY OF NUMBERS AND LAPLACE TRANSFORM

After completing this course the learner should be able to

- Analyze vector functions to find derivatives, tangent lines, integrals, arc length, and curvature,
- Compute limits and directional derivatives of functions of 2 and 3 variables,
- Differentiate vector fields
- Determine gradient vector fields and find potential functions
- Analyse the fundamental theorem of calculus and see their relation to the fundamental theorems of calculus in calculus , leading to the more generalised version of Stokes' theorem in the setting of differential forms.
- Understand basic properties of congruence,
- familiarize famous theorems - Fermats Theorem,Wilsons Theorem
- Understand the properties of Euler –Phi Function
- Develop the idea about Laplace Transform and its properties
- Solve linear differential equations using the Laplace transform technique,

FIFTH SEMESTER

MM5CRT05: MATHEMATICAL ANALYSIS

After completing this course the learner should be able to

- Describe the real line as a complete, ordered field
- Determine the basic algebraic and order properties of real numbers
- Understand the term convergence
- Use the definitions of convergence as they apply to sequences, series and functions,
- Produce rigorous proofs of results that arise in the context of real analysis.
- Write solutions to problems and proofs of theorems that meet rigorous standards based on content, organization and coherence, argument and support, and style

MM5CRT06: DIFFERENTIAL EQUATIONS

- After studying this course the students should be able to
    - Obtain an integrating factor which may reduce a given differential equation into an exact one and eventually provide its solution.
    - Identify and obtain the solution of Clairaut's equation.
    - Fine the complementary function and particular integrals of linear differential equation.
    - Familiarize the orthogonal trajectory of the system of curves on a given surface.
    - Describe the origin of partial differential equation and distinguish the integrals of first order linear partial differential equation into complete, general and singular integrals.
    - Use Lagrange's method for solving the first order linear partial differential equation
    - Solve differential equations of first order using graphical, numerical, and analytical methods,
    - Solve and apply linear differential equations of second order (and higher),
    - Find power series solutions of differential equations, and
    - Develop the ability to apply differential equations to significant applied and/or theoretical problems.
    - Demonstrate their ability to write coherent mathematical proofs and scientific arguments needed to communicate the results obtained from differential equation models
    - Demonstrate their understanding of how physical phenomena are modeled by differential equations and dynamical systems
    - Implement solution methods using appropriate technology.

MM5CRT07: ABSTRACT ALGEBRA

After completing this course the learner should be able to

- Assess properties implied by the definitions of groups and rings,
- Use various canonical types of groups (including cyclic groups and groups of permutations) and canonical types of rings (including polynomial rings and modular rings),
- Analyze and demonstrate examples of subgroups, normal subgroups and quotient groups,
- Analyze and demonstrate examples of ideals and quotient rings,
- Use the concepts of isomorphism and homomorphism for groups and rings
- Produce rigorous proofs of propositions arising in the context of abstract algebra

CODE: HUMAN RIGHTS AND MATHEMATICS FOR ENVIORNMENTAL STUDIES

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

- Help the students to understand how their decisions and actions affect the environment.
- Build knowledge and skills necessary to address complex environmental issues ,and ways we can take action to keep our enviorment healthy and sustasinable for future
- Help the students to understand basic concepts of Human Rightes

- Understand about Fundamental Rights and Indian Constitution
- Identify the Application of Mathematics in Nature
- Develop the idea about the Fibonacci numbers and Golden ratio in nature

Open course

MM5GET02: APPLICABLE MATHEMATICS

- After the completion of this course the student will be able to
  - Understanding the basic operations of Mathematics
  - Applies shortcut methods for solving problems
  - Apply mathematical concepts and principles to perform computations
  - Apply mathematics to solve real life problems
  - Create, use and analyze graphical representations of mathematical relationships
  - Communicate mathematical knowledge and understanding
  - Apply technology tools to solve problems · Perform abstract mathematical reasoning
  - Learn independently
  - Compute limits, derivatives, and definite & indefinite integrals of algebraic, logarithmic and exponential functions
  - Analyze functions and their graphs as informed by limits and derivatives
  - Familiarize with basic operations on real numbers, logarithms and quadratic equations
  - Identify the definitions of trigonometric ratios and their applications to problems involving heights and distance
  - Get basic ideas of two dimensional geometry and graphing straight lines
  - Use various methods to compute the probabilities of events
  - Acquires basic ideas of derivatives, standard results and various rules for finding the derivatives of functions
  - Differentiate integration from differentiation and integration of simple functions
  - Acquires the basic arithmetic skills involving percentages, averages, time and rates, elementary algebra and geometry

SIXTH SEMESTER

MM6CRT09: REAL ANALYSIS

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

- Applies this term into problems ·
- Illustrate the convergence properties of power series
- Identifies Continuity and Discontinuity of various functions in different contexts
- Distinguish Uniform continuity from continuity and related theorems
- Understand Integrability and theorems on integrability
- Recognize the difference between pointwise and uniform convergence of a sequence of functions
- Illustrate the effect of uniform convergence on the limit function with respect to continuity, differentiability, and integrability

- Develops a knowledge about Riemann Integration and applies into problems
- Determine the Riemann integrability and the Riemann
- Apply the Mean Value Theorem and L 'Hospital rules to problems in the context of real analysis

MM6CRT11: COMPLEX ANALYSIS

On completion of this course, the students will be able to

- Compute sums, products, quotients, conjugate, modulus, and argument of complex numbers
- Define and analyze limits and continuity for complex functions as well as consequences of continuity
- Conceive the concepts of analytic functions and will be familiar with the elementary complex functions and their properties
- Determine whether a given function is differentiable, and if so find its derivative
- Use differentiation rules to compute derivatives
- Write complex numbers in polar form
- Evaluateexponentials and integral powers of complex numbers
- Find all integral roots and all logarithms of nonzero complex numbers
- Apply the concept and consequences of analyticity and the CauchyRiemann equations and of results on harmonic and entirefunctions including the fundamental theorem of algebra
- Find parameterizationsof curves, and compute complex line integrals directly
- Understand the theory and techniques of complex integration
- Applies the theory into application of the power series expansion of analytic functions
- Understand the basic methods of complex integration and its application in contour integration.
- Analyze sequences and series of analytic functions and types of convergence,
- Evaluate complex contour integrals directly and by the fundamental theorem, apply the Cauchy integral theorem in its various versions, and the Cauchy integral formula
- Represent functions as Taylor, power and Laurent series, classify singularities and poles, find residues and evaluate complex integralsusing the residue theorem
- Use the Cauchy Residue Theorem to evaluate integrals and sum series
- Identify the isolated singularities of a function and determine whether they are removable, poles, or essential
- Compute Laurent series at an isolated singularity, and determine the residue
- Understand uses of improper integrals in various situations
- Use the residue theorem to compute complex line integrals and real integrals

MM6CRT10: GRAPH THEORY AND METRIC SPACES

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

- Understand the new topics Graph Theory
- Understand the basic concepts of graphs, directed graphs, and weighted graphs and able to present a graph by matrices
- Understand the properties of trees and able to find a minimal spanning tree for a given weighted graph
- Understand Eulerian and Hamiltonian graphs
- Recall the defining properties of a metric space, and determine whether a given function defines a metric
- Determine how that a function is or is not a metric
- Show that a set ina metric space is or is not open and/or closed
- Show that a function between metric spaces is or is not continuous
- Show that a sequence in a metric space is or is not convergent
- Show that a metric space is or is not complete
- Familiarize with open sets, closed sets and Cantor set

MM6CRT12: LINEAR ALGEBRA

Upon completion of this course, students should be able to:

- Basic concepts and properties of Matrices
  - Understand the idea about vector space
  - Analyze finite and infinite dimensional vector spaces and subspaces over a field and their properties, including the basis structure of vector spaces
  - Use the definition and properties of linear transformations and matrices of linear transformations and change of basis, including kernel, range and isomorphism
  - Compute with the characteristic polynomial, eigenvectors, eigenvalues and Eigen spaces, as well as the geometric and the algebraic multiplicities of an eigen value and apply the basic diagonalization result

MM6PRT01 : Project

- Demonstrate library research skills in the area of mathematics,
- Critique mathematical presentations, and
- Produce a mature oral presentation of a non-trivial mathematical topic.