

Program Outcome B.Sc. Mathematics

- 1) Think in a critical and logical manner.
- 2) Know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand.
- 3) Acquire good knowledge and understanding in advanced areas of mathematics and statistics, chosen by the student from the given courses.
- 4) Familiarize the students with suitable tools of mathematical analysis to handle issues and problems in mathematics and related sciences.
- 5) Acquire good knowledge and understanding to solve specific theoretical and applied problems in advanced areas of mathematics and statistics.
- 6) Provide students/learners sufficient knowledge and skills enabling them to undertake further studies in mathematics and its allied areas on multiple disciplines concerned with mathematics.
- 7) Encourage the students to develop a range of generic skills helpful in employment, internships and social activities.
- 8) building a solid foundation for higher studies in mathematics.

Course Outcome of Matrices, Trigonometry and Differential Calculus

The programme outcome is

1. To give foundation knowledge for the students to understand basics of mathematics including applied aspect for developing enhanced quantitative skills and pursuing higher mathematics and research as well.
2. By the time students complete the course they will have wide ranging application of the subject and have the knowledge of matrices and basics of differentiation.
3. Find Maxima and minima of function of two variables.
4. Explain subtangent and subnormal.
5. Find angle of intersection of two curves.
6. Find circle, radius, and centre of curvature.
7. Expand $\sin n\theta$, $\cos n\theta$ and $\tan n\theta$ by using Demoivre's theorem.
8. Expand $\cos n\theta$, $\sin n\theta$ and $\tan n\theta$ in terms of θ .
9. Define hyperbolic functions.
10. Define inverse hyperbolic functions.
11. The student will be able to sum the trigonometric series of real and complex number, and separate the trigonometric function in form of $A+iB$.
12. The main objective of the course is to equip the student with necessary analytic and technical skills. By applying the principles of differentiation, he learns to solve a variety of practical problems in science and engineering.
13. Calculate the limit and examine the continuity of a function at a point.
14. Understand the consequences of various mean value theorems for differentiable functions.
15. Sketch curves in Cartesian and polar coordinate systems.
16. Apply derivative tests in optimization problems appearing in social sciences, physical sciences, life sciences and a host of other disciplines.
17. The student is equipped with standard concepts and tools at an intermediate to advance level that will serve him well towards taking more advance level course in mathematics.

Course Outcome of Practical

This course will enable the students to:

1. become familiar the student with different computer software such as Mathematica /MATLAB /Maple /Scilab/Maxima etc.
2. The students will be able to compute various operations on matrices by using different computer software such as Mathematics /MATLAB /Maple/Scilab/Maxima etc.
3. The students will also be able to compute n^{th} derivative of various functions by using different computer software.

Course Outcome of Integral Calculus and vector Analysis

This course will enable the students to:

1. give foundation knowledge for the students to understand basics of mathematics including applied aspect for developing enhanced quantitative skills and pursuing higher mathematics and research as well.
2. By the time students complete the course they will have wide ranging application of the subject and have the knowledge of surface area and volume of shapes.
3. The main objective of the course is to equip the student with necessary analytic and technical skills. By applying the principles of integral he learns to solve a variety of practical problems in science and engineering.
4. The student is equipped with standard concepts and tools at an intermediate to advance level that will serve him well towards taking more advance level con in Mathematics.
5. Solve Basic Integral Calculus problems.
6. Explain properties of definite integrals.
7. Prove reduction formulae and solve some problems by using these formulae.
8. Evaluate double and triple integrals.
9. Apply change variable method to find the value of double and triple integral.
10. Explain properties of Beta functions.
11. Derive relation between Beta and Gamma functions.
12. Evaluate integrals by using Beta and Gamma functions.
13. Find Cosine and Sine series expansions for given functions.

Course Outcome of Group Theory and Analytic Geometry

Group theory is one of the Wilding blocks of modem algebra. Objective of this course is to

1. introduce students to basic concepts of Group and their Properties
2. Recognize the mathematical objects called groups.
3. Link the fundamental concepts of groups and symmetries of geometrical objects.

4. Explain the significance of the notions of cosets, normal subgroups, and factor groups.
5. Analyse consequences of Lagrange's theorem.
6. Learn about structure preserving maps between groups and their consequences.
7. This course will lead the student to basic course in advanced mathematics and geometry.
8. The subjects learn and visualize the fundamental ideas about coordinate geometry and learn to describe some of the surface by using analytical geometry.
9. On successful completion of the course students should have gained knowledge about regular geometrical figures and their properties. They have the foundation for higher course in geometry.
10. On successful completion of the course students should have knowledge about higher different mathematical methods and will help him in going for higher studies and research.

Course Outcome of Ordinary Differential Equations

This course will enable the students to:

1. Understand the genesis of ordinary differential equations.
2. Learn various techniques of getting exact solutions of solvable first order differential equations and linear differential equations of higher order.
3. Know Picard's method of obtaining successive approximations of solutions of first order differential equations, passing through a given point in the plane and Power series method for higher order linear equations, especially in cases when there is no method available to solve such equations.
4. Grasp the concept of a general solution of a linear differential equation of an arbitrary order and learn a few methods to obtain the general solution of such equations.
5. Formulate mathematical models in the form of ordinary differential equations to suggest possible solutions of the day-to-day problems arising in physical, chemical, and biological disciplines.

Course Outcome of Real Analysis

This course will enable the students to:

1. Understand many properties of the real line \mathbb{R} and learn to define sequence in terms of functions from \mathbb{R} to a subset of \mathbb{R} .
2. Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
3. Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.
4. Learn some of the properties of Riemann integrable functions, and the applications of the fundamental theorems of integration.

Course Outcome of Linear Algebra

This course will enable the students to:

1. Understand the concepts of vector spaces, subspaces, bases, dimension, and their properties.
2. Relate matrices and linear transformations, compute eigen values and eigen vectors of linear transformations.
3. Learn properties of inner product spaces and determine orthogonality in inner product spaces.
4. Realise importance of adjoint of a linear transformation and its canonical form.
5. Define Vector Space, Quotient space Direct sum, linear span and linear independence, basis and inner product.
6. Discuss the linear transformations, rank, nullity.

Course Outcome of Multivariable Calculus and Partial Differential Equations

This course will enable the students to:

1. Apply a range of techniques to solve first & second order partial differential equations.
2. Model physical phenomena using partial differential equations such as the heat and wave equations.
3. Learn conceptual variations while advancing from one variable to several variables in calculus.
4. Apply multivariable calculus in optimization problems.
5. Know inter-relationship amongst the line integral, double, and triple integral formulations.
6. Know applications of multivariable calculus tools in physics, economics, optimization, and understanding the architecture of curves and surfaces in plane and space etc.
7. Realize importance of Green, Gauss and Stokes' theorems in other branches of mathematics

Course Outcome of Linear Programming Problems

This course will enable the students to:

1. Analyze and solve linear programming models of real-life situations.
2. Provide graphical solutions of linear programming problems with two variables, and illustrate the concept of convex set and extreme points.
3. Understand the theory of the simplex method.
4. Know about the relationships between the primal and dual problems, and to understand sensitivity analysis.

5. Learn about the applications to transportation, assignment and two-person zero-sum game problems.
6. Define basic feasible solutions, Slack and Surplus variable.
7. Explain simplex method.
8. Demonstrate Big-M method
9. Illustrate two phase method
10. Prove dual of the dual is primal.
11. Interpret dual simplex method.

Course Outcome of Complex Analysis

This course will enable the students to:

1. Visualize complex numbers as points of \mathbb{R}^2 and stereographic projection of complex plane on the Riemann sphere.
2. Understand the significance of differentiability and analyticity of complex functions leading to the Cauchy Riemann equations.
3. Learn the role of Cauchy Goursat theorem and Cauchy integral formula in evaluation of contour integrals.
4. Apply Liouville's theorem in fundamental theorem of algebra.
5. Understand the convergence, term by term integration and differentiation of a power series.
6. Learn Taylor and Laurent series expansions of analytic functions, classify the nature of singularity, poles and residues and application of Cauchy Residue theorem.

Course Outcome of Numerical Analysis

Students will able to

1. Define Basic concepts of operators Δ, E, ∇
2. Find the difference of polynomial
3. Solve problems using Newton forward formula and Newton backward formula.
4. Derive Gauss's formula and Stirling formula using Newton forward formula and Newton backward formula.
5. Solve initial and boundary value problems in differential equations using numerical methods.
6. Apply various numerical methods in real life problems.
7. Find maxima and minima for differential difference equation
8. Derive Simpson's 1/3, 3/8 rules using trapezoidal rule
9. Find the solution of the first order and second order equation with constant coefficient
10. Find the summation of series finite difference techniques.
11. Find the solution of ordinary differential equation of first by Euler, Taylor and Runge-Kutta methods

Course Outcome of Operations Research

Students will able to:

1. Define nature and feature of Operations Research
2. Find the replacement period of equipment that fails Identify and develop operational research models from the verbal description of the real system.
3. Understand the mathematical tools that are needed to solve optimisation problems.
4. Develop a report that describes the model and the solving technique, analyse the results and propose recommendations in language understandable to the decision-making processes in Management Engineering.

Course Outcome of Modern Algebra

Students will able to:

1. Define subgroup, center, Normalizer of a subgroup.
2. Find cycles and transpositions of a given permutations.
3. Prove Lagrange's theorem, Euler's theorem and Fermats theorem
4. Define cyclic groups.
5. Prove a group has no proper subgroup if it is cyclic group of prime order.
6. Define normal subgroups, quotient groups and index of a subgroup.
7. Define homomorphism, kernel of a homomorphism, isomorphism.
8. Prove Cayley's theorem, the fundamental theorem of homomorphism for groups
9. Define rings, zero divisors of a ring, integral domain, field and prove theorems

Course Outcome of Graph Theory

Students will able to:

1. Able to define the basic concepts of graphs, directed graphs, and weighted graphs.
2. Defines a graph, identifying edges and vertices.
3. Finds the degree of a vertex.
4. Express and prove handshaking lemma.
5. Able to define the properties of bipartite graphs, particularly in trees.
6. Defines bipartite graphs.
7. Lists basic properties of trees.
8. Expresses and prove Cayley Theorem.
9. understand the concept of colorings and theory.
10. Explains 4-colour problem.
11. Explains basic results about colouring vertices.
12. Defines chromatic polynomials.
13. understand Eulerian and Hamiltonian graphs
14. Defines Eulerian graphs.
15. Defines Hamiltonian graphs.
16. Explains basic results related with Eulerian and Hamiltonian graphs.
17. understand the concept of plane graph and theory.
18. Explains operations on graph circuits.

Course Outcome of Number Theory and Relativity

The student will be able to:

1. solve problems in elementary number theory
2. apply elementary number theory to cryptography.
3. describe the basic concepts of the theory of relativity.
4. to discuss postulates of the special theory of relativity and their consequences.

Course Outcome of Mechanics

1. The course is aimed at exposing the students to foundations of analysis which will be useful in understanding various physical Phenomena and gives the students the foundation of Mathematics.
2. The object of the paper is to give students knowledge of basic mechanics such as simple harmonic motion, motion under other laws and forces.
3. The student, after completing the course can go for higher problems in mechanic such as hydrodynamics.
4. This will be helpful in getting employment in industry.

Course Outcome of Metric Space

The student will be able to:

1. Define metric space, pseudo metric, discrete and usual metric space, diameter of a set with examples.
2. Have knowledge of open and closed sets in a metric space, Interior point, Limit point, Adherent point, Closed set, Neighbourhood, Closure of a set. 'Maier of a set,
3. Prove Bolzano-Weirstrass theorem.
4. Understand the concept of Complete metric space.
5. Define Cauchy sequence, Convergent sequence, Bounded Sequence Separated sets, Connected, and disconnected sets, Continuity and connectedness, Compactness, Compactness and uniform continuity, Continuity and Uniform continuity in a metric space.