

PROGRAMME OUTCOME, PROGRAMME SPECIFIC OUTCOME & COURSE OUTCOME

DEPARTMENT OF MATHEMATICS, HINDOL COLLEGE, KHAJURIAKATA,

DHENKANAL, ODISHA

PROGRAMME OUTCOME:

After successful completion of Bachelor's Degree in (Hons.) Mathematics program a student shall be able to gain knowledge as the following.

- PO – 1. Gain basic knowledge, understanding, skill, attitudes and academics achievements.
- PO – 2. The learning outcomes of Mathematics for the course are aimed at facilitating the learners to acquire these attributes keeping in view of their preferences and aspirations for knowledge of Mathematics.
- PO – 3. Demonstrate the ability to manipulate and visualize data and to compute standard statistical Summaries.
- PO – 4. Learn, select and apply appropriate methods and procedures, resources and computing tool Such as Excel, MATLAB, MATHEMATICA etc.
- PO – 5. Able to think rationally, analyze situations and solve problems adequately.

PROGRAMME SPECIFIC OUTCOMES

- PSO – 1. Think in a critical manner
- PSO – 2. Acquire knowledge in Calculus and Geometry.
- PSO – 3. Analyze and solve real world problems applying mathematical models.
- PSO – 4. Familiarize the students with suitable tools of mathematical analysis to handle issues and problems in mathematics and related sciences.
- PSO – 5. Encourage the students to develop a range of generic skills helpful in employment, Internships and social activities.

COURSE OUTCOMES

CORE PAPER – I. CALCULUS

This course will enable the students to:

1. Assimilate the notions of limit of a sequence and convergence of a series of real numbers.
2. Emphasis of this course is to equip the student with necessary analytic and technical skills to handle problems of mathematical nature as well as practical problems.
3. Target of this course is to explore the different tools for higher order derivatives.
4. Plot the various curves
5. Calculate the limit and examine the continuity of a function at a point.
6. Understand the consequences of various mean value theorems for differentiable functions.
7. After completing the course, students are expected to be able to use Leibnitz's rule to evaluate derivatives of higher order.
8. Able to study the geometry of various types of functions.
9. Evaluate the area, volume using the techniques of integrations.
10. Able to identify the difference between scalar and vector, acquired knowledge on some the basic properties of vector functions.

CORE PAPER – II. DISCRETE MATHEMATICS

This course will enable the students to:

1. This is a preliminary course for the basic courses in mathematics and all its applications.
2. They can study advance courses in mathematical modeling.
3. Learn about partially ordered sets, lattices and their types.
4. The objective is to acquaint students with basic counting principles,
5. The objective is to acquaint students with set theory and logic,
6. Solve real-life problems using finite-state and Turing machines.
7. Assimilate various graph theoretic concepts and familiarize with their applicatinos.

CORE PAPER -III. REAL ANALYSIS

This course will enable the students to:

1. The objective of the course is to have the knowledge on basic properties of the field of real numbers.
2. Studying Bolzano-Weierstrass Theorem, sequences and convergence of sequences,
3. Series of real numbers and its convergence etc.

4. This is one of the core courses essential to start doing mathematics.
5. On successful completion of this course, students will be able to handle fundamental properties of the real numbers that lead to the formal development of real analysis
6. Understand limits and their use in sequences, series, differentiation and integration.
7. Students will appreciate how abstract ideas and rigorous methods in mathematical analysis can be applied to important practical problems.

CORE PAPER – IV. DIFFERENTIAL EQUATION

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. Grasp the concept of a general solution of a linear differential equation of an arbitrary order and also learn few methods to obtain the general solution of such equations.
4. 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.
5. A student completing the course is able to solve differential equations and able to model problems in nature using ordinary differential equations.

CORE PAPER – V. THEORY OF REAL FUNCTIONS

This course will enable the students to:

1. The objective of the course is to have knowledge on limit theorems on functions.
2. Limits of functions, continuity of functions and its properties.
3. Uniform continuity, differentiability of functions, algebra of functions and Taylor's theorem and its applications.
4. The student how to deal with real functions and understand uniform continuity, mean value theorems.
5. On the completion of the course, students will have working knowledge on the concepts and theorem of the elementary calculus of functions of one real variable.
6. They will work out problems involving derivatives of function and their applications.
7. They can use derivatives to analyze and sketch the graph of a function of one variable.
8. They can also obtain absolute value and relative extrema of functions.
9. This knowledge is basic and students can take all other analysis course after learning this course.

CORE PAPER – VI. GROUP THEORY – I

This course will enable the students to:

1. Recognize the mathematical objects called groups.
2. Link the fundamental concepts of groups and symmetries of geometrical objects.
3. Study the basic courses in advance mathematics, such as Group theory – II and ring theory.
4. Understand cyclic groups, permutation groups and related results.
5. Analyze consequence of Lagrange's theorem.
6. Apply knowledge to problems in physics, computer science, economics and engineering.
7. After this course student can opt for courses in field theory, commutative algebras, linear classical groups etc.

CORE PAPER – VII. PARTIAL DIFFERENTIAL EQUATIONS AND SYSTEM OF ODEs

This course will enable the students to:

1. The objective of this course is to understand basic methods for solving Partial Differential Equations of first order and second order.
2. In this process, students will able to solve Wave equation, Heat equation, Laplace equation etc.
3. They will also learn classification of Partial Differential Equations and system of ordinary differential equations.
4. After completing this course, a student will be able to take more courses on wave equation, heat equation, diffusion equation etc.
5. All these courses are important in engineering and industrial applications for solving boundary value problems.

CORE PAPER- VIII. NUMERICAL METHODS AND SCIENTIFIC COMPUTING

1. This course enables the student to:
2. Calculation of error and approximation is necessity in all real life, industrial and scientific computing.
3. The objective of the course is to acquaint students with various numerical methods of finding solution of different types of problem, which arises in different branches of science such as locating roots of equations.
4. The objective of this course is to finding solution of systems of linear equations and differential equations, interpolations, differentiation, evaluating integration.
5. Students can handle physical problems to find an approximate solution.
6. After getting trained a student can opt for advance courses in numerical analysis in higher mathematics.

7. Use of good mathematical software will help in getting the accuracy one need from the computer and can assess the reliability of the numerical result, and determine the effect of round off error or loss of significance.

CORE PAPER- IX TOPOLOGY OF METRIC SPACES

This course will enable the students to:

1. This is an introductory course in topology of metric spaces.
2. The objective of this course is to impart knowledge on open sets, closed sets.
3. Learn basic facts about the cardinality of a set.
4. Understand several standard concepts of metric and their properties like openness, closedness, completeness, Bolzano- weierstrass property, compactness, and connectedness.
5. Identify the continuity of a function defined on metric spaces.
6. The objective of this course is to introduce a student the basics of linear algebra and some of its application.
7. On successful completion of the course student will learn to work with abstract topological spaces.
8. This a foundation course for all analysis courses in future.

CORE PAPER -X. RING THEORY

This course will enable the students to:

1. This is a second course in modern algebra which deals with ring theory.
2. Some basics of ring theory like ring, ideals, ring homomorphisms and their properties.
3. Understand the basic concepts of group actions and their applications.
4. Recognize and use the Sylow theorems to characterize certain finite groups.
5. This course is an integral part of any course on Modern algebra the others being Group theory and Field Theory.
6. After completing this course, this will be help students to continue more courses in advanced Ring theory modules,
7. This will be help students Galois groups.

CORE PAPER -XI. MULTIVARIABLE CALCULUS

This course will enable the students to:

1. Learn conceptual variations while advancing from one variable to several variables in calculus.
2. Apply multivariable calculus in optimization problems.
3. Inter – relationship amongst the line integral, double and triple integral formulations.

4. Applications of multivariable calculus tools in physics, economics, optimization, and understanding the architecture of curves and surfaces in plane and space etc.
5. Realize importance of Green, Gauss and Stokes' theorems in other branches of mathematics.

CORE PAPER- XII. LINEAR ALGEBRA

This course will enable the students to:

1. Linear algebra is a basic course in almost all branches of science.
2. Understand the concepts of vector spaces, subspaces, bases, dimension and their properties.
3. Relate matrices and linear transformations, compute eigen values and eigen vectors of linear transformations.
4. A full course in undergraduate program will help students in finding real life applications later.
5. The objective of this course is to introduce a student the basics of linear algebra and some of its application
6. The student will use this knowledge wherever he\She goes after undergraduate program.
7. It has applications in computer science, finance mathematics,
8. More applications in industrial mathematics, bio mathematics and what not.

CORE PAPER – XIII. COMPLEX ANALYSIS

This course will enable the students to:

1. Visualize complex numbers and learn theories of functions of complex variables.
2. Understand the significance of differentiability and analyticity of complex functions leading to the Cauchy Reimann Equations.
3. Learn 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.

CORE PAPER – XIV. GROUP THEORY - II

This course will enable the students to:

1. The objective of this course is to be exposed to more advance results in group theory after completing a basic course.
2. The course introduces results on automorphism, subgroup, group action Sylow theorems etc.
3. The knowledge of automorphism helps to study more on field theory.

4. Students learn on direct products, group actions, class equations and their applications with proof of results.
5. This course helps to op for more advance courses in algebra and linear classical groups.

DISCIPLINE SPECIFIC ELECTIVE - I. LINEAR PROGRAMMING

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 variable and illustrate the concept of convex set and extreme points.
3. Understand the theory of simplex method.
4. Learn about transportation problems, assignment problems and their applications.
5. Students will know the application of linear programming method in game theory.

DISCIPLINE SPECIFIC ELECTIVE PAPER- II PROBABILITY AND STATISTICS

1. The objective of the course is to expertise the student to the extensive role of statistics in everyday life
2. To learn computation, which has made this course a core course in all branches of mathematical and engineering sciences.
3. The students shall learn probability and statistics for various random variables, multivariate distributions, correlations and relations.
4. He shall learn law of large numbers and shall be able to do basic numerical calculations.

DISCIPLINE SPECIFIC ELECTIVE PAPER- III. DIFFERENTIAL GEOMETRY

1. After learning methods on curve tracing and Analytic Geometry.
2. The objective of this course is to teach Differential geometry of curves and surfaces which trains a student using tools in calculus to derive intrinsic properties of plain curves and space curves.
3. After completing this course, a student will learn on serret-Frenet formulae.
4. They also learn relation between tangent, normal and binormals, first and second fundamental forms and ideas on various curvatures.
5. He has scope to take more advanced courses in surface theory and geometry.

DISCIPLINE SPECIFIC ELECTIVE PAPER- IV PROJECT

1. The student is expected to devote about 100 hours.
2. The project will be evaluated by a committee of faculty members at the end of the sixth semester.
3. The committee will be constituted by the Under Graduate (B.A./B.Sc.) Mathematics (Honours) Project committee of the college keeping in mind the areas of project they will cover.