DEPARTMENT OF MATHEMATICS

COURSE OUTCOMES

**CORE PAPER-1**

Course Outcomes: After completing the course, students are expected to be able to use Leibnitz's rule to evaluate derivatives of higher order, able to study the geometry of various types of functions, evaluate the area, volume using the techniques of integrations, able to identify the difference between scalar and vector, acquired knowledge on some the basic properties of vector functions.

**CORE PAPER-II**

Course Outcomes: The acquired knowledge will help students in simple mathematical modeling. They can study advance courses in mathematical modeling, computer science, statistics, physics, chemistry etc.

**CORE PAPER-III**

Course Outcome: 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 and understand limits and their use in sequences, series, differentiation and integration. Students will appreciate how abstract ideas and rigorous methods in mathematical analysis can be applied to important practical problems.

**CORE PAPER-IV**

Course Outcomes: A student completing the course is able to solve differential equations and is able to model problems in nature using Ordinary Differential Equations. This is also prerequisite for studying the course in Partial Differential Equations and models dealing with Partial Differential Equations.

**CORE PAPER-V**

Course Outcome: On the completion of the course, students will have working knowledge on the concepts and theorems of the elementary calculus of functions of one real variable. They will work out problems involving derivatives of function and their applications. They can use derivatives to analyze and sketch the graph of a function of one variable, can also obtain absolute value and relative extrema of functions. This knowledge is basic and students can take all other analysis courses after learning this course.

**CORE PAPER-VI**

Course Outcomes: A student learning this course gets idea on concept and examples of groups and their properties . He understands cyclic groups, permutation groups, normal subgroups and related results. After this course he can opt for courses in ring theory, field theory, commutative algebras, linear classical groups etc. and can be apply this knowledge to problems in physics, computer science, economics and engineering.

**CORE PAPER-VII**

Course Outcomes: After completing this course, a student will be able to take more courses on wave equation, heat equation, diffusion equation, gas dynamics, nonlinear evolution equations etc. All these courses are important in engineering and industrial applications for solving boundary value problem.

**CORE PAPER-VIII**

Course Outcome: Students can handle physical problems to find an approximated solution. After getting trained a student can opt for advance courses in Numerical analysis in higher mathematics. Use of good mathematical software will help in getting the accuracy one need from the computer and can assess the reliability of the numerical results, and determine the effect of round off error or loss of significance.

**CORE PAPER-IX**

Course Outcomes: On successful completion of the course students will learn to work with abstract topological spaces. This is a foundation course for all analysis courses in future.

**CORE PAPER-X**

Course Outcomes: After completing this course, this will help students to continue more courses in advanced Ring theory modules, Galois groups.

**CORE PAPER-XI**

Course Outcomes: After reading this course a student will be able to calculate partial derivatives, directional derivatives, extremum values and can calculate double, triple and line integrals. He will have idea of basic vector calculus including green’s theorem, divergence theorem and stokes theorem. He can take courses in calculus on manifolds, Differential geometry and can help in numerical computations involving several variables.

**CORE PAPER-XII**

Course Outcomes: The student will use this knowledge wherever he/She goes after undergraduate program. It has applications in computer science, finance mathematics, industrial mathematics, bio mathematics and what not.

**CORE PAPER-XIII**

Course Outcomes: Students will be able to handle certain integrals not evaluated earlier and will know a technique for counting the zeros of polynomials. This course is prerequisite to many other advance analysis courses.

**CORE PAPER-XIV**

Course Outcomes: The knowledge of auto morphism helps to study more on field theory. Students learn on direct products, group actions, class equations and their applications with proof of all results. This course helps to opt for more advanced courses in algebra and linear classical groups.

**Discipline Specific Elective Paper-I**

Course Outcomes: More knowledge on this topic in higher studies will help students to deal industrial models. This is also prerequisite for studying advanced courses in Nonlinear Programming Problems, Inventory Control Problem and Queuing Theory etc.

**Discipline Specific Elective Paper-II**

Course Outcome: The students shall learn probability and statistics for various random variables, multivariate distributions, correlations and relations. He shall learn law of large numbers and shall be able to do basic numerical calculations.

**Discipline Specific Elective Paper-III**

Course Outcome: After completing this course a student will learn on serret-Frenet formulae, relation between tangent, normal and binormals, first and second fundamental forms and ideas on various curvatures. He has scope to take more advanced courses in surface theory and geometry.

DEPARTMENT OF MATHEMATICS

COURSE OUTCOMES

# N.C. Autonomous College, Jajpur

## Department of Mathematics

## BSc-Math(Hons.) PROGRAM OUTCOMES

1- Acquisition of Mathematical Knowledge
2- Critical Thinking
3- Research-oriented approach
4- Technical Communication
5- Environmental Awareness
6- ICT Ability and Digital Skills
7- Problem-solving Attitude
8- Employability Skills
9- Exposure to Global Knowledge in Mathematics
10- Inculcation of Investigative and Inquisitive Approach

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## MTC-101

**Course Outcomes:**

After the course the students are expected to be able to:

• define and understand basic notions in abstract integration theory, integration theory
on topological spaces and the n-dimensional space.
• describe and apply the notion of measurable functions and sets and use Lebesgue monotone and dominated convergence theorems and Fatous' Lemma.
• describe the construction of and apply the Lebesgue integral.
• describe the construction of product measures and use Fubini's theorem.
• describe the notion of absolute continuity and singularities of measures and apply Lebesgue decomposition and the Radon- Nikodym theorem.
• apply Holder's and Minkowski's inequalities and describe Riesz representation theorem.
• describe the notion of extended real valued and complex measures.

## MTC-102

**Course Outcomes:**

The student should be able to Represent complex numbers algebraically and geometrically, Define and analyze limits and continuity for complex functions as well as consequences of continuity, Apply the concept and consequences of analyticity and the Cauchy-Riemann equations and of results on harmonic and entire functions including the fundamental theorem of algebra, 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 and Represent functions as Taylor, power and Laurent series, classify singularities and poles, find residues and evaluate complex integrals using the residue theorem.

## MTC-103

**Course Outcomes:**

On successful completion of the course students will learn to work with abstract topological spaces. This is a foundation course for all analysis courses in future.

## MTC-104

**Course Outcomes:**

A student learning this coursegets idea on concept and examples of groups and their properties. He understands cyclic groups, permutation groups, normal subgroups and related results. After thiscourse he can opt for courses in ring theory, field theory, commutative algebras, linearclassical groups etc. and can be apply this knowledge to problems in physics, computer science, economics

## MTC-201

**Course Outcomes:**

• recognize inner product spaces
• Identify duals of some normed spaces.
• Identify whether a real valued function defined on Cartesian product of a vector space is inner product or not and an inner product space is Hilbert space or not.
• explain the normed space which is not an inner product space
• identify orthogonal sets
• understand the notion of orthogonal complement and the decomposition of the space
• explain total sets
• explain main theorems for normed spaces
• explain Hahn -Banach teorem
• identify open mapping theorem
• explain closed gragh theorem

## MTC-202

**Course Outcomes:**
A student completing the course can solve differential equations and isable to model problems in nature using Ordinary Differential Equations. This is also prerequisite forstudying the course in Partial Differential Equations and models dealing with PartialDifferential Equations.

## MTC-203

**Course Outcomes**:

• analyze the solution set of a system of linear equations.

• express some algebraic concepts (such as binary operation, group, field).
• do elementary matrix operations.
• express a system of linear equations in a matrix form.
• do the elementary row operations for the matrices and systems of linear equations.
• investigate the solition of a system using Gauss elimination.
• apply Cramer's rule for solving a system of linearequations, if the determinant of the matrix of coefficients of the system is not zero.
• generalize the concepts of a real (complex) vector space to an arbitrary finite-dimensional vector space.
• definite a vector space and subspace of a vector space.
• explain properties of R^n and subspaces of R^n.
• determine whether a subset of a vector space is linear dependent.
• describe the concept of a basis for a vector space.
• investigate properties of vector spaces and subspaces using by linear transformations.
• express linear transformation between vector spaces.
• represent linear transformations by matrices.
• Explain the ordered what happens basis is changed. to representing matrices when
• Describe the concepts of eigenvalue, eigenvector and characteristic polynomial.
• determine whether a linear transformation is diagonalizable or not.

## MTC-204

**Course Outcomes:**

• understand how to assess and check the feasibility and optimality of a particular solution to a general constrained optimization problem
• use the optimality conditions to search for a local or global solution from a starting point
• formulate the dual problem of some general optimization types and assess their duality gap using concepts of strong and weak duality
• understand the computational details behind the numerical methods discussed in class, when they apply, and what their convergence rates are.
• master the main numerical methods.
• understand the bases of linear programming, unconstrained optimization, constrained optimization.

• be able to analyze the behaviour of these numerical methods and to be able to discuss their stability, their order of convergence and their conditions of application.
• be able to apply these methods to academic and simple practical instances.
• demonstrate the abilities to – apply knowledge of mathematics and computing to the design and analysis of optimization methods, – analyze a problem and identify the computing requirements appropriate for its solution
• design and conduct experiments and numerical tests of optimization methods, and to analyze and interpret their results.

## MTC-301

**Course Outcomes:**

Apply numerical methods to find our solution of algebraic equations using different methods under different conditions, and numerical solution of system of algebraic equations. Apply various interpolation methods and finite difference concepts. Work out numerical differentiation and integration whenever and wherever routine methods are not applicable. Work numerically on the ordinary differential equations using different methods through the theory of finite differences. Work numerically on the partial differential equations using different methods through the theory of finite differences.

## MTC-302

**Course Outcomes**:

Upon successful completion of this course students will be able to know the basic definitions and theorems in number theory, to identify order of an integer, primitive roots, Euler's criterion, the Legendre symbol, Jacobi symbol and their properties, to understand modular arithmetic number theoretic functions and apply them to cryptography.

## MTC-303

**Course Outcomes:**

Students should be able to:

• Distinguish types of studies and their limitations and strengths,
• Describe a data set including both categorical and quantitative variables to support or refute a statement,
• Apply laws of probability to concrete problems,
• Perform statistical inference in several circumstances and interpret the results in an applied context,
• Use mathematical tools, including calculus and linear algebra, to study probability and mathematical statistics and in the description and development of statistical procedures,
• Use a statistical software package for computations with data,
• Use a computer for the purpose of simulation in probability and statistical inference
• Communicate concepts in probability and statistics using both technical and nontechnical language

**MTC-304**

**Course Outcomes:**

The acquired knowledge will help students in simple mathematical modeling. They can study advance courses in mathematical modeling, computer science, statistics, physics, chemistry etc.

**MTC-305**

**Course Outcomes**:

- Demonstrate advanced knowledge of formal computation and its relationship to languages
- Distinguish different computing languages and classify their respective types
- Recognise and comprehend formal reasoning about languages
- Show a competent understanding of the basic concepts of complexity theory

**MTC-401**

**Course Outcomes:**

Student can Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations. Analyse and evaluate the accuracy of common numerical methods.

## MTC-402

**Course Outcomes:**

➢ To implement and analyze cryptographic and number-theoretic algorithms.

➢ To be able to use Maple to explore mathematical concepts and theorems.

## MTC-403

**Course Outcomes:**

➢ To implement and analyze cryptographic and number-theoretic algorithms.

➢ To be able to use Maple to explore mathematical concepts and theorems.

➢ Explains the relationship between deterministic finite automata and regular languages.

➢ Proves the undecidability or complexity of a variety of problems

➢ Uses pigeon-holing arguments and closure properties to prove particular problems cannot be solved by finite automata.

➢ Illustrates concrete examples of undecidable problems from different fields.

➢ Defines and explains the significance of the "P = NP?" question and NP-completeness.

➢ Illustrates concrete examples of decidable problems that are known to be unsolvable in polynomial time.

**PG DEPARTMENT OF MATHEMATICS**

**N. C. AUTONOMOUS COLLEGE, JAJPUR**

**PG-MATHEMATICS PROGRAMME OUTCOMES**

1: To build a strong base with proper understanding of algebra, topology etc.

2: To increase Problem-solving skills

3: To develop critical reasoning and applied skills

4: To enable students to use Mathematics in interdisciplinary courses

5: To prepare students for scientific investigation

6: To help students understand fundamental axioms and terms

7: To inculcate scientific temperament

8: To undertake original research

9: To enhance technical communication

10: To acquire knowledge through logical reasoning

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