| **Department of Mathematics for UG** | |
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| Programme Outcome of UG Course in Mathematics | *After the successful completion of this course, the student have the following abilities:*<br>▪ An ability to analyze a problem, and identify and define the mathematicalapproaches required for its solution.<br>▪ An ability to function effectively in teams to accomplish a common goal. An ability to communicate effectively with a wide range of audiences.<br>▪ An ability to analyze the local and global impact of mathematics on individuals, organizations, and society. Recognition of the need for and an ability to engage in continuing professional development.<br>▪ An ability to use current techniques, skills, and tools necessary for mathematications.<br>▪ An ability to apply mathematical ability, algorithmic principles, and mathematicsin the modeling and design of mathematics based computer systems in a way that demonstrates comprehension of the tradeoffs involved in designchoices.<br>▪ An ability to apply mathematics and its principles in the construction of software systems of varying complexity.<br>▪ The mathematics UG students after the completion of the course will gain a thorough knowledge in preparing competitive examinations conducted by different organisations.<br>▪ The UG curriculum needs computer based courses which enable the students to solve computer oriented numerical problems.<br>▪ Abstract courses and mathematical structures included in the UG program enable the students to prepare themselves for higher education leading to M.Sc./MCA degree courses. |
| Programme Specific Outcome | *After the successful completion of this course, the student will:*<br>▪ Be able to explain the core ideas and the techniques of mathematics at the college level. ·<br>▪ Be able to recognize the power of abstraction and generalization, and to carry out investigative mathematical work with independent judgment.<br>▪ Be able to setup mathematical models of real world problems and obtain solutions in structured and analytical approaches with independent judgement.<br>▪ Be able to carry out objective analysis and prediction of quantitative information with independent judgment.<br>▪ Be able to communicate effectively about mathematics to both lay and expert audiences utilizing appropriate information and communication technology.<br>▪ Be able to work independently, and to collaborate effectively in team work and team building.<br>▪ Be able to conduct self-evaluation, and continuously enrich themselves through lifelong learning.<br>▪ Be able to communicate to lay audiences and arouse their interest in the beauty and precision of mathematical arguments and science.<br>▪ 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.<br>▪ Be able to cultivate a mathematical attitude and nurture the interests.<br>▪ Students will be able to understand and view mathematical structures.<br>▪ Students will learn numerical aptitude applying both qualitative and quantitative knowledge for their future career. |

| UG-Course Outcomes on Mathematics | |
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| **Course** | **Outcomes** |
| C1: Calculus, Geometry and Differential equation & Practical | ▪ Students will measure/calculate length, perimeter, area, volume of surface of revolution of a curve and techniques of sketching conics;<br>▪ Students will demonstrate knowledge of the basic concepts of conics and classification of quadrics .<br>▪ Students will demonstrate their abilityto solve a variety of differential equations analytically and numerically.<br>▪ Students will demonstrate their ability to graphically analyze functions by computer practical |
| C2: Algebra and Tutorial | ▪ Students willunderstand complex numbers, way of representing numbers, relationships among numbers, different method for solving polynomial equations .<br>▪ On successful completion of this subject the students will have the solving ability oflinear equations.<br>▪ Students will demonstrate their ability to graphically or numerically analyze functions by presentation. |
| C3:Real Analysis and Practical | After completing this course the Students will understand,<br>▪ Describe the real line as a complete, ordered field,<br>▪ Determine the basic topological properties of subsets of the real numbers,<br>▪ Use the definitions of convergence as they apply to sequences, and series,<br>▪ The convergence of sequences and series of different test through plotting on computer. |
| C4:Differential Equation &Vector Calculus and Tutorial | After studying this course the students should be able to ·<br>▪ General solution of homogenous and non homogenous equation of higher orderand their super position ,<br>▪ Describe Euler's equation.method of undetermined coefficients and method of variation of parameters.<br>▪ Find power series solutions of differential equations, and develop the ability to apply differential equations to significant applied and/or theoretical problems.<br>▪ Demonstrate their understanding of how physical phenomena are modeled by differential equations and dynamical systems.Implement solution methods using appropriate technology.<br>▪ Analyse vector functions to find derivatives, tangent lines, integrals, arc length, and curvature,<br>▪ Compute limits and derivatives of functions of 2 and 3 variables,<br>▪ differentiation and integration of vector functions<br>▪ the ability to graphically or analytically analyze functions by presentation |
| C5: Theory of Real Functions & Introduction to Metric Spaces& Tutorial | After completing this course the Students will understand,<br>▪ the sequential approachesof limit ,continuity , uniform continuity and their some important properties.<br>▪ Recognize the difference between pointwise and uniform convergence of a sequence of functions<br>▪ Apply the Mean Value Theorem and the Fundamental Theorem of Calculus to problems in the context of real analysis.<br>▪ Recall the defining properties of a metric space, and determine whether a given function defines a metric<br>▪ Familiarize with open sets, closed sets and Cantor set.<br>▪ the ability to graphically or analytically analyze functions by presentation. |

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| C6: Group theory -I and Tutorial | Upon completion of this course, students should be able to:<br>▪ Students will understand the permutation of a group , center of a group ,Lagrange's theorem and Fermat's Little theorem.<br>▪ Students will understand the External direct product of a finite groups, finite abelian groups and Cauchy's theorem<br>▪ Students will understand different properties of group homomorphisms and isomorphisms theorems and Cayley's theorem<br>▪ the ability to graphically or mathematically analyze the different theorem on Group by presentation. |
| C7: Numerical Methods and Practical | After completing this course the learner should be able to<br>▪ Analyse the error incumbent in any such numerical approximation,<br>▪ implement a variety of numerical algorithms using appropriate technology<br>▪ Compare the viability of different approaches to the numerical solution of problems arisingin roots of solution of non-linear equations, interpolation and approximation,<br>▪ Numericaldifferentiation and integration, solution of linear systems using different method.<br>▪ understand graphically or numerically analyze the different methods ofNumerical method by computer practical. |
| C8: Riemann Integration and Series of Functionsand Tutorial. | After the completion of this course the student will be able to:<br>▪ Develops a knowledge about Riemann Integration and apply into problems<br>▪ Determine the Riemann integrability and Improper integrals and their simple properties,<br>▪ Recognize the difference between pointwise and uniform convergence of a sequence offunctions<br>▪ Illustrate the effect of uniform convergence on the limit function with respect tocontinuity, differentiability, and integrability<br>▪ Develops a knowledge about Fourier series ,Power series and their properties and applications,<br>▪ Students will demonstrate their ability to graphically or analytically analyze integrability conditions, the sequence of functions , series of functions and their natures by presentation. |
| C9: Multivariate Calculus and tutorial. | On completion of this course successful students will be able to:<br>▪ Analyse functions of several variables to find limit,continuity and differentiability.<br>▪ Evaluate double and triple integrals over rectangular and non-rectangular region and volume by triple integrals in cylindrical and spherical coordinates,<br>▪ Differentiate vector fields,Determine gradient vector fields and find potential functions,<br>▪ Analyse the fundamental theorem of calculus and see their relation in calculus , leading to the more generalisedversion of Stokes' theorem in the setting of differential forms.<br>▪ Students will demonstrate their ability to graphically or numerically analyze Partial differentiation, condition for differentiability relation between divergence theorem by presentation. |
| C10:Ring theory and Linear algebra I, Tutorial | After completing this course the students will be able to<br>▪ Assess properties implied by the definitions of rings, factor rings ,prime and maximal ideals,<br>▪ Analyse and demonstrate examples of ideals and quotient rings,<br>▪ Use the concepts of isomorphism and homomorphism for rings<br>▪ Use the definition and properties of linear transformations and matrices of linear transformations and change of basis, including kernel, range and isomorphism.<br>▪ Students will demonstrate the ability to graphically or analytically analyze prime and maximal ideals, homomorphism and isomorphism theorem on rings |

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| | and vectorspaces by presentation. |
| C11: Partial Differential Equations and Applications & Practical | Upon completion of this course, students should be able to:<br>▪ Be familiar with the modelling assumptions and derivations that lead to PDEs,<br>▪ Recognize the major classification of PDEs and the qualitative differences between the classes of equations,<br>▪ Be competent in solving linear PDEs using classical solution methods.<br>▪ Students will demonstrate their ability to graphically or analytically analyze the solution of Cauchy problem ,characteristic for PDE and solution of Heat equation by python languages. |
| C12: Group Theory II& Tutorial | Upon completion of this course, students should be able to:<br>▪ Demonstrate knowledge of group homomorphism, isomorphism andautomorphisim.<br>▪ Demonstrate knowledge of properties of external and internal direct product and fundamental theorem of finite abelian groups<br>▪ Demonstrate knowledge of conjugates, the Class Equation ,p-groups, Cayley's theorem and Sylow's theorems.<br>▪ Derive and apply Sylow Theorems ,Cauchy's theorem and simplicity of $A_n$ for $n \geq 5$.<br>▪ Students will demonstrate their ability to graphically or analytically analyze the application of factor groups to automorphismgroups ,Sylow's theorem and consequences , simplicity of alternating groups and conjugacy in $S_n$by presentation. |
| C13:Metric Spaces and Complex Analysis & Tutorial | Upon completion of this course, students should be able to:<br>▪ Demonstrate knowledge of Cauchy sequences and cantor's theorem,<br>▪ A sequence in a metric space is or is not convergent<br>▪ Demonstrate knowledge of Heine-Borelproperty,contracting mapping, Homeomorphism and Banach fixed point theorem and its application to ordinary differential equation.<br>▪ Conceive the concepts of analytic functions and will be familiar with the elementary complex functions and their properties, and 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,<br>▪ Applies the theory into application of the power series expansion of analytic functions, and understand the basic methods of complex integration and its application in contour integration,<br>▪ Evaluate complex contour integrals directly and by the fundamental theorem,apply the Cauchy integral theorem in its various versions, and the Cauchy integral Formula,<br>▪ Represent functions as Taylor, power and Laurent series, classifysingularities and poles, find residues and evaluate complex integralsusing theresidue theorem,<br>▪ Compute Laurent series and its examples ,absolute and uniform convergence of power series,<br>▪ Students will demonstrate the ability of different problems on metric space and some important theorem on complex analysis by presentation. |
| C14: Ring Theory and Linear Algebra II & Tutorial | Upon completion of this course, students should be able to:<br>▪ Demonstrate knowledge of polynomial ring ,integral domain, unique factorization domain and Euclidean domain,<br>▪ Demonstrate knowledge of dual space and basis, eigen space of linear operator and the minimal polynomial for a linear operator.<br>▪ Demonstrate knowledge of inner product space, least squares approximation, |

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| | normal and self-adjoint operator, spectral theorem,<br>▪ Students will demonstrate the ability of unique factorization domain and its applications, Cayley Hamilton theorem and its consequences, orthogonal projections and spectral theoremby presentation. |
| DSE1:Linear Programming& Tutorial | On completion of this unit successful students will be able to:<br>▪ Formulate optimization problems;Solving problems using different methods,<br>▪ Place a Primal linear programming problem into standard form and use the Simplex Method or Revised Simplex Method to solve it and find the dual, and identify and interpret the solution of the Dual Problem from the final tableau of the Primal problem,<br>▪ Explains the Transportation Problem and formulate it as an LPP and hence solve the problem,<br>▪ Determine that an Assignment Problem is a special case of LPP and hence solve by Hungarian method,<br>▪ To understand the theory of games for solving simple games.<br>▪ Students will demonstrate the ability of Solving problems using different methods and the theory of games for solving simple games and its applications in real life by presentation. |
| DSE2:Probability and Statistics & Tutorial | ▪ Students will be able to compute probabilities and conditional probabilities in appropriate ways.<br>▪ Students will be able to solve word problems using combinatorial analysis.<br>▪ Students will be able to represent and statistically analyse data both graphically and numerically.<br>▪ Students will demonstrate the ability ofconditional probabilities statistically analyse data both graphically and numericallyby presentation. |
| DSE3: Mechanics & Tutorial | ▪ Students will be able to understand the virtual work, stable and unstable equilibrium<br>▪ Students will be able to solve the problems on stability of nearly orbit, motion in a particle in 3D and motion on a smooth sphere ,cone and any surface.<br>▪ Students will be able to understand degree of freedom, D'Alembert's Principle, compound pendulum and conservation of momentum and energy. |
| DSE4: Bio Mathematics & Practical | On completion of this unit successful students will be able to:<br>▪ Demonstrate knowledge of SI,SIR,SIRS and SIC.<br>▪ Demonstrate knowledge about different types of models and applications,<br>▪ Students will demonstrate the knowledge ofGrowth model, decay model ,lake pollution model limited growth of population and battle model by practical. |
| DSE5: Point Set Topology & Tutorial | Upon completion of this course, students should be able to:<br>▪ Define and illustrate the concept of countable set and uncountable set, cardinal numbers and cardinal arithmetic, Zorns lemma and ordinal numbers,<br>▪ Define and illustrate the concept of topological spaces and continuous functions, product topology and quotient topology, metric topology and Baire category theorem,<br>▪ Define connectedness ,compactness, and totally bounded spaces prove a selection of related theorems.<br>▪ Students will demonstrate the ability of topological spaces and analyze some important theorem by presentation. |