Department of Mathematics

Mathematics Learning Outcomes

- **The main objective of this subject is to cultivate a mathematical aptitude and**
- **nurture the interests of the students towards problem solving aptitude. Further, it**
- **aims at motivating the young minds for research in mathematical sciences and to**
- **train computational scientists who can work on real life challenging problems.**
- **Mathematics and Statistics open doors in engineering, business, finance,**
- **computing, data sciences, health sciences, environmental sciences and public**
- **policy. They are also fascinating in their own right. Recent discoveries in the**
- **mathematical sciences have played an essential role in internet search algorithms,**
- **disease control, communications technology, climate modelling and much more.**
- **Mathematics and Statistics are among the most important disciplines in today's**
- **complex world, in part because they serve as the common language of science.**
- **By the end of a degree program in Mathematics or Statistics, a student will:**
- **have the versatility of work effectively in a broad range of analytic,**
- **scientific, government, financial, health, technical and other**
- **positions.**

- **recognize the importance and value of mathematical and statistical**
- **thinking, training, and approach to problem solving, on a diverse**
- **variety of disciplines;**
- **recognize and appreciate the connections between theory and**
- **applications;**
- **be able to independently read mathematical and statistical literature**
- **of various types, including survey articles, scholarly books, and**
- **online sources;**
- **be life-long learners who are able to independently expand their**
- **mathematical or statistical expertise when needed, or for interest's**

COURSE OUTCOMES OF MATHEMATICS

1st-YEAR PAPER- I

Code	Course Title	HPW
MATH 101	**Differential calculus, (Core Course)**	**6TH**

On Completion of this course the students will be able to:

- Explain the relationship between the derivative of a function as a function and the notion of the derivative as the slope of the tangent line to a function at a point.
- Compare and contrast the ideas of continuity and differentiability.
- To inculcate to solve algebraic equations and inequalities involving the sequence root and modulus function.
- To able to calculate limits in inderminate forms by a repeated use of L' Hospital rule.

- To find the roots of algebraic and transcendental equations by using Rolls theorem and Mean value theorem and also solve the Taylor's series and Maclarian series.
- To find maxima and minima, critical points and inflection points of functions of several variables and to determine the concavity and convexity, radius of curvature of curves.
- To able to evaluate integrals of rational functions by partial fractions and also Jacobian of functions.

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1st-YEAR PAPER-II

Code	Course Title	HPW
MATH 102	**Differential Equations, (Core Course)**	**6TH**

On successful completion of the course, Students will be able to:

- The main aim of the course is to introduce the students to the technique of solving various problems of engineering and science
- Distinguish between linear, nonlinear, partial and ordinary differential equations.
- Solve basic application problems described by second order linear differential equations with constant coefficients and also with variable coefficient.
- Find the solutions of first order first degree differential equations, wronskian and its properties.
- Find the transforms of derivatives and integrals.
- Obtain the solution by Variation of parameters method, Cauchy- Euler equation and Legendre differential equations.
- Find the solutions of simultaneous differential equations and Total differential equations
- To find the solutions of partial differential equations, Linear partial differential equation of first order, Lagrange's method. Classification of second order partial differential equations into elliptical, parabolic and hyperbolic.

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2nd-YEAR PAPER-III

Code	Course Title	HPW
MATH 201TH	**Real Analysis, (Core Course)**	**6TH**

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

- Describe the basic difference between the rational and real numbers. Give the definition of concepts related to metric spaces such as countability, compactness, convergent etc.
- Give the essence of the proof of Bolzanoweistrass theorem the contraction theorem as well as existence of convergent subsequence using Cauchy ‘s Criteria.
- Evaluate the limits of wide class of real sequences.
- Determine whether or not real series are convergent by comparisontest,p- test, root test and ratio test. We can also discuss the convergence of alternating series by using Leibnitzrule.
- To find solutions of sequences and series of functions. We can understand the concept of pointwise, and uniform convergence with the help of Mn -test and M test. Results about uniform convergence, power series and radius of convergence.
- Students will be able to demonstrate basic knowledge of key topics in classical real analysis.
- The course pervious the basic for further studies with in function analysis, topology & function Theory.

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2nd -YEAR PAPER II [ANNUAL]

Code	Course Title	HPW
MATH 202TH	Algebra, (Core Course)	6TH

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

- Students will be able to understand definition of group, abelian and non-abelian groups, the groups Z_n of integers under addition modulo n and the group U(n), Cyclic group, Normal subgroups, quotient groups.
- Understand group homomorphism.
- Understand basic theory of Rings, Commutative and Non-Commutative rings, Polynomial rings, rings of matrices, subring, Ideals, Integral domain and fields in detail.

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2nd -YEAR PAPER II[ANNUAL]

Code	Course Title	HPW
MATH 309TH	Integral Calculus, SEC-1	6TH

On successful completion of the course:

- This course will provide understanding of integration by partial fraction, integration of rational and irrational functions, properties of definite integrals, reduction formulae. Areas

and lengths of curves in the plane, volumes and surfaces of solids of revolution, Cartesian and parametric forms. Double and triple integrals.

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2nd-YEAR PAPER II[ANNUAL]

Code	Course Title	HPW
MATH 310TH	Vector Calculus, SEC-2	6TH

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

- Vector calculus motivates the study of vector differentiation and integration in two and three dimensional spaces.
- It helps to understand the students about Scalar and vector product of three and product of four vectors. Reciprocal vectors. Vector differentiation, scalar point function and vector point function. Derivative along a curve, directional derivatives.
- To understand the concept of orthogonal curvilinear coordinates. Gradient, Divergence, Curl and Laplacian operator in terms of orthogonal curvilinear coordinates system.
- To understand the concept of vector integration: line integral, surface integral, volume integral. Theorem of Gauss, Green and Stokes and its applications.
- It is widely accepted as a prerequisite in various fields of science and engineering.
- It offers important tools for understanding functions (both real & complex) non-Euclidean geometry and topology.
- These tools are employed successfully in different branches of engineering and physics (such as electromagnetic fields, fluid flow and gravitational fields).

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3rd - YEAR PAPER IV [ANNUAL]

Code	Course Title	HPW
MATH 303TH	Linear Algebra, DSE-1A	6TH

On Completion of this course the students will be able to Understand:

- Vector space, subspace sum and Direct sum of subspaces, Linear dependent, Linear independent subset of a vector space, spanning set and basis of a vector space.
- The homomorphism and isomorphism of a vector space also they can understand the concept of Linear transformation and it's matrix representation. Null space and range space of Linear transformation, rank and nullity with its applications.

- The algebra of Linear transformations minimal polynomials of Linear transformation and singular and non-singular transformations.
- The inner product space, Cauchy- Schwartz inequality. Orthogonal basis and orthonormal sets. Bessel's inequality for finite dimensional vector space. Gram-Schmidt orthogonalization process.

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3rd - YEAR PAPER IV [ANNUAL]

Code	Course Title	HPW
MATH 304TH	Numerical Methods, DSE-1B	6TH

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

- Solve an algebraic or transcendental equation using Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method, LU-decomposition method.
- Solve a linear system of equations using Gauss- Jacobi, Gauss- Siedel and SOR iterative methods.Understand the concept of interpolation by using Lagrange and Newton interpolation method.
- Find the concept of Finite difference operators , numerical differentiation by using Newton forward and backward difference method, Sterling's difference method.
- Calculate a definite integral using Trapezoidal rule, Simpson's rule, Euler method.These appropriate methods areused toCode in modern computer language.

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11I-YEAR PAPER-II ,

Code	Course Title	HPW
MATH 305TH	Complex Analysis	6TH

The main aim of the course is to introduce the students:

- Technique of solving various problems of engineering and science

- Limits, limits involving the point at infinity continuity, properties of complex numbers, region in a complex plane functions of complex variables and their mapping. Cauchy-Reimann equations.
- The analytic functions, examples of analytic function derivatives and integrals of analytic function.
- Understand the concept of contours integration and Cauchy integral formula.
- Liouville's theorem and the fundamental theorem of algebra. Convergence of series, Taylor series and Laurent series.

3rd - YEAR PAPER IV [ANNUAL]

Code	Course Title	HPW
MATH 313TH	Probability & Statistics, SEC-3	6TH

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

- Understand basic theoretical and applied principles of statistics needed to enter the job force.
- They will have a better informative view on sample space, probability axioms, cumulative distribution functions, probability density function, mathematical expectations, moments, moment generating functions, Binomial, Poisson, continuous distribution. Joint cumulative distribution function & its properties, joint probability density functions, marginal and conditional distributions, expectation of function of two random variables.

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3rd - YEAR PAPER IV [ANNUAL]

Code	Course Title	HPW
MATH 317TH	Transportation & Game Theory, SEC-4	6TH

- The game theory provides powerful tools for analysing transport systems and making decisions in situations. The students will be able to thoroughly grasp the topics like transportation problem and its mathematical formulation, optimal solution, Hungarian method for solving assignment problem. In game theory, solving 2-person zero sum games, games with mixed strategies, graphical solution.

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