B.Sc HONOURS MATHEMATICS

Paper	Paper Name	Outcomes After completion of the course the student should be able to
SEMESTER I		
COURSE 1	ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES	**CO 1 :** Apply critical thinking skills to solve complex problems involving complex numbers, trigonometric ratios, vectors, and statistical measures. **CO 2 :** To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations **CO 3 :** To Explain the basic principles and concepts underlying a broad range of fundamental areas of chemistry and to Connect their knowledge of chemistry to daily life. **CO 4 :** Understand the interplay and connections between mathematics, physics, and chemistry in various applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts. **CO 5 :** To explore the history and evolution of the Internet and to gain an understanding of network security concepts, including threats, vulnerabilities, and countermeasures.
COURSE 2	ADVANCES IN MATHEMATICAL, PHYSICALAND CHEMICAL SCIENCES	**CO 1 :** Explore the applications of mathematics in various fields of physics and chemistry, to understand how mathematical concepts are used to model and solve real-world problems. **CO 2 :** To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations. 3. Understand the different sources of renewable energy and their generation processes and advances in nanomaterials and their properties, with a focus on quantum dots. To study the emerging field of quantum communication and its potential applications. To gain an understanding of the principles of biophysics in studying biological systems. Explore the properties and applications of shape memory materials. **CO 3 :** Understand the principles and techniques used in computer-aided drug design and drug delivery systems, to understand the fabrication techniques and working principles of nanosensors. Explore the effects of chemical pollutants on ecosystems and human health. **CO 4 :** Understand the interplay and connections between mathematics, physics, and chemistry in various advanced applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts. **CO 5 :** Understand and convert between different number systems, such as binary, octal, decimal, and hexadecimal. Differentiate between analog and digital signals and understand their characteristics. Gain knowledge of different types of transmission media, such as wired (e.g., copper cables, fiber optics) and wireless (e.g., radio waves, microwave, satellite).
SEMESTER II		
COURSE 3	DIFFERENTIAL EQUATIONS &	**CO 1 :** Solve first order first degree linear differential equations. **CO 2 :** Convert a non-exact homogeneous equation to exact differential equation by using an integrating factor.

	PROBLEM SOLVING SESSIONS	**CO 3 :** Know the methods of finding solution of a differential equation of first order but not of first degree. **CO 4 :** Solve higher-order linear differential equations for both homogeneous and non-homogeneous, with constant coefficients. **CO 5 :** Understand and apply the appropriate methods for solving higher order differential equations.
COURSE 3	**ANALYTICAL SOLID GEOMETRY**	**CO 1 :** understand planes and system of planes **CO 2 :** know the detailed idea of lines **CO 3 :** understand spheres and their properties **CO 4 :** know system of spheres and coaxial system of spheres **CO 5 :** understand various types of cones
SEMESTER III	
COURSE 5	**GROUP THEORY**	**CO 1 :** Acquire the basic knowledge and structure of groups **CO 2 :** Get the significance of the notation of a subgroup and cosets. **CO 3 :** understand the concept of normal subgroups and properties of normal subgroup **CO 4 :** Study the homomorphisms and isomorphisms with applications. **CO 5 :** Understand the properties of permutation and cyclic groups
COURSE 6	**NUMERICAL METHODS**	**CO 1 :** Difference between the operators $\Delta \nabla$, ,e and the relation between them **CO 2 :** Know about the newton – gregory forward and backward interpolation **CO 3 :** Know the central difference operators $\delta \mu \sigma$, , and relation between them **CO 4 :** Solve algebraic and transcendental equations **CO 5 :** Understand the concept of curve fitting
COURSE 7	**LAPLACE TRANSFORMS**	**CO 1 :** Understand the definition and properties of laplace transformations **CO 2 :** get an idea about first and second shifting theorems and change of scale property **CO 3 :** Understand laplace transforms of standard functions like bessel, error function etc **CO 4 :** Know the reverse transformation of laplace and properties **CO 5 :** Get the knowledge of application of convolution theorem
COURSE 8	**SPECIAL FUNCTIONS**	**CO 1 :** Understand the Beta and Gamma functions, their properties and relation between these two functions, understand the orthogonal properties of Chebyshev polynomials and recurrence relations. **CO 2 :** Find power series solutions of ordinary differential equations. **CO 3 :** Solve Hermite equation and write the Hermite Polynomial of order (degree) n, also Find the generating function for Hermite Polynomials, study the orthogonal properties of Hermite Polynomials and recurrence relations. **CO 4 :** Solve Legendre equation and write the Legendre equation of first kind, also find the generating function for Legendre Polynomials, understand the orthogonal properties of Legendre Polynomials. **CO 5 :** Solve Bessel equation and write the Bessel equation of first kind of order n, also find the generating function for Bessel function understand the orthogonal properties of Bessel unction.
SEMESTER IV	

COURSE 9	RING THEORY	**CO 1 :** Acquire the basic knowledge of rings, fields and integral domains **CO 2 :** get the knowledge of subrings and ideals **CO 3 :** Construct composition tables for finite quotient rings **CO 4 :** Study the homomorphisms and isomorphisms with applications. **CO 5 :** Get the idea of division algorithm of polynomials over a field.
COURSE 10	INTRODUCTION TO REAL ANALYSIS	**CO 1 :** Get clear idea about the real numbers and real valued functions. **CO 2 :** Obtain the skills of analysing the concepts and applying appropriate methods for testing convergence of a sequence/ series. **CO 3 :** Test the continuity and differentiability and Riemann integration of a function. **CO 4 :** Know the geometrical interpretation of mean value theorems. **CO 5 :** Know about the fundamental theorem of integral calculus
COURSE 11	INTEGRAL TRANSFORMS WITH APPLICATIONS	**CO 1 :** Understand the application of Laplace transforms to solve odes **CO 2 :** Understand the application of Laplace transforms to solve Simultaneous des **CO 3 :** Understand the application of Laplace transforms to Integral equations **CO 4 :** Basic knowledge of Fourier-Transformations **CO 5 :** Comprehend the properties of Fourier transforms and solve problems related to finite Fourier transforms.
SEMESTER V		
COURSE 12	LINEAR ALGEBRA	**CO 1 :** Understand the concepts of vector spaces, subspaces **CO 2 :** Understand the concepts of basis, dimension and their properties **CO 3 :** Understand the concept of linear transformation and its properties **CO 4 :** Apply cayley- hamilton theorem to problems for finding the inverse of a matrix and higher powers of matrices without using routine methods **CO 5 :** Learn the properties of inner product spaces and determine orthogonality in inner product spaces
COURSE 13	VECTORs CALCULUS	**CO 1 :** Learn multiple integrals as a natural extension of definite integral to a function of two variables in the case of double integral/three variables in the case of triple integral. **CO 2 :** Learn applications interms of finding surface area by double integral and volume by triple integral . **CO 3 :** Determine the gradient,divergence and curl of avector and vector identities. **CO 4 :** Evaluate line,surface and volume integrals. **CO 5 :** understand relation between surface and volume integrals (Gauss divergence theorem),relation between line integral and volume integral(Green'stheorem),relation between line and surface integral (Stokes theorem)
COURSE 14	ADVANCED NUMERICAL METHODS	**CO 1 :** Find derivatives using various difference formulae **CO 2 :** Understand the process of numerical integration **CO 3 :** Solvesimultaneous linear systems of equations **CO 4 :** Understand iterative methods **CO 5 :** Find numerical solution of ordinary differential equations
COURSE 15	NUMBER THEORY	**CO 1 :** Understand the fundamental theorem of arithmetic

		CO 2 : Understand mobius function, euler quotient function, the mangoldt function , liouville's function, the divisor functions and the generalized convolutions.
		CO 3 : Understand euler's summation formula, application to the distribution of lattice points and the applications to $\mu(n)$ and $\lambda(n)$
		CO 4 : Understand the concepts of congruencies, residue classes and complete residues systems.
		CO 5 : Comprehend the concept of quadratic residues mod p and quadratic non residues mod p.
SEMESTER VI		**LONG TERM INTERNSHIP**