Program outcome of B.Sc. (H) Mathematics

PO1 Disciplinary knowledge: Capable of demonstrating comprehensive knowledge and understanding of Mathematics.

PO2 Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.

PO3 Critical thinking and Analytical Reasoning: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.

PO4 Problem solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.

PO5 Research-related skills: A sense of inquiry and capability for asking relevant/appropriate questions, problematising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.

PO6 Cooperation/Team work: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.

PO7 Scientific reasoning: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

PO8 Information/digital literacy: Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.

PO9 Self-directed learning: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.

PO10 Multicultural competence: Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

PO11 Moral and ethical awareness/reasoning: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.

PO12 Lifelong learning: Ability to acquire knowledge and skills, including „learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

Program Specific Outcomes of B.Sc. (H) Mathematics

PSO1: Bachelor's degree in mathematics is the culmination of in-depth knowledge of algebra, calculus, geometry, differential equations and several other branches of mathematics. This also leads to study of related areas like computer science and statistics. Thus, this programme helps learners in building a solid foundation for higher studies in mathematics.

PSO2: The skills and knowledge gained has intrinsic beauty, which also leads to proficiency in analytical reasoning. This can be utilised in modelling and solving real life problems.

PSO3: Students undergoing this programme learn to logically question assertions, to recognise patterns and to distinguish between essential and irrelevant aspects of problems. They also share ideas and insights while seeking and benefitting from knowledge and insight of others. This helps them to learn behave responsibly in a rapidly changing interdependent society.

PSO4: Students completing this programme will be able to present mathematics clearly and precisely, make vague ideas precise by formulating them in the language of mathematics, describe mathematical ideas from multiple perspectives and explain fundamental concepts of mathematics to non-mathematicians.

Paper Code: CC1

Paper Name: Calculus, Geometry & Vector Analysis

Course Outcomes: After completing the course, students will be able to

CO1: Define the differentiability of a function at a point, at an interval or in the entire domain of its definition. Remember the quadric surfaces like cone, cylinder, ellipsoid, hyperbola.

CO2: Understand the higher order derivatives of functions like trigonometric, exponential, logarithmic, hyperbolic etc. Explain about the Indeterminate forms & L ' Hospital rule.

CO3: Solve the volume of revolution & surface area of revolution of a solid about some axis or line. Apply L'Hospital rule for different limits.

CO4: Categorize the nature of a conic by evaluating the canonical forms. Analyze the limits & differentiability of vector functions.

CO-PO-PSO MAPPING

CC1																
CO/PO/PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	1	1	2	3	2	3	1	2	1	2	2	3	2	2	3
CO2	3	1	2	3	2	1	2	1	3	2	2	3	3	2	2	2
CO3	3	2	3	2	2	2	2	2	2	2	2	2	2	2	1	2
CO4	2	1	2	3	2	1	2	1	2	2	2	2	2	2	2	3
	2.75	1.25	2	2.5	2.25	1.5	2.25	1.25	2.25	1.75	2	2.25	2.5	2	1.75	2.5

Paper Code: CC2

Paper Name: Algebra

Course Outcomes: After completing the course, students will be able to

CO1: Define De-Moivre's theorem for rational indices. Recall Descartes rule of signs, Sturm's theorem. Define Euclid's theorem. Define rank of a matrix. Define prime numbers.

CO2: Explain row-echelon form of a matrix. Demonstrate Chinese Remainder theorem. Illustrate exponential, logarithmic, trigonometric & hyperbolic functions of complex variable.

CO3: Solve cubic equation by Cardan's method & biquadratic equation by Ferrari's method. Apply Descartes rule of signs & Sturm's theorem on some equations. Construct row-echelon form of a matrix.

CO4: Examine whether a relation defined on a set is an equivalence relation. List the roots of a cubic & a biquadratic equation. Analyse the condition of invertibility of a matrix.

CO5: Evaluate inverse of a mapping. Explains Sturm's function. Determine the existence of solution of linear system of equations.

CO-PO-PSO MAPPING

CC2																
CO/PO/PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	1	2	3	2	1	3	1	2	2	1	2	3	2	2	3
CO2	3	1	3	3	2	2	2	2	3	2	3	2	3	3	3	3
CO3	3	1	3	3	2	1	2	2	2	2	2	3	2	2	2	2
CO4	3	2	2	3	2	1	2	1	2	2	3	2	3	2	3	3
CO5	3	1	2	3	2	2	2	1	2	1	2	2	2	2	2	2
	3	1.2	2.4	3	2	1.4	2.2	1.4	2.2	1.8	2.2	2.2	2.6	2.2	2.4	2.6

Paper Code: CC3

Paper Name: Real Analysis

Course Outcomes: After completing the course, students will be able to

CO1: Define the concept of interior points, limit points, isolated points, dense sets, convergence of a sequence and series.

CO2: Analyse the relation between the limit point of a set and the limit of a convergent sequence.

CO3: Evaluate the limits of some important sequences: $\left\{n^{\frac{1}{n}}\right\}, \left\{x^{\frac{1}{n}}\right\}, \{a^{x_n}\}, \left\{\left(1+\frac{1}{n}\right)^n\right\}$

CO4: Analyse the convergence of a series using Cauchy criterion, comparison test, limit comparison test, ratio test, Cauchy's n-th root test, Kummer's test and Gauss test, Leibniz test.

CO-PO-PSO MAPPING

CC3																
CO/PO/PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	2	3	1	2	0	3	1	3	3	3	2	2	3
CO2	3	2	3	3	2	1	3	0	2	1	3	2	3	3	3	3
CO3	3	1	3	3	1	1	3	1	2	1	3	2	2	2	1	2
CO4	3	1	3	3	2	1	3	0	2	2	2	2	3	3	2	3
	3	1.75	2.75	2.75	2	1	2.75	0.25	2.25	1.25	2.75	2.25	2.75	2.5	2	2.75

Paper Code: CC4

Paper Name: Group Theory-I

Course Outcomes: After completing the course, students will be able to

CO1: Remember elementary properties of group. Define cyclic groups, order of an element Recall properties of permutations.

CO2: Illustrate the Normal subgroups, Quotient groups and group homomorphism. Demonstrate Lagrange's theorem and Fermat's little theorem.

CO3: Apply necessary and sufficient condition of subgroups and Normal subgroups. Solve various problems on Isomorphism theorems

CO4: Categorize the set of all Congruences on a group. Analyse Lagrange's theorem and Cayley's theorem.

CO-PO-PSO MAPPING

CC4																
CO/PO/PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	2	3	1	2	0	2	1	3	3	3	2	1	3
CO2	3	1	3	3	2	1	3	1	3	1	2	2	2	1	1	2
CO3	2	2	3	3	3	2	3	1	2	2	2	2	3	2	2	3
CO4	3	1	2	3	3	1	2	0	2	1	3	2	2	3	2	2
	2.75	1.5	2.5	2.75	2.75	1.25	2.5	0.5	2.25	1.25	2.5	2.25	2.5	2	1.5	2.5

Paper Code: CC5

Paper Name: Theory of Real Functions

Course Outcomes: After completing the course, students will be able to

CO1: Define limit of a function, continuity of a function, differentiability of a function. Recall algebra of limits for functions, algebra of continuous functions, algebra of differentiable functions.

CO2: Explain Sequential criterion for limits & continuity, Darboux's theorem & Rolle's theorem for differentiability.

CO3: Solve one sided limits, both sided limits, find point of continuity & point of differentiability of some important functions.

CO4: Examine discontinuity of function & classify types of discontinuity.

CO5: Evaluate the maximum & minimum value of a function in an interval, evaluate series expansion of some important functions such as sinx, cosx, log(1+x) with their range of validity. Discuss the Lagrange's mean value theorem & Cauchy mean value theorem as an application of Rolle's theorem.

CO-PO-PSO MAPPING

CC5																
CO/PO/PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	3	3	3	1	2	1	2	2	3	2	3	2	2	3
CO2	3	1	2	2	3	2	2	1	2	2	2	3	3	2	2	3
CO3	3	1	3	3	2	2	3	1	2	2	3	2	3	2	3	3
CO4	3	1	2	2	2	1	2	1	2	2	2	2	2	2	2	2
CO5	3	2	3	3	2	1	2	1	3	1	3	3	3	3	1	2
	3	1.4	2.6	2.6	2.4	1.4	2.2	1	2.2	1.8	2.6	2.4	2.8	2.2	2	2.6

Paper Code: CC6

Paper Name: Ring Theory & Linear Algebra-I

Course Outcomes: After completing the course, students will be able to

CO1: Define Ring, Integral domain, field. Recall vector subspaces in $\mathbb{R}^n$. Remember Linear span, basis and dimension of a vector space

CO2: Demonstrate linear transformation of vector spaces. Understand ring homomorphism. Compare maximal ideals and prime ideals.

CO3: Solve the characteristic equation to find eigenvalues and then find the eigenvectors of a matrix. Utilize Caley-Hamilton theorem to find inverse of a matrix.

CO4: Analyse congruence of rings, 1st, 2nd and 3rd isomorphism theorems on Rings.

CO-PO-PSO MAPPING

CC6																
CO/PO/PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	1	2	2	3	1	2	0	3	1	3	3	3	2	2	3
CO2	3	2	3	3	2	2	3	2	2	1	2	2	3	3	2	2
CO3	3	2	3	3	3	1	3	2	2	2	3	2	2	3	3	2
CO4	3	2	3	3	2	2	3	0	3	1	2	2	2	3	2	3
	3	1.75	2.75	2.75	2.5	1.5	2.75	1	2.5	1.25	2.5	2.25	2.5	2.75	2.25	2.5

Paper Code: CC7

Paper Name: ODE & Multivariate Calculus-I

Course Outcomes: After completing the course, students will be able to

CO1: Understand the formation of ordinary differential equation.

CO2: Solve 1st & 2nd Order linear and nonlinear ordinary differential equations.

CO3: Apply various analytic methods to obtain Solutions of 1^{st} and 2^{nd} order diff equation which occur is science & Engineering.

CO4: Analyse the method of Characteristics to understand and Concepts related to Science & Engineering.

CO-PO-PSO MAPPING

CC7																
CO/PO/PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	1	2	2	3	1	2	1	2	2	2	3	3	2	2	3
CO2	3	2	3	3	3	1	3	2	2	3	3	2	3	3	3	3
CO3	3	2	3	3	2	1	2	2	2	1	2	2	3	2	2	2
CO4	3	2	3	2	2	2	3	1	2	1	3	2	2	3	3	2
	3	1.75	2.75	2.5	2.5	1.25	2.5	1.5	2	1.75	2.5	2.25	2.75	2.5	2.5	2.5

Paper Code: CC8

Paper Name: Riemann Integration & Series of Functions

Course Outcomes: After completing the course, students will be able to

CO1: Define the concept of partition and refinement of partition, upper Darboux sum, lower Darboux sum, negligible set, pointwise and uniform convergence of a series of functions.

CO2: Analyse the properties of integrability of sum, scalar multiple, product, quotient, modulus of Riemann integrable functions.

CO3: Test the convergence of improper integral using Comparison test, M-test, Abel's test and Dirichlet's test.

CO4: Evaluate the radius of convergence of power series.

CO-PO-PSO MAPPING

CC8																
CO/PO/PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	1	2	2	3	1	2	0	2	2	3	3	3	2	2	3

CO2	3	1	3	3	2	2	3	0	3	1	3	2	2	3	3	2
CO3	3	1	3	3	3	1	3	1	2	1	3	2	3	3	3	3
CO4	2	2	2	3	2	2	2	1	3	1	3	3	2	3	2	2
	2.75	1.25	2.5	2.75	2.5	1.5	2.5	0.5	2.5	1.25	3	2.5	2.5	2.75	2.5	2.5

Paper Code: CC9

Paper Name: PDE & Multivariate Calculus-II

Course Outcomes: After completing the course, students will be able to

CO1: Define vector field, line integral. Recall Lagrange's auxiliary equations & Charpit's auxiliary equations. Define upper sum, lower sum, upper integral & lower integral.

CO2: Classify second order linear differential equations as hyperbolic, elliptic or parabolic. Demonstrate independence of path.

CO3: Solve partial differential equation of first order. Apply Charpit's method for solving non-linear first order partial differential equations. Solve the vibrating string problem, the heat conduction problem. Make use of Green's theorem & Stoke's theorem.

CO4: Analyze the difference between the general solution & singular solution of a non-homogeneous partial differential equation. Categorize different types of heat equation & wave equation.

CO5: Evaluate Cauchy problem of finite & infinite string. Determine volume & surface area by multiple integrals.

CO6: Discuss heat & wave equations with different boundary & initial conditions. Construct different types non-linear first order differential equations.

CO-PO-PSO MAPPING

CC9

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3	2	1	2	2	2	2	2	3	3	2	2	3
CO2	3	1	3	3	2	2	3	1	2	2	3	2	2	3	3	2
CO3	3	1	2	3	3	2	2	1	3	2	2	2	3	3	2	2
CO4	3	1	3	3	2	2	3	1	2	1	3	2	2	3	2	3
CO5	3	2	2	3	2	1	3	0	2	1	3	3	2	2	2	2
CO6	3	1	2	3	3	2	2	0	3	2	3	3	3	2	2	3
	3	1.33	2.33	3	2.33	1.67	2.5	0.83	2.33	1.67	2.67	2.5	2.5	2.5	2.167	2.5

Paper Code: CC10

Paper Name: Mechanics

Course Outcomes: After completing the course, students will be able to

CO1: Discusses equilibrium conditions and stability for static & dynamic cases.

CO2: Understand rectilinear motion and Planer motion in a Cartesian and polar co-ordinates Explain linear momentum and angular momentum principle.

CO3: Make use of energy test of stability condition of stability of a perfectly rough heavy body lying on a fixed body.

CO4: Analyses the motion under attractive inverse square law. Inspect vertical motion under gravity in a resisting medium.

CO5: Evaluate the configurations and algebras of freedom of a multi-particle system.

CO-PO-PSO MAPPING

CC10																
CO/PO/PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**

CO1	2	1	2	2	2	1	2	1	2	2	2	2	2	2	2	2
CO2	2	1	1	2	2	1	1	1	2	2	2	2	2	2	2	2
CO3	2	1	2	3	2	1	2	1	2	2	2	2	3	2	2	3
CO4	2	2	2	2	2	2	2	1	2	2	2	2	2	3	3	2
CO5	2	2	2	3	2	1	2	1	2	2	3	2	2	3	3	2
	2	1.4	1.8	2.4	2	1.2	1.8	1	2	2	2.2	2	2.2	2.4	2.4	2.2

Paper Code: CC11

Paper Name: Probability & Statistics

Course Outcomes: After completing the course, students will be able to

CO1: Define Sigma field, axioms of Probability, recall Conditional probability, Bay's theorem. Remember Bernoulli trials, and Random variables.

CO2: Demonstrate Probability mass function, Probability density function. Compare discrete and Continuous random variables.

CO3: Construct moment generating functions for different distribution. Find mean, variance, etc., by Expectation.

CO4: Analyse weak and strong law of large numbers, compare point estimation and interval estimation.

CO5: Evaluate Critical region and Confidence interval of testing of hypothesis.

CO-PO-PSO MAPPING

CC11																
CO/PO/PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	3	2	3	2	3	2	3	2	3	3	3	3	3	3
CO2	3	2	3	3	2	2	3	1	2	2	3	2	2	3	3	2

CO3	3	1	2	3	3	2	3	2	3	2	3	3	3	2	2	3
CO4	3	2	3	3	2	1	3	1	2	2	3	2	2	3	3	2
CO5	3	2	2	3	2	1	2	1	2	1	2	2	2	3	3	2
	3	1.8	2.6	2.8	2.4	1.6	2.8	1.4	2.4	1.8	2.8	2.4	2.4	2.8	2.8	2.4

Paper Code: CC12

Paper Name: Group Theory-II & Linear Algebra-II

Course Outcomes: After completing the course, students will be able to

CO1: Define automorphism, inner automorphism, Fundamental theorem of finite abelian groups. Recall Cauchy's theorem for finite abelian groups. Define dual space, double dual, Cayley-Hamilton theorem.

CO2: Explain External direct product & its properties. Explain automorphism groups of finite & infinite cyclic groups. Classify Quadratic forms according to their nature.

CO3: Make use of Gram-Schmidt orthonormalization process. Make use of second derivative test for critical point of a function of several variables. Apply Sylvester's law of inertia. Construct Hessian Matrix.

CO4: Distinguish the diagonalisable matrices. Categorize critical points of a function of several variables.

CO5: Evaluate minimal polynomial of a matrix. Determine eigenspaces of a linear operator. Determine Jordan canonical form of a matrix.

CO6: Discuss Bessel's inequality & orthogonal complements. Construct adjoint of a linear operator.

CO-PO-PSO MAPPING

CC12																
CO/PO/PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**

CO1	3	1	3	3	3	2	3	0	3	1	3	3	3	3	3	3
CO2	3	1	2	3	2	2	2	1	2	1	2	2	3	2	2	3
CO3	3	2	2	3	3	2	2	2	2	2	3	2	3	3	2	3
CO4	3	2	3	3	2	1	3	2	2	2	2	3	2	2	2	2
CO5	3	1	3	2	3	2	3	2	3	2	2	2	3	2	3	3
	3	1.5	2.5	2.83	2.5	1.83	2.67	1.33	2.33	1.67	2.33	2.33	2.83	2.5	2.5	2.83

Paper Code: CC13

Paper Name: Metric Space & Complex Analysis

Course Outcomes: After completing the course, students will be able to

CO1: Define the concept of open balls, open sets, boundary points, interior points, limit points, closure of a set, diameter of a set, compact sets, connected sets.

CO2: Understand Cantor's intersection theorem, Heine-Borel theorem, Banach Fixed point Theorem and its applications.

CO3: Solve complex integration along a contour using upper bounds for moduli of contour integrals, Cauchy-Goursat theorem, Cauchy integral formula.

CO4: Determination the limits of complex valued functions and radius of convergence of power series using Cauchy-Hadamard theorem.

CO-PO-PSO MAPPING

CC13																
CO/PO/PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	2	3	1	3	0	2	2	3	3	3	3	3	3
CO2	3	2	3	2	3	1	3	0	2	2	3	2	3	3	3	2

CO3	3	1	3	3	2	2	3	1	3	2	2	2	3	2	2	3
CO4	2	1	2	3	2	2	2	0	3	2	3	2	2	3	3	2
	2.75	1.5	2.5	2.5	2.5	1.5	2.75	0.25	2.5	2	2.75	2.25	2.75	2.75	2.75	2.5

Paper Code: CC14

Paper Name: Numerical Methods

Course Outcomes: After completing the course, students will be able to

CO1: Solve the initial value problem by using Numerical techniques upto a desired degree of accuracy

CO2: Calculate roots of algebraic or transcendental equations upto a desired degree of accuracy.

CO3: Asses the approximation techniques to formulate and apply appropriate Strategy to solve real world problems.

CO4: Evaluate the integration using Numerical techniques upto a desired degree of accuracy.

CO5: Compare the results Comes from interpolation and curve fitting

CO-PO-PSO MAPPING

CC14																
CO/PO/PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	3	3	2	2	3	1	3	2	3	3	3	3	3	3
CO2	3	2	2	3	2	1	2	1	2	2	3	2	2	3	3	2
CO3	3	1	3	3	2	2	3	2	3	2	3	3	3	2	2	3
CO4	3	2	2	3	3	2	3	1	2	3	3	2	3	2	3	3
CO5	3	2	3	2	3	2	2	2	3	2	3	3	3	3	3	3

	3	1.8	2.6	2.8	2.4	1.8	2.6	1.4	2.6	2.2	3	2.6	2.8	2.6	2.8	2.8

Paper Code: DSE-A1

Paper Name: Bio Mathematics

Course Outcomes: After completing the course, students will be able to

CO1: Learn about the development, analysis of Bio-Mathematical model such as Population growth model.

CO2: Find steady states and linear stability analysis of Biologically meaningful steady states of Lotka -Volterra Predator-prey model.

CO3: Formulate Epidemic models (SI, SIR, SIRS) and find basic reproduction number.

CO4: Construct improved Predator-Prey model introducing logistic growth term for the Prey and other Predator models, their steady states and linear stability analysis.

CO-PO-PSO MAPPING

DSE-A1																
CO/PO/PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	2	2	3	3	3	2	2	3	2	2	3	2	2	2	2
CO2	2	2	3	3	3	3	3	2	3	2	2	3	2	3	2	2
CO3	3	1	3	3	3	2	3	2	2	2	3	2	3	3	3	3
CO4	3	1	3	3	3	2	3	2	2	2	3	2	3	3	3	3
	2.5	1.5	2.75	3	3	2.5	2.75	2	2.5	2	2.5	2.5	2.5	2.75	2.5	2.5

Paper Code: DSE-B1

Paper Name: Linear Programming & Game Theory

Course Outcomes: After completing the course, students will be able to

CO1: Explain the concept of convex sets, basic and non-basic feasible solutions, LPP, type of strategies.

CO2: Understand the feasibility conditions, optimality conditions, Hungarian method, simplex method & two-phase method.

CO3: Solve LPP using simplex method, two phase method, and game problem using graphical method & algebraic method

CO4: Analyze the relation between primal problem and dual problem. Analyze the inter relation between theory of games and LPP.

CO5: Formulate LPP from daily life involving equations.

CO-PO-PSO MAPPING

DSE-B1																
CO/PO/PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	1	2	3	3	2	3	1	2	2	3	2	3	2	2	3
CO2	3	1	3	3	2	1	3	1	2	2	3	2	2	2	2	3
CO3	3	2	3	3	2	2	3	1	2	2	3	3	3	2	3	3
CO4	2	2	3	2	2	1	3	1	3	2	3	3	2	3	3	2
CO5	3	3	3	3	3	3	3	1	3	2	3	3	2	3	3	2
	2.8	1.8	2.8	2.8	2.4	1.8	3	1	2.4	2	3	2.6	2.4	2.4	2.6	2.6

Paper Code: DSE-A2

Paper Name: Mathematical Modelling

Course Outcomes: After completing the course, students will be able to

CO1: Describe and solve Bessel's equation and Legendre's equation.

CO2: Evaluate Laplace transform and inverse transform.

CO3: Solve initial value problem up to second order using Laplace transform and inverse transform.

CO4: Create a simulation model to determine the area under a curve, volume under a surface.

CO-PO-PSO MAPPING

DSE-A2																
CO/PO/PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	1	2	2	2	1	2	0	2	2	2	2	2	1	1	1
CO2	3	1	1	3	2	1	2	0	2	1	1	2	2	1	1	2
CO3	3	2	2	3	2	1	1	0	3	2	2	3	3	1	1	3
CO4	3	2	2	3	3	3	2	3	3	3	2	3	2	2	2	2
	3	1.5	1.75	2.75	2.25	1.5	1.75	0.75	2.5	2	1.75	2.5	2.25	1.25	1.25	2

Paper Code: DSE-B2

Paper Name: Advanced Mechanics

Course Outcomes: After completing the course, students will be able to

CO1: Learn about the theory, Concepts, principles and governing equations of motion of a dynamical system.

CO2: Understand the solutions of equations of motion of a dynamical system.

CO3: Solve various types of problems in Mechanics, using various methods.

CO4: Interpret the results from solving various problems analytically.

CO-PO-PSO MAPPING

DSE-B2																
CO/PO/PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	1	2	2	2	1	2	0	2	2	2	2	3	2	2	3
CO2	2	2	2	3	2	2	2	1	2	2	2	2	3	2	2	3
CO3	3	2	3	3	2	2	3	2	2	2	3	2	2	3	3	2
CO4	3	2	3	3	3	2	3	1	2	2	3	3	3	3	3	3
	2.75	1.75	2.5	2.75	2.25	1.75	2.5	1	2	2	2.5	2.25	2.75	2.5	2.5	2.75

Paper Code: SEC-A

Paper Name: C Programming Language

Course Outcomes: After completing the course, students will be able to

CO1: Learn about Computes fundamentals.

CO2: Understand the code, expressions, Statements and functions in C.

CO3: Write a C program using computer operations, functions, Expressions, Statements in C

CO4: Solve various types of problems using C-program.

CO-PO-PSO MAPPING

SEC-A																
CO/PO/PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	2	2	3	2	2	2	3	3	3	2	3	2	2	2	2
CO2	2	2	3	3	3	2	3	3	3	3	2	3	2	3	3	2
CO3	3	2	3	3	2	2	3	3	2	2	2	2	2	3	3	3
CO4	2	3	3	3	2	2	3	3	2	2	3	2	3	2	3	3
	2.25	2.25	2.75	3	2.25	2	2.75	3	2.5	2.5	2.25	2.5	2.25	2.5	2.75	2.5

Paper Code: SEC-B

Paper Name: Scientific computing with SageMath

Course Outcomes: After completing the course, students will be able to

CO1: Use of SageMath as a Calculator

CO2: Create graphical representations of functions like plotting of polynomial functions, trigonometric functions, functions with asymptotes, polar functions.

CO3: Create programs for average of integers, mean, median, mode, factorial, checking primes, checking next primes, finding all primes in an interval, finding gcd, lcm, etc.

CO4: Evaluate determinant, inverse of a given real square matrix (if it exists), solving a system of linear equations, finding roots of a polynomial using inbuilt functions.

CO-PO-PSO MAPPING

SEC-B																
CO/PO/PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**

CO1	3	2	2	2	2	2	2	3	3	3	2	3	2	1	1	2
CO2	2	2	3	3	2	2	3	3	2	2	2	2	2	2	2	2
CO3	3	3	3	3	2	2	3	3	3	2	3	2	2	3	1	2
CO4	2	2	2	3	2	2	2	3	2	2	2	2	2	1	1	2
	2.5	2.25	2.5	2.75	2	2	2.5	3	2.5	2.25	2.25	2.25	2	1.75	1.25	2