Semester	1
Course *1	**Minor**
Paper Code	B1MT230111T
Paper Title	**Calculus-1 and Vector Algebra & Matrix Algebra [Chem+Microbio+Biotech]**
No. of Credits *2	**4**
Theory / Practical / Composite	**Theory**
Minimum No. of preparatory hours per week a student has to devote	**4**
Number of Modules	**2**
Syllabus	**Module-1 [Calculus-1]** 1. Infinite Sequence and Series [9]: Bounded, monotone and convergence sequence; Bounded monotone sequence converge (statement only): applications [3]. Convergence and divergence of a series. Necessary condition of convergence, Geometric & p-series (statement only). Statement of tests of convergence of positive series: Comparison, D'Alembert, Cauchy, Raabe's Test: Applications [5]. Statement of Leibnitz Test for convergence of alternating series [1]. 2. Differentiation and Mean Value theorems [16]: LHD & RHD: examples, Sign of Derivative-monotone increasing and decreasing functions [4], Mean Value Theorems: Rolle's , Lagrange's and Cauchy's theorems and its applications [no proof][5] , Taylor's finite and infinite Series expansion , Application of the principle of maximum and minimum for a function of a single variable in geometrical, physical and other problems [4], Fourier Series: statement of Dirichlet's Theorem: examples [3]. **Module-2 [Vector Algebra & Matrix Algebra]**

	3. Vector Algebra and its applications to Geometry [16] Basic Vector operations [2], Multiplication of Vectors: Scalar and vector triple product [5], Vector Equations of different forms of planes and straight lines, shortest distance between lines, volume of tetrahedron [9] 4. Matrices & Determinants [11]: Unitary and Hermitian Matrices [3], Laplace's expansion method for determinants [1], rank of a matrix by elementary row operations [4], consistency of a system of linear equations. [3]
Learning Outcomes *3	On successful completion of this course a student will be able to do the following: • Find whether the dependent variable is increasing/decreasing with increase in independent variable value and the rate of increment/decrement thereby understanding to finding of increment/decrement of a quantity with the change of dependant factor and applying to population dynamics and inferring about the same. • Understand conditions under which mean value of two values of a variable is attained by that variable; will learn that if one knows a range for the velocity of a vehicle, a bound of its displacement may be calculated. • Learn in finding approximately unknown value of a function in terms of nearby known values. • Understand conditions under which a given function can be approximated by a simpler series of functions thereby simplifying the study of the function. • Will be familiarised with the conditions under which a given periodic function may be represented in terms of sine/cosine functions. • Learn how maximum/minimum value of a given real-valued function can be found: • Learn to test converging/diverging/oscillatory behaviour of successive values of a real variable. • Will be introduced to the concept of adding countable number of real numbers and thereby testing whether such an expression corresponds to a real number. • Find whether the dependent variable is increasing/decreasing with increase in independent variable value and the rate of Increment/decrement.

	- Become familiar with conditions under which approximate value of a dependent variable may be found when value of the variable and rate of change of that variable at a nearby point are known. - Establish bounds between which an unknown quantity lies. - Learn the method for searching minimum/maximum value of a given dependent variable. - Study properties of geometrical figures through handling of directed line segments. - Study matrices as a means of representing linear maps like geometrical transformations and coordinate changes and how does evaluating determinant associated with a square matrix helps in establishing important properties like invertibility of the matrix. - Will get acquainted with the methods of checking whether a given system of hyperplanes have a common point and, in case it has, to find the common points. - Will get familiarized with the process of writing a system of linear equations in terms of matrices.
Reading/Reference Lists *4	- Introduction to Real Analysis—Bartle, Sherbert - Real Analysis—S.K.Mapa - Higher Algebra (Linear and Abstract)—S.K.Mapa - Vector Algebra—Maity,Ghosh Online Lectures: - https://youtu.be/nH05UiErAX4 - https://youtu.be/tffrrtzUhmw

Evaluation	Theory CIA: 20+5+5=30 Semester Exam: 70	Practical (if applicable) CA: Semester Exam:
Paper Structure for Theory Semester Exam	. 7 questions each carrying 10 marks out of 12/13 questions	