Semester	**2**
Course [*1]	**Minor**
Paper Code	B1MT230211T
Paper Title	**Complex Numbers & Applications of Calculus and ordinary differential equations [Chemistry+ 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[Complex Numbers and Applications of Calculus]** 1. Complex numbers [13] (Basic Operations: Multiplication, Division; Modulus and Argument; Complex Conjugate and its properties), Triangle Inequality [3], De-Moivre's theorem and its applications [3], Functions of a complex variable: Exponential, sine, cosine, logarithms and complex powers, Hyperbolic Functions and related problems,[7] 2. Application of Calculus [12] Tangent and Normal [3], Curvature **(3)**. Asymptotes (Cartesian equation only)[3], concavity and inflection points [3**]**. **Module-2 [Ordinary Differential Equations]** 3. Ordinary Differential equations [27]: Formation of ode -exemplification from various fields (2) First order ode: Exact differential equations, Non-exact differential equations & Integrating factors (no proof) (4) Linear ode and Bernoulli's equation(2).First order higher degree ordinary differential equations;

	Clairaut's equation: general solutions (3).General solution of linear homogeneous differential equations of second order [2] , Wronskian and related problems [2].Linear non-homogeneous equations with constant co-efficients; Cauchy Euler equation[5]; Second order linear differential equations with variable co-efficients ; method of variation of parameters [7]
Learning Outcomes *[3]	On successful completion of the course a student will be able to do the following: • Learn to simulate real life problems through mathematical models involving differential equations to predict possible outcome and to suggest remedial measures: have many useful applications in environmental and social sciences including that of climate change and in predicting behaviour of infectious diseases. • Study an algebraic equation geometrically through curve tracing to throw light on the nature of given algebraic equation; in Particular, studying the topic helps in (a) finding the rate of increment/decrement of a function (b) verifying whether the curve is limited to a finite region of a plane and whether the function value can be closely approximated ultimately by that of a line (c)verifying whether the curve opens up or closes down (d) verifying how closely given curve resembles a straight line locally. and learn how to apply these concepts in studying financial systems. • Learn complex numbers as natural and useful extension of real number system in which a polynomial equation can always be solved.
Reading/Reference Lists *[4]	• Introduction to Real Analysis—Bartle, Sherbert • Classical Analysis—S.K.Mapa • Higher Algebra (Linear and Abstract)—S.K.Mapa • Differential Equation—Maity,Ghosh • Application of Calculus—Maity,Ghosh Online Lectures:

	• https://youtu.be/JOfnCCNj4gQ • https://youtu.be/_LX1p0VFkp4 • https://youtu.be/0FLrxud3fgU • https://ocw.mit.edu/courses/18-03-differential-equations-spring-2010/	
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.	