Semester	**I**
Course	**Multi-dis**
Paper code	**M1BT230111T**
Paper Title	**Biological Thermodynamics and Kinetics**
No. of Credits	**3**
Theory / Practical / Composite	**Theory**
Minimum No. of preparatory hours per week a student has to devote	3
Number of Modules	1
Syllabus	**SECTION-1:** **Unit I: Principles of Thermodynamics and Applications in Biology:** Importance and scope of thermodynamics, Systems and surroundings, Types of systems (closed, isolated and open), Extensive and intensive properties, State and path functions, Steady state and equilibrium state. First law of thermodynamics: Internal energy, Reversible and irreversible processes and work done, Isothermal and adiabatic processes, Enthalpy, Heat capacities, Thermochemistry-enthalpy changes in physicochemical and biochemical reactions, Kirchoff's law. Second law of Thermodynamics: Carnot cycle and refrigeration, Physical concept of entropy, Entropy and irreversibility, Entropy change of systems and surroundings for various processes, Entropy change during isothermal mixing of ideal gases, Entropy and unavailable work, Helmholtz free energy and Gibbs free energy, Spontaneity and equilibrium, Gibbs Helmholtz equations and applications, Clausius-Clapeyron equation and phase transition, equilibrium constant and standard free energy change, Coupled reactions, Chemical potential, Partial molar quantities, Donnan equilibrium, Concept of activity and activity coefficient, Fugacity, Thermodynamic requirements of chemical and biochemical reactions. **Unit II: Chemical Bonding:** Co-ordinate bonding and co-ordination compounds: Lewis acid base adducts, Double salts and complex salts, Werner's theory of co-ordination, Ligand and its classifications, Co-ordination number, Chelate complexes, Inner metallic complexes, Chelate effect, Applications of co-ordination

	compounds (analytical application, industrial application,

	chelation therapy), IUPAC nomenclature, Isomerism in respect of co-ordination number 4 and 6, Determination of configurations of cis- and trans-isomers by chemical methods, Stability constants of co-ordination complexes. Structure and bonding in co-ordination compounds: Valence Bond Theory and its drawbacks, Crystal Field Theory- splitting of d^n configurations in octahedral and tetrahedral fields, Crystal Field Stabilisation Energy (CFSE) in weak and strong fields, Pairing energy, Factors affecting the magnitude of 10Dq, Spectrochemical series, Tetragonal distortion of octahedral complexes, Jahn-Teller theorem, Square planar coordination, Qualitative aspect of Molecular orbital theory- □- and □-bonding in octahedral complexes. **SECTION-2:** **Unit III: Chemical Kinetics and applications in Biology:** Concepts of rate, rate constant, order and molecularity of a reaction, Rate equations and rate constants for 1st, 2nd and 3rd order reactions, Pseudo unimolecular reaction, Half value period and its significance, Rate determining step, Zero and fractional orders, Steady state approximations, Overview of collision and Transition state Theories, Kinetically controlled and thermodynamically controlled reactions, Temperature dependence of chemical reactions, Arrhenius equation, Activation energy, Enzyme kinetics, Catalysis- homogeneous and heterogeneous, Enzyme catalysis, Michelis- Menten equation.
Learning Outcomes *[3]	1. Understanding the principles and applications of thermodynamics in biological field. 2. Acquiring information about Chemical Bonding applicable to inorganic molecules and biological macromolecules. 3. Introduction to the methods of chemical kinetics and applications in biological systems
Reading/Reference Lists *[4]	**SECTION-1**. 1. G.W. Castellan, Physical Chemistry, Narosa, 4th edition, 2004. 2. P. C. Rakshit, Physical Chemistry, Sarat Book House, Revised & enlarged 7th edition, 2014. 3. R. P. Sarkar, General and Inorganic Chemistry (Part-II), New Central Book Agency (P) Limited, 3rd Revised edition, 2011. 4. J. D. Lee, Concise Inorganic Chemistry, ELBS, 1991. 5. S. K. Ghosh, Advanced General Organic Chemistry- A Modern Approach, New Central Book Agency (P) Limited, 2010. 6. P.

	Sykes, A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988). **SECTION-2**. 1. P. C. Rakshit, Physical Chemistry, Sarat Book House, Revised & enlarged 7th edition, 2014. 2. G.W. Castellan, Physical Chemistry, Narosa, 4th edition, 2004.	
Evaluation	Theory CIA: 13 Semester Exam: 35	Practical (if applicable) CA: Semester Exam:
Paper Structure for Theory Semester Exam	Full marks for end semester examination: 35 **SECTION-1:** Any two from three questions with subparts: 5×2 = 10 marks. Any two from three questions with subparts: 7.5×2 = 15 marks. [No sub-part will be of more than 5 marks] **SECTION-2:** Any two from three questions with subparts: 5×2 = 10 marks.	