Semester IV						
S. No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	BB 403	Metabolism and Bioenergetics	2	1	0	6
2	BB 404	Biophysics	3	0	0	3
3	BB 411	Biology Lab I	0	0	3	3
4	BB 606	Biophysical methods	3	0	0	3
5		Institute Elective – I	3	0	0	6
6		Program Elective-I	3	0	0	6
7		HSS Elective-I	3	0	0	6
		Total Credits				33

1	**Title of the course** (L-T-P-C)	**Metabolism and Bioenergetics (2-1-0-6)**
2	**Pre-requisite courses(s)**	
3	**Course content**	**1.** Design principles of metabolism **2.** Principles of energy release from biological macromolecules. **3.** Principles of bioenergetics. **4.** Carbohydrate metabolism **5.** Alternative oxidation of glucose by Pentose Phosphate pathway (PPP). **6.** Krebs /TCA /CAC cycle **7.** Strategies in citrate cycle. **8.** Oxidative phosphorylation **9.** Photosynthesis **10.** Fatty acid metabolism **11.** Amino acid metabolism **12.** Nucleic acid metabolism **13.** One carbon metabolism **14.** Secondary metabolism **15.** Interconvertibility of fuels **16.** Molecular chaperones in protein folding, experimental strategies to study protein mis-folding and disease, regulation of metabolism through metabolic networks, metabolic messengers, generation of NO and oxygen radicals.
4	**Texts/References**	**1**. Rodney F Boyer, Concepts in Biochemistry. John Wiley & Sons; 3rd Edition edition (2 December 2005) **2.**Thomas Millar, Biochemistry Explained: A Practical Guide to Learning Biochemistry. CRC Press; 1 edition (30 May 2002) **3**.Lubert Stryer et al., Biochemistry. W. H. Freeman; 6th Edition edition (14 July 2006) **4**.John E. McMurry and Tadgh Begley. The Organic Chemistry of Biological Pathways. WH Freeman; 2nd edition (11 December 2015) **5**.Laurence A Moran, Principles of Biochemistry. Pearson; 5 edition (30 July 2013) **6.**David L. Nelson and Michael M. Cox, Lehninger Principles of Biochemistry WH Freeman; 7th ed. 2017 edition (1 January 2017)

1	**Title of the course** (L-T-P-C)	**Biophysics (3-0-0-3)**
2	**Pre-requisite courses(s)**	

3	**Course content**	• Diffusion and Brownian motion and Biological applications.
		• Electrostatic interactions
		• Chemical Potential and Chemical reactions
		• Self-assembly, micelles, cell membranes
		• Helix coil transition
		• Stretching of macromolecules
		• Protein folding
		• Unzipping of DNA
		• Machines in membranes
		  ○ Electro-osmotic effects
		  ○ Ion pumping
		• Nerve Impulses
		  ○ Action Potentials
		  ○ Ion Channels
		• Physical Techniques and related biology
		  ○ X-ray diffraction, light and neutron scattering
		  ○ Nuclear magnetic Resonance
		  ○ Fluorescence
		  ○ DNA Microarrays
		  ○ Manipulation of biomolecules using optical tweezers.
		  ○ Tomography
		  ○ Patch clamps

4	**Texts/References**	**1**. Physical Biology of the Cell, Second Edition by Rob Phillips, Jane Kondev, Julie Theriot, and Hernan Garcia (Garland Science, 2012). **2**. Biological Physics: Energy, Information, Life Student edition by Philip Nelson. (Chiliagon Science)

1	**Title of the course** (L-T-P-C)	**Biology Lab I** **(0-0-3-3)**
2	**Pre-requisite courses(s)**	None
3	**Course content**	1. Biological solutions preparation 2. Titration of amino acids, 3. Estimations of reducing non-reducing sugars, proteins, DNA, RNA, lipids, 4. paper chromatography/TLC, 5. SDS-PAGE, isoelectric focusing, 6. DNA melting curves 7. Enzyme assays
4	**Texts/References**	NA

1	**Title of the course** (L-T-P-C)	**Biophysical methods (3-0-0-3)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	Chromatography: Principles of Chromatography, Chromatography Equipment, Modes of Chromatography, Open Column Chromatography, High Performance Liquid chromatography (HPLC), Fast Protein Liquid Chromatography, Perfusion Chromatography, Membrane- Based Chromatography Systems, Chromatography of a Sample Protein. Spectroscopic Techniques: The Nature of Light, The Electromagnetic Spectrum, Ultraviolet/Visible Absorption Spectroscopy, Fluorescence Spectroscopy, CD spectroscopy, Spectroscopic Techniques Using Plane-Polarized Light, Infrared Spectroscopy, Raman spectroscopy, ESR, Lasers, SPR Mass Spectrometry: Principles of Mass Spectrometry, Mass Spectrometry of Proteins/Peptides, Interfacing MS With other Methods, Uses of Mass Spectrometry in Biochemistry Electrophoresis: Principles of Electrophoresis, Nondenaturing Electrophoresis, Denaturing Electrophoresis, Electrophoresis in DNA Sequencing, Isoelectric Focusing (IEF), Immunoelectrophoresis, Agarose Gel Electrophoresis of Nucleic Acids, Pulsed Field Gel Electrophoresis, Capillary Electrophoresis, Electroblotting Procedures, Electroporation. Three-dimensional structural detection: The Protein- Folding Problem, Structure Determination by NMR, Crystallization of Biomacromolecules, X-Ray Diffraction by Crystals, Calculation of Electron Density Maps, Other Diffraction Methods, Other Diffraction Methods, Structural Databases
4	**Texts/References**	Methods in Modern Biophysics by Bengt Nolting 3rd Physical Biochemistry: Principles and Applications by David Sheehan 2nd edition (Wiley)