1.	Fundamentals of Systems Biology: From Synthetic Circuits to Whole-cell Models Paperback – Import, 16 Feb, by Markus W. Covert (Author), CRC Press (2015)
2.	An Introduction to Systems Biology: Design Principles of Biological Circuits (Chapman & Hall/CRC Mathematical and Computational Biology), 7 Jul by Uri Alon (2006)
3.	Systems Biology 1st Edition, June, Wiley-Blackwell by Edda Klipp, Wolfram Liebermeister, Christoph Wierling, Axel Kowald, Hans Lehrach, Ralf Herwig (2009)
4.	Stochastic Modeling for Systems Biology, Chapman & Hall/CRC, by Wilkinson, D. J. (2006)

ADVANCED BIOANALYTICAL TECHNIQUES

Details of course: -

Course Title	Course Structure			Pre-Requisite
	L	T	P	
Advanced Bioanalytical Techniques (BT413)	03	01	00	Nil

Course Objective:

This course will provide insight into the development of advanced bioanalytical techniques. It will introduce students to select specific methods of bioanalytical techniques and to apply those in solving complex analytical problems in biotechnological research.

Course Outcome (CO):

1 Distinguish between different types of microscopies like confocal and fluorescence microscopy, also learning basics of SEM, TEM, atomic force microscopy and various other dynamic methods.

2 Outline the basics of spectroscopy by electromagnetic radiation and Spectrum, also studying interaction of Radiation with Matter including Bear –Lambert Law and other techniques.

3 Define X ray spectrometers in detail with its equipment's, principle and other devices which follow the same principle as X-ray absorption meter, X-ray fluorescence spectrometry.

4 Discuss principle and working dynamics of various hybrid techniques like GC-MS, LC-MS and ICP-MS.

5 List immunochemical methods like immunoassay immunodiffusion and rocket immunoelectrophoresis.

S.No.	Content	Contact Hours
1.	**Advanced Imaging Techniques In Microscopy Live cell imaging,** Confocal microscopy and fluorescence microscopy - High content/throughput screening - Basics of SEM and TEM & Specimen preparations. Advanced EM techniques:	**7**

	Electron tomography and Serial block face imaging using SEM – CryoEM - Methods to study interactions: FRET, FCCS and BiFC - Atomic Force Microscopy - Dynamics methods: photobleaching and activation – STED - Structured Illumination Microscopy - Multiphoton microscopy and In vivo imaging.	
2.	**Spectroscopic techniques:** UV – Visible Spectroscopy: Introduction; Electromagnetic Radiation and Spectrum; Interaction of Radiation with Matter; Lambert Law; Beer Law; Bear –Lambert Law; Absorption Instruments; Radiation Sources; Materials of Optical Components. **Infrared Spectroscopy**: Introduction; Near – Middle – Far IR range of Spectrum; Basic Components of IR Spectrophotometers: Optical Null and Ratio Recording Type Spectrophotometers; NMR: Theory and Principle of NMR - Multi nuclear NMR- Analysis of spectra and Interpretations. **Mass Spectrometer:** Principles of modern ionization methods and mass analyzers (TOF and FT-ICR), hybrid/tandem mass methods (MS-MS) and applications of MS in the analysis of drugs and macromolecules	**6**
3.	**X Ray Spectrometers:** Introduction, X-ray Spectrum, Block diagram of X-ray Spectroscopy Instrument, X-ray Generating Equipment, Collimators, Monochromators. Detectors: Photographic Emulsion, Ionization Chamber, 6The Geiger Muller Counter, Proportional Counter, Scintillation Counter. X-ray Diffrcatometer, X-ray Absorption Meter. X-ray Fluorescence Spectrometry **Ion Detectors:** Faraday Cup, Electron Multiplier, Micro Channel Plate.	**7**
4.	**Hybrid Techniques:** Gas chromatography with mass spectrometric detection (GC-MS), liquid chromatography with mass spectrometric detection (LC-MS), inductively coupled plasma with mass spectrometric detection (ICP-MS). Analysis of data: **HPLC chromatograms.**	**6**
5.	**Immunochemical methods:** Immunoassay, Immunodiffusion, Rocket Immunoelectrophoresis. High-Throughput Next generation sequencing (HT-NGS) platforms**.**	**8**
6.	**Flow Cytometer**: Introduction to flow cytometry- Fluorochromes and fluorescence - Readings on flow cytometry data analysis. Isoelectric focusing and 2-Dimensional polyacrylamide gel electrophoresis and their uses.	**8**
Total		**42**

Books: -

S.No.	**Name of Books/ Author/Publisher**
1.	Robert D. Braun, 'Introduction to Instrumental Analysis', McGraw Hill, Singapore, (1987)
2.	G.W.Ewing, 'Instrumental Methods of Analysis', McGraw Hill, (1992)