Name of the Programme: M.Sc. Part-I (Biochemistry)

Course Code: CHB-505 **Title of the Course:** Analytical Biochemistry-II

Number of Credits: 4

Effective from AY: 2022-23

Pre-requisites for the Course:	Students should have graduate level knowledge either in chemical or life sciences or should have qualified change of discipline test.	
Course Objectives:	1. To Introduce various electro-analytical, imaging and spectral characterisation techniques for analysis. 2. To evaluate the utility of various analytical techniques as a qualitative and quantitative tool. 3. To develop concepts in techniques and instruments required for macromolecule structure determination and other techniques such as tracers for metabolic pathways.	
Content:		**No. of hours**
	1. Automation in biochemistry a. Definition and history. b. Discrete analysers and flow analysis. c. Advantages and disadvantages of automation.	4
	2.Electroanalytical methods a. Introduction to ion selective and gas sensing electrodes and their applications. b. Introduction to potentiometry, conductometry, coulometry and voltammetry. c. Introductions to biosensors.	7
	3. Optical methods of analysis a. Theory, instrumentation and application of nephelometry. b. Theory, instrumentation and application of turbidimetry. c. Theory, instrumentation and application of UV-visible spectrophotometry. d. Theory, instrumentation and application of fluorometric analysis. e. Theory, instrumentation and application of flame emission photometry and Atomic absorption spectrophotometry.	12
	4. Microscopy and Bioimaging a. Imaging living cells and tissues and measuring cellular dynamics. Theory of microscopy, basic aspects of compound microscope. b. Light microscopy: Theory, instrumentation and applications of bright field, dark field, phase-contrast, inverted microscopy. c. Principle and application of fluorescence microscopy, confocal scanning microscopy, epifluorescence and immuno-fluorescence microscopy.	11

	d. Electron microscopy: Theory, instrumentation and applications of atomic force microscopy (AFM), scanning electron microscopy (SEM), transmission electron microscopy (TEM). Optical tweezers, photography.	
	5. Radioisotope techniques a. Nature of radioactivity and its detection, measurement of radioactivity, Disintegration kinetics. b. Radio-activity counters and radioanalysis – GM Counter, Scintillation Counter, Isotope dilution analysis. c. Theory and application of Autoradiography d. Theory and application of radiorespirometry. e. Tracer techniques for metabolic pathways. f. Safety measures in handling radioisotopes.	8
	6.Spectroscopic techniques for structure determination of biomolecules: a. Principles, application and profile analysis of: FTIR, NMR, ESR, Single crystal X-ray diffraction, optical rotatory dispersion, circular dichroism. b. Structure elucidation of metabolites using combined spectroscopic data.	12
	7. Mass Spectrometry: a. Principle, components, working and applications of mass spectrometer. b. Different types of ionization methods used in mass spectrometer (CI, EI, ESI, FAB). c. Different types of mass analysers used in mass spectrometers (magnetic sector, ion trap, quadrupole), MALDI-MS, MALDI-TOF-MS, ICP-MS. d. Structural information by tandem mass spectrometry.	6
Pedagogy:	Mainly lectures and tutorials. Seminars / term papers /assignments / presentations / self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	
References/ Readings:	1. Wilson, K.; Walker, J.; Principles and Techniques of Practical Biochemistry; Cambridge University Press; 2010,7th Edition. 2. Homes, D. J.; Peck, H.; Analytical Biochemistry; Pearson Education Limited; 1998, 3rd Edition. 3. de Hoffmann, E.; Stroobant, V.; Mass Spectrometry: Principles and Applications; John Wiley & Sons Ltd; 2007, 3rd Edition. 4. Christian, G. D.; Dasgupta, P. K.; Schug, K. A.; Analytical Chemistry; John Wiley & Sons; 2013, 7th Edition. 5. Skoog, D. A.; Holler, F. J.; Crouch, S. R. Principles of Instrumental Analysis; Cengage Learning; 2016,7th Edition. 6. Parakhia, M. V.; Tomar, R. S.; Patel, S.; Golakiya, B. A.; Molecular Biology and Biotechnology: Microbial Methods; New India, 2010.	
Course Outcomes:	1. Students will be in a position to explain the principles of various techniques.	

	2. Students will be able to differentiate between various analytical techniques based on their theory and sensitivity achieved. 3. Students will be able to choose between various techniques of structure elucidation based on the information desired and interpret the data obtained to a fair level. 4. Students will be able to apply the knowledge of various techniques for designing experiments in research and development.