DEPARTMENT OF BIOTECHNOLOGY				*CLASS: I B.Sc. Biotechnology*				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/week**	**CIA**	**Ext**	**Total**
II	Core-4	20U2LMC4	Bioinstrumentation	3	3	25	75	100

Course Objectives

1. To introduce students to various analytical instrumentation used in biotechnology labs.
2. To understand the physical principles of emerging bio-analytical techniques.
3. To identify and interpret results of bio-analytical techniques.
4. To critically assess the advances in the field of bio-analytical chemistry

Unit-I: Microscopy

Microscopy: Introduction –magnification, resolving power and numerical aperture and types - bright field, dark field, Phase contrast, Fluorescence, Polarising microscopy; Electron microscopy- SEM and TEM.

Unit-II: pH meter and Centrifuge

pH meter: Principle, working and applications. Centrifuge: Basic principles of Sedimentation- types of centrifuges and types of rotors. Mechanism of diffusion and sedimentation.

Unit-III: Colorimetry and Spectroscopy

Colorimetry: Beer - Lambert's Law – principle and applications; Spectrophotometry - UV, Visible, Fluorescence and Infrared spectroscopy –principle, instrumentation and applications.

Unit-IV: Chromatography

Chromatography: Paper Chromatography; Thin layer Chromatography; Gas chromatography, ion exchange, High pressure Liquid Chromatography- principle, instrumentation and applications.

Unit-V: Electrophoresis and Radio-activity

Electrophoresis: Types-moving boundary and zone electrophoresis. Techniques and applications of Agarose gel electrophoresis, native PAGE, SDS-PAGE- principle, instrumentation and applications. Radio isotope techniques: natural radiations, nature of radioactivity – Detection and measurement of radioactivity –- Geiger-Muller counter– Autoradiography Applications of radioisotopes in Biological sciences – Hazards and containment of radioactivity.

Books for Study

1. Jeyaraman J. 1985. Laboratory Manual in Biochemistry.Wiley Eastern Limited, New Delhi.
2. Plummer D. 1987. An Introduction to Practical Biochemistry. Tata McGraw – Hill Publishing Company Ltd., New Delhi.
3. Veerakumari L. 2009. Bioinstrumentation. MJP publishers.

Books for Reference

1. Wilson, K and Walker,J, Principles and Techniques of Practical Biochemistry, 1995, Cambridge University Press, New York.
2. Boyer, R.F., Modern Experimental Biochemistry, 1993,The Benjamin / Cummings Publishing Company, Inc., New York.
3. Switzer RL, Garrity LF. 1999. Experimental Biochemistry. W. H. Freeman and Co.

Web Resources

1. http://nptel.ac.in
2. http://swayam.gov.in

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, Assignments and group discussions, Problem solving

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K - Level
CLO-1	Explain the principle, components and application of different types of microscopes.	Up to K-2
CLO-2	Infer the principle, working and applications of different centrifuges and pH meter	Up to K-4
CLO-3	Apply the concept of electromagnetic radiation, absorption spectrum, Beer's –Lambert's law and verification of the law.	Up to K-3
CLO-4	Analyse various chromatographic techniques by its working principle and applications	Up to K-4
CLO-5	Categorize the various electrophoretic techniques and radioactivity measurements	Up to K-4

Mapping of Course outcomes with Program specific Outcomes:

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CLO-1	3	3	3	3	1	3	--
CLO-2	3	1	2	1	1	3	--
CLO-3	3	3	1	3	1	3	--
CLO-4	3	3	2	2	2	3	--
CLO-5	3	3	2	3	3	3	--

Advance application-3; Intermediate level-2; Basic level-1

Mapping of Course learning outcomes with Program Outcomes:

CO/PSO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	2	2	2	3
CLO-2	3	2	--	2	3
CLO-3	3	3	1	--	--
CLO-4	3	3	2	--	--
CLO-5	3	3	2	--	--

Advance application-3; Intermediate level-2; Basic level-1

LESSON PLAN – BIOINSTRUMENTATION

Unit	Description	Staff Name	Hours	Mode
UNIT - I	Microscopy: Introduction – magnification, resolving power and numerical aperture and types - bright field, dark field.		3	Chalk and talk Demonstration
	Phase contrast, Fluorescence, Polarising microscopy.		3	Chalk and talk PPT
	Electron microscopy- SEM and TEM.		3	Chalk and talk
UNIT - II	pH meter: Principle , working and applications		2	Chalk and talk Demonstration
	Centrifuge: Basic principles of Sedimentation- types of centrifuges and types of rotors. Mechanism of diffusion and sedimentation.		7	Chalk and talk Demonstration
UNIT - III	Colorimetry: Beer - Lambert's Law – principle and applications.		3	Chalk and talk Demonstration
	Spectrophotometry: UV-Visible, Fluorescence and Infrared spectroscopy –principle, instrumentation and applications.		6	Chalk and talk PPT
Unit-IV	Chromatography: Paper Chromatography; Thin layer Chromatography- principle, instrumentation and applications.		3	Chalk and talk Demonstration
	Gas chromatography, ion exchange, High pressure Liquid Chromatography- principle, instrumentation and applications.		3	Chalk and talk PPT
	High pressure Liquid Chromatography- principle, instrumentation and applications		3	Chalk and talk
UNIT - V	Electrophoresis: Types-moving boundary and zone electrophoresis. Techniques and applications of Agarose gel electrophoresis, native PAGE, SDS-PAGE- principle, instrumentation and applications.		5	Chalk and talk Demonstration
	Radio isotope techniques: The nature of radioactivity- natural radiation – Detection and measurement of radioactivity, GM counter. Autoradiography Applications of radioisotopes in Biological sciences. Hazards and containment of radioactivity		4	Chalk and talk
			45	

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Bioinstrumentation Course

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A MCQs		Section B Short Answers		Section C (Either / or Choice)	Section D (Open Choice)
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 4	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 2	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	**Total Marks**	% of Marks without choice	**Consolidated**
K1	5	4	10	-	**19**	15.83	**42%**
K2	5	6	10	10	**31**	25.83	
K3	-	-	20	30	**50**	41.67	**42%**
K4	-	-	10	10	**20**	16.67	**16%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K2 Level)	1Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1Question from Unit-IV (K3 Level)
		2 Questions from Unit-IV (K4 Level)	1Question from Unit-III (K3 Level)
		2 Questions from Unit-V (K3 Level)	1Question from Unit-V (K4 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Course content designed by Ms. R. Suguna