SRI VENKATESWARA COLLEGE OF ENGINEERING

COURSE DELIVERY PLAN - THEORY

Department of Biotechnology	LP: BT22401 Rev. No:0
B.E/B.Tech/M.E/M.Tech : **B. Tech Biotechnology** Regulation: **2022** PG Specialisation : NA Sub. Code / Sub. Name : **BT22401/Analytical Techniques and Instrumentation** Unit **I**	Date: 18.01.2024

UNIT – I INTRODUCTION TO SPECTROMETRY **9**

Properties of electromagnetic radiation, wave properties, Components of optical instruments, Sources of radiation, Wavelength selectors, Sample containers, Radiation transducers, signal process and read outs, signal to noise ratio, Sources of noise, Enhancement of signal to noise, Types of optical instruments.

Objective: To acquire fundamental knowledge about the Light spectrum, Absoprtion, Fluorescence, NMR, Mass spectroscopy

Session No *	Topics to be covered	Ref	Teaching Aids
1.	Introduction and characteristic properties of electromagnetic radiation.	T1 (13-32) T2 (1-11)	BB/LCD
2.	Importance of the wave properties and major components of optical instruments.	T1 (158-169)	BB/LCD
3.	The main sources of radiation in the optical instruments.	T1 (193-203)	BB/LCD
4.	The major perspectives of the wavelength selectors in the optical instruments.	T1 (203-220)	BB/LCD
5.	The functional aspects of the sample containers and radiation transducers in the optical instruments.	T1 (220-232)	BB/LCD
6.	The importance and application of signal process and read outs in the optical instruments.	T1 (232-233)	BB/LCD
7.	The measurement and applications of signal to noise ratio reflecting the output of the instruments.	T1 (135- 150) T2 (180-192)	BB/LCD
8.	The analysis of sources of noise and enhancing signal to noise in the betterment of the output.	T1 (234-235)	BB/LCD
9.	The different types of optical instruments in functional aspects.	T1 (235-243)	BB/LCD
Content beyond syllabus covered (if any): Advance application of optical instruments			

* Session duration: 50 minutes

Sub. Code / Sub. Name: **BT22401/Analytical Techniques and Instrumentation**

Unit : II

UNIT – II MOLECULAR SPECTROSCOPY 9

Molecular absorption spectrometry, Beer's law, Theory of UV – visible absorption spectrometry, Instrumentation, Applications, Theory of fluorescence and Phosphorescence, Instrumentation, Applications, Theory of Infrared absorption spectrometry, IR instrumentation, Applications, Theory of Raman spectroscopy, Instrumentation, Application of FTIR and Raman spectroscopy in the analysis of biological samples.

Objective: To acquire fundamental knowledge about the Light spectrum, Absoprtion, Fluorescence, NMR, Mass spectroscopy

Session No *	Topics to be covered	Ref	Teaching Aids
10.	Molecular absorption spectrometry and the application of Beer's law.	T1 (378-385) T2 (159-172)	BB/LCD
11.	Application of Beer- Lambert's Law, theory and instrumentation perspectives of UV – visible absorption spectrometry, Instrumentation.	T1 (312-320)	BB/LCD
12.	Application of Beer- Lambert's Law, theory and instrumentation perspectives of UV – visible absorption.	T1 (444-469)	BB/LCD
13.	Principle and importance of fluorescence and Phosphorescence.	T1 (444-469)	BB/LCD
14.	Principle and importance of fluorescence and Phosphorescence.	T1 (478-488) T2 (288)	BB/LCD
15.	Theory, instrumentation structure and applications of Infrared absorption spectrometry.	T1 (488-502) T2 (293-305)	BB/LCD
16.	Theory, instrumentation structure and applications of Infrared absorption spectrometry.	T1 (505-599)	BB/LCD
17.	Principles and application of Raman spectroscopy.	T1 (533-540) T2 (321-340) R2 (334-357)	BB/LCD
18.	Importance of Raman spectroscopy in Fourier Transform Infrared (FTIR) spectroscopy in the analysis of biological samples.	T1 (540-549) T2 (325-335)	BB/LCD
Content beyond syllabus covered (if any): Advance technologies pertaining to the IR spectroscopy			

* Session duration: 50 mins

Sub. Code / Sub. Name: **BT22401/Analytical Techniques and Instrumentation**
Unit : IV

UNIT–IV SEPARATION METHODS **9**

General description of chromatography, Band broadening and optimization of column performance, Liquid Chromatography, Partition chromatography, Adsorption chromatography, Ion exchange chromatography, Size exclusion chromatography, Affinity chromatography- principles of GC and applications, HPLC, Applications of chromatography techniques in biotechnology and Biopharmaceutical industry.

Objective: To acquaint the student with different chromatographic methods for separation of biological products.

Session No *	Topics to be covered	Ref	Teaching Aids
28.	General description of chromatography, work flow, and its different types.	T1 (836-843) T2 (513-532)	BB/LCD
29.	Band broadening and optimization of column performance.	T1 (843-858)	BB/LCD
30.	Principle and importance of Liquid Chromatography, Partition chromatography, Adsorption chromatography, Ion exchange chromatography	T1 (893-931) T2 (545-548)	BB/LCD
31.	Principle and importance of Liquid Chromatography, Partition chromatography, Adsorption chromatography, Ion exchange chromatography	T1 (923-927)	BB/LCD
32.	Principle and importance of Size exclusion chromatography, Affinity chromatography- principles of GC and applications,	T1 (927-930) T4(364-380)	BB/LCD
33.	Principle and importance of Size exclusion chromatography, Affinity chromatography- principles of GC and applications,	T1 (836-843) T2(513-530)	BB/LCD
34.	Principle and importance of HPLC, Applications of chromatography techniques in biotechnology and Biopharmaceutical industry.	T1 (843-858) T3 (600-640)	BB/LCD
35.	Principle and importance of HPLC, Applications of chromatography techniques in biotechnology and Biopharmaceutical industry.	T1 (893-931) T2 (545-548)	BB/LCD
36.	Principle and importance of HPLC, Applications of chromatography techniques in biotechnology and Biopharmaceutical industry.	T1 (893-931) T2(545-548)	BB/LCD

Content beyond syllabus covered (if any): Nil

* Session duration: 50 mins

Sub. Code / Sub. Name: **BT22401/Analytical Techniques and Instrumentation**

Unit : III

UNIT – III MAGNETIC RESONANCE SPECTROSCOPY AND MASS SPECTROMETRY 9

Theory of NMR, Environmental effects on NMR spectra, Chemical shift, NMR spectrometers, Applications of 1H and 13C NMR, Molecular mass spectra, Ion sources, Mass spectrometer. Applications of molecular mass spectrometry, Electron paramagnetic resonance, g values, Instrumentation.

Objective: To acquire fundamental knowledge about the Light spectrum, Absoprtion, Fluorescence, NMR, Mass spectroscopy

Session No *	Topics to be covered	Ref	Teaching Aids
19.	Principle aspects and Theory of NMR and its application in Molecular characterization.	T1 (300-302)	BB/LCD
20.	Environmental effects on spectra acquired through NMR	T1 (302-306)	BB/LCD
21.	The importance of chemical shift in the spectral features of NMR spectrometer.	T1(312-320)	BB/LCD
22.	Applications of different kinds of NMR such as 1H and 13C NMR in molecular characterization.	T1 (312-320)	BB/LCD
23.	The flowchart of working aspects, application of Mass spectrometer.	T1 (320- 325)	BB/LCD
24.	Different types of mass analyzers and its application in molecular mass spectrometry.	T1 (320- 325)	BB/LCD
25.	The major importance of Electron paramagnetic resonance effect in mass spectrometer.	T1 (320-325), T4 (412-436)	BB/LCD
26.	The principles aspects of g values in Instrumentation.	T1 (647- 666)	BB/LCD
27.	The principles aspects of g values in Instrumentation.	T1 (647- 666)	BB/LCD

Content beyond syllabus covered (if any): Nil

* Session duration: 50 mins

Sub. Code / Sub. Name: **BT22401/Analytical Techniques and Instrumentation**

Unit : V

UNIT – V ELECTROPHORESIS AND SURFACE MICROSCOPE **9**

Introduction to electrophoresis, Types of electrophoresis, Agarose gel electrophoresis, Polyacrylamide gel electrophoresis, Study of surfaces, Scanning probe microscopes, AFM and STM.

Objective: To gain the knowledge on separation of proteins, DNA using electrophoresis and structure determination of molecules through surface microscopy.

Session No *	Topics to be covered	Ref	Teaching Aids
37.	Principle aspects and applications of electrophoresis	R1(214-231), R3	BB/LCD
38.	Principle aspects and applications of electrophoresis	R1(214-231), R3	BB/LCD
39.	Types of electrophoresis: continuous and discontinuous electrophoresis with examples	R1(214-231), R3	BB/LCD
40.	Theory, instrumentation structure and applications Agarose gel electrophoresis	R1(214-231), R3	BB/LCD
41.	Theory, instrumentation structure and applications Polyacrylamide gel electrophoresis	R1(214-231), R3	BB/LCD /Video Lecture
42.	Study of surfaces through electron simulated analysis methods	T2 (666)	BB/LCD
43.	Principle aspects and applications of Scanning probe microscopes	T2 (667-674)	BB/LCD
44.	Principle aspects and applications of Atomic force microscope	T1(675- 726)	BB/LCD
45.	Principle aspects and applications of scanning tunneling microscope	T1 (675-726)	BB/LCD
Content beyond syllabus covered (if any): Nil			

* Session duration: 50 mins

TEXTBOOKS:

1. Skoog, D.A, James H. F and Stanly R. C, "Principles of Instrumental Analysis", 7th Edition, Cengage Learning, 2017.
2. Willard H. H, "Instrumental Methods of Analysis", 7th Edition, CBS, 2012.
3. Braun R. D, "Introduction to Instrumental Analysis", 2nd Edition Pharma Book Syndicate, 2012.
4. Ewing G.W, "Instrumental Methods of Chemical Analysis", 5th Edition, McGraw, Hill, 2013.

REFERENCE BOOKS:

1. Sharma, B.K, "Instrumental Methods of Chemical Analysis: Analytical Chemistry", Goel Publishing House, 1972.
2. Haven Mary C. Laboratory Instrumentation. 4th Edition, John Wiley & Sons, 2017.
3. Hert DG, Fredlake CP, Barron AE. Advantages and limitations of next-generation sequencing technologies: a comparison of electrophoresis and non-electrophoresis methods. Electrophoresis. 2008 Dec;29(23):4618-26.

	Prepared by	Approved by
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Designation	Assistant Professor, Biotechnology	HOD
Date	18-01-2024	18-01-2024
Remarks: Nil		
Remarks: Nil		

18/1/24

*If the same lab plan is followed in the subsequent semester/year it should be mentioned and signed by the Faculty and the HOD