Q. Code:668749

Reg. No. | | | | | | | | | | | | | |

B.E. / B.TECH. DEGREE EXAMINATIONS, MAY 2024

Fourth Semester

BT22401 – ANALYTICAL TECHNIQUES AND INSTRUMENTATION

(Biotechnology)

(Regulation 2022)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Learn the working principle and application of spectroscopic methods used for biological products	**2**
CO 2	Compare and study the principles and applications of mass spectrometry, nuclear magnetic and electron resonance spectroscopic techniques for various biological applications.	**3**
CO 3	Perceive with chromatographic techniques used in various industries such as Biotech/Biopharma/Food/ Etc.,	**3**
CO 4	Interpret the advanced microscopic methods for characterizing the biomolecules/ bioproducts	**3**
CO 5	Separate the biomolecules using electrophoresis	**2**

PART- A (20 x 2 = 40 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Specify the basic components of optical instruments used in spectroscopy.	**1**	**2**
2.	Define absorbance and Transmittance.	**1**	**2**
3.	Specify the major design requirements of monochromators.	**1**	**2**
4.	Outline the principle of monochromators in studying the spectral properties of materials.	**1**	**3**
5.	Brief about the sample preparation in the IR spectrophotometers for solid Samples.	**2**	**2**
6.	Distinguish between fluorescence and phosphorescence.	**2**	**3**
7.	Write the Beer's law and discuss the reasons for derivation of Beer's law.	**2**	**3**
8.	Mention two applications of Raman spectroscopy in materials analysis.	**2**	**2**

9.	List the experimental considerations when using NMR spectrometers.	**3**	**2**
10.	Why do we go for a solid-state detector instead of a scintillation detector?	**3**	**3**
11.	Explain the dead time in the GM counter.	**3**	**2**
12.	Deduce the relationship between mass and charge in mass spectrometry.	**3**	**3**
13.	How affinity chromatography is employed in protein purification?	**4**	**3**
14.	State the role of the elution buffer in ion exchange chromatography.	**4**	**3**
15.	Define Rf and Rm values with their significance.	**4**	**2**
16.	What are the requirements for pumping system in HPLC?	**4**	**3**
17.	Write down the applications of gel electrophoresis in molecular biology.	**5**	**2**
18.	Explain the mechanism of gel electrophoresis/Zone Electrophoresis.	**5**	**2**
19.	Differentiate between agarose gel electrophoresis and polyacrylamide gel electrophoresis.	**5**	**3**
20.	Contrast the surface properties of materials using AFM and STM.	**5**	**3**

PART- B (5 x 10 = 50 Marks)

		Marks	CO	RBT LEVEL
21. (a)	Explain the electromagnetic spectrum and indicate various Biotechnological instruments that are operated in the determination of iron content present in the drinking water.	**(10)**	**1**	**2**
	(OR)			
(b)	Describe the working principle of instruments highlighting how signal-to-noise is enhanced. Explain any two instrumental methods for the same.	**(10)**	**1**	**2**
22. (a)	Explain the instrumentation of UV-visible spectrophotometer with a neat block diagram.	**(10)**	**2**	**3**
	(OR)			
(b)	Write in brief about the fundamental modes of vibrations in polyatomic molecules and list the various detectors used in IR Spectroscopy.	**(10)**	**2**	**3**
23. (a)	Describe the fundamental principles of NMR spectroscopy and explain how	**(10)**	**3**	**3**

	the interaction of nuclei with an external magnetic field and radiofrequency pulses leads to the acquisition of NMR spectra.			
	(OR)			
(b)	Explain the principle, mechanism, and working of Mass spectrometry and briefly explain the flame ionization detector working principle.	**(10)**	**3**	**3**
24. (a)	Discuss the principles of high-performance liquid chromatography and compare its advantages over traditional liquid chromatography.	**(10)**	**4**	**3**
	(OR)			
(b)	With a neat diagram explain the various stages of gas chromatography and label the main instruments.	**(10)**	**4**	**3**
25. (a)	Explain the principles of PAGE electrophoresis and its advantages in resolving proteins based on size and charge.	**(10)**	**5**	**2**
	(OR)			
(b)	Explain the principles and operation of Atomic Force Microscopy.	**(10)**	**5**	**2**

PART- C (1 x 10 = 10 Marks)

(Q.No.26 is compulsory)

		Marks	CO	RBT LEVEL
26.	Explain the technique that would be most useful to identify and quantify the presence of a known impurity in a drug substance.	**(10)**	**3**	**3**

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