U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

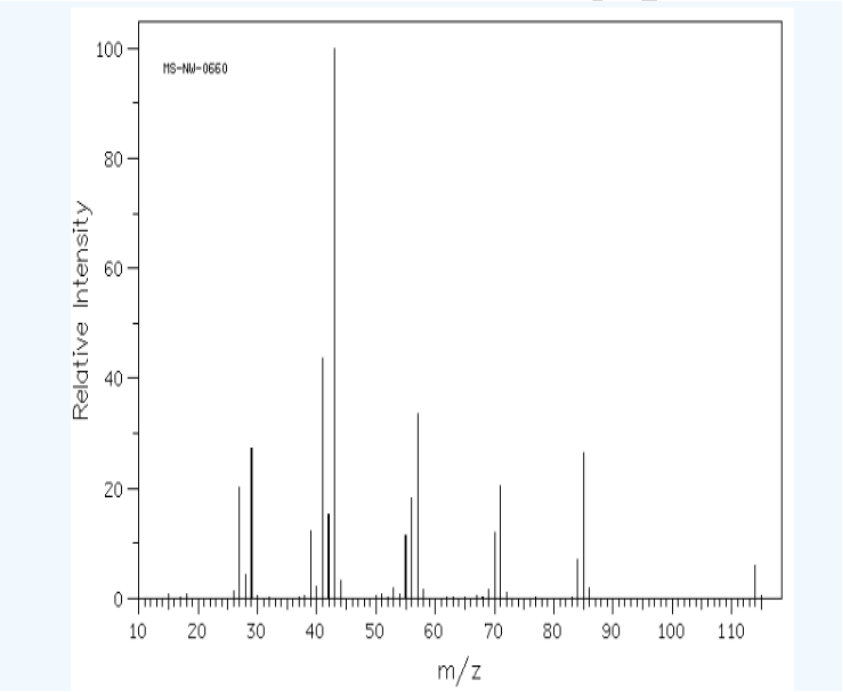
Autonomous Institute Affiliated to VTU

September / October 2024 Supplementary Examinations

Programme: B.E. **Semester: V**
Branch: Biotechnology **Duration: 3 hrs.**
Course Code: 22BT5PCBAT **Max Marks: 100**
Course: Bioanalytical Techniques

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

		UNIT - I	CO	PO	Marks
1	a)	i. A chromatography column with a length of 10.3 cm and an inner diameter of 4.61 mm is packed with a stationary phase that occupies 61.0% of the volume. If the volume flow rate is 1.13 mL/min, find the linear flow rate in cm/min. ii. How long does it take for solvent (which is the same as unretained solute) to pass through the column? iii. Find the retention time for a solute with a retention factor of 10.0	*CO 1*	*PO 1,5*	**10**
	b)	Explain the principle and applications of different types of column chromatography.	*CO 1*	*PO 1,5*	**10**
		UNIT - II			
2	a)	When isoelectric focusing is combined with gel electrophoresis it is called 2D- electrophoresis. Please compare/contrast it with regular SDS-PAGE by answering the following questions: i. How is 2D electrophoresis different from conventional SDS-PAGE? ii. Can you make a prediction about the amino acid composition present in a protein based on 2-D electrophoresis? iii. Can the same prediction be made using a conventional SDS-PAGE? Why?	*CO 2*	*PO 1,5*	**6**
	b)	A scientist instructs his students to conduct 3 experiments i. To isolate total RNA for northern blotting to assess the level of transcripts of interest. ii. To resolve the protein isolated from *E coli* to detect the over expressed protein iii. To understand the interaction of DNA and Protein through Gel retardation assay. With appropriate reasons, Identify the gels that are used to conduct the 3 three experiments,	*CO 2*	*PO 1,5*	**6**

		c)	Elucidate the principle of Pulse Gel Electrophoresis and add a note on its applications.	*CO 2*	*PO 1,5*	**8**
			UNIT - III			
	3	a)	A 1.000 g sample of octane (C8H18) is burned in a bomb calorimeter containing 1200 grams of water at an initial temperature of 25.00ºC. After the reaction, the final temperature of the water is 33.20ºC. The heat capacity of the calorimeter (also known as the "calorimeter constant") is 837 J/ºC. The specific heat of water is 4.184 J/g ºC. Calculate the heat of combustion of octane in kJ/mol.Explain the principle and working of this technique.	*CO 3*	*PO 1,5,12*	**10**
		b)	Comment on the intricacies of instrumentation and principle of preparative and analytical ultra centrifugation.	*CO 3*	*PO 1,5,12*	**10**
			OR			
	4	a)	The following figure shows the mass spectrum of a saturated hydrocarbon (containing only carbon and hydrogen with only single bonds between carbons, not double bonds).  i. Draw five different structures that would have the molecular weight of this compound. ii. Choose three smaller m/z values from the spectrum and draw one structure for each of them. Note that these fragments will not have complete Lewis structures.	*CO 3*	*PO 1,5,12*	**8**
		b)	Caffeine has a mass of 194.19 amu, determined by mass spectrometry, and contains C, N, H, O. What is a molecular formula for this molecule?	*CO 3*	*PO 1,5,12*	**4**
		c)	Explain the principle and applications of AFM and scanning tunneling microscopy.	*CO 3*	*PO 1,5,12*	**8**

			UNIT - IV			
	5	a)	For N 2 O the following spectroscopic data are available. Predict the nature of N_2O molecule $Wave\ number(cm^{-1})$ | *Infrared* | *Raman* 589 | *Active (PQR)* | *Inactive* 1285 | *Active (PR)* | *Active (Polarised)* 2224 | *Active (PR)* | *Active (depolarised)*	*CO 3*	*PO 1,5,12*	**4**
		b)	For acetone a normal mode of vibration that involves the stretching of the carbonyl band is active in both Raman infrared spectra. The Raman line associated with this normal mode is found at 547 nm when excited by incident light show wavelength is 500 nm. Calculate the wavelength of the centre of corresponding infrared absorption band. Explain the principle and working of this technique.	*CO 3*	*PO 1,5,12*	**10**
		c)	Write a note on single crystal diffraction	*CO 3*	*PO 1,5,12*	**6**
			OR			
	6	a)	What is chemical shift? How is it measured? What are the factors affecting the chemical shift?	*CO 4*	*PO 1,5,12*	**10**
		b)	Explain the principle and working of EPR. For what conditions can EPR be done ?	*CO 3*	*PO 1,5,12*	**10**
			UNIT - V			
	7	a)	Compare and contrast between GM and Scintillation Counter	*CO 3*	*PO 1,5,12*	**10**
		b)	Discuss the principle and applications of Autoradiography in life science research	*CO 3*	*PO 1,5,12*	**10**

****