


Name:	
Enrolment No:	

UPES
End Semester Examination, May 2024

Course: Instrumentation in Microbiology
Semester : 2nd
Program: MSc Microbiology
Duration : 3 Hours
Course Code: HSMB 7015 **Max. Marks: 100**

Instructions: Attempt all the questions

S. No.	Section A Short answer questions/ MCQ/T&F (20Qx1.5M= 30 Marks)	Marks	COs
Q1	Define mobile phase in the context of HPLC.	1.5	CO3
Q2	The HPLC column pressure can achieve a value upto 5000 psi. Is this statement true or false?	1.5	CO3
Q3	The dispersion type of FTIR is more preferable than the interferometric type. Is this statement true or false?	1.5	CO2
Q4	The phenomenon responsible for imaging specimen via electron microscopy is: a. Uncertainty principle b. Dual nature of matter c. de-Broglie theory d. Both (b)and (c)	1.5	CO1
Q5	The resolution of an optical microscope is given by: a. $(0.5\lambda)/n \sin\theta$ b. $\lambda/n \sin\theta$ c. $(1.5\lambda)/n \sin\theta$ d. None of the above	1.5	CO1
Q6	Which of the following is true for UV-VIS and FTIR spectroscopy?	1.5	CO2

	<p>a. both of them involve electronic transitions</p> <p>b. both of them involve rotational transitions</p> <p>c. UV-VIS involves vibrational transitions and FTIR involves rotational transitions</p> <p>d. UV-VIS involves electronic transitions and FTIR involves vibrational transitions</p>		
Q7	Which contrast agent is widely used in fluorescence microscopy?	1.5	CO1
Q8	A spectrophotometric detector cannot be used in a HPLC system. Is this statement true or false?	1.5	CO3
Q9	Illustrate the resolution of optical microscope, SEM and TEM.	1.5	CO1
Q10	The sharp peaks observed in XRD plot occurs due to high degree of X-ray diffraction from the crystal planes. Is this statement true or false?	1.5	CO2
Q11	The atoms in flame photometry undergo electronic excitation at the primary heating zone. Is this statement true or false?	1.5	CO2
Q12	Which of the following best describes Bragg's law of diffraction: <p>(a) $\lambda = d \sin\theta$</p> <p>(b) $\lambda = d \cos\theta$</p> <p>(c) $n\lambda = d \sin\theta$</p> <p>(d) $n\lambda = 2d \sin\theta$</p>	1.5	CO2
Q13	Apart from XRD, the d-spacing of crystals planes can be analyzed by TEM as well. Is this statement true or false?	1.5	CO1
Q14	In flame photometry, which phenomenon does the ultrasonic nebulizer work on?	1.5	CO2
Q15	In UV-Vis spectroscopy, what is the wavelength range emitted by a hydrogen discharge lamp?	1.5	CO2
Q16	The flow range in a HPLC pump is 0.01 – 10 mL/min. Is this statement true or false?	1.5	CO3
Q17	The electrochemical detectors in HPLC can identify the presence of a species within pg-ng range. Is this statement true or false?	1.5	CO3

Q18	If M_o is magnification of objective lens and M_e is the magnification of eyepiece, then the total magnification of an optical microscope is: (a) $M_o + M_e$ (b) $M_o - M_e$ (c) $M_o \times M_e$ (d) M_o/M_e	1.5	CO1
Q19	Mention one radiation source which can be used in FTIR spectroscopy.	1.5	CO2
Q20	A field emission electron gun is preferred for acquiring high resolution images in SEM.	1.5	CO1
Section B (4Qx5M=20 Marks)			
Q 1	What do you mean by resolution? If the numerical apertures of two microscopes are 0.12 and 0.87, which of them will have higher resolution? Justify your answer.	5	CO1
Q2	a. Describe Beer-Lambert's law. b. A solution of tryptophan exhibits peak absorbance of 0.54 at 280 nm in a 0.5 cm length cuvette. What is the concentration of the solution if absorbance coefficient is 6.4×10^3 L/Mol/cm?	5	CO1
Q3	Discuss why FTIR spectroscopy is termed as one of the tools to study "molecular fingerprint"?	5	CO2
Q4	Explain why X-rays are suitable for probing the crystal structure of a particular sample.	5	CO2
Section C (2Qx15M=30 Marks)			
Q 1	Examine how atomic absorption spectroscopy and flame photometry are different from each other for identifying the presence of trace metals in a sample.	15	CO2

Q2	(a) Explain how electrons can lead to the formation of microstructural image of a sample. (b) Discuss the working principle of scanning electron microscope with the help of a suitable diagram.	15	CO1
Section D (2Qx10M=20 Marks)			
Q 1	Discuss the various allowed as well as forbidden transitions in UV-VIS spectroscopy.	10	CO2
Q2	Explain the functioning of an HPLC instrument.	10	CO3