UPES
End Semester Examination, May 2025
Course: Instrumentation in Microbiology
Semester   : 6th
Program: Integrated BMSc Nutrition & Dietetics
Duration   : 3 Hours
Course Code: HSMB 3011O   **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 stationary phase in the context of HPLC.	1.5	CO3
Q2	The HPLC column can achieve a maximum pressure of 1000 psi. Is this statement true or false?	1.5	CO3
Q3	Define hyperchromic effect in UV-Vis spectroscopy.	1.5	CO2
Q4	The sample preparation in TEM requires the implementation of a plain mesh grid. Is this statement true or false?	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 not true for FTIR spectroscopy? a. functional groups in a specimen can be identified b. globar can be used as a radiation source c. windows used in sample cells are glass-based materials d. thermoelectric detectors are used for signal acquisition	1.5	CO2

Q7	SEM utilizes maximum of 50 keV electron beam energy. Is this statement true or false?	1.5	CO1
Q8	An electrochemical detector can 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 indicates the presence of a highly crystalline phase of a sample. Is this statement true or false?	1.5	CO2
Q11	The atoms in flame photometry undergo electronic excitation at the interconal zone. Is this statement true or false?	1.5	CO2
Q12	Which of the following best describes Beer-Lambert's law: (a) $A = \varepsilon/cb$ (b) $A = \varepsilon b/c$ (c) $A = \varepsilon cb$ (d) $A = 1/(\varepsilon cb)$	1.5	CO2
Q13	Focusing of electron beam in SEM and TEM is achieved by typical glass optics arrangement. Is this statement true or false?	1.5	CO1
Q14	State Scheibe-Lomakin equation in flame photometry analysis.	1.5	CO2
Q15	In FTIR spectroscopy, what is the wavelength range emitted by a Nernst glower?	1.5	CO2
Q16	The flow range in a HPLC pump is 10 – 50 mL/min. Is this statement true or false?	1.5	CO3
Q17	The fluorescence 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 Mo is magnification of objective lens and Me is the magnification of eyepiece, then the total magnification of an optical microscope is: (a) Mo + Me (b) Mo – Me (c) Mo x Me (d) Mo/Me	1.5	CO1

Q19	A discharge lamp can be employed as a radiation source in FTIR spectroscopy. Is this statement true or false?	1.5	CO2
Q20	The electron energy in TEM is less than that used in SEM. Is this statement true or false?	1.5	CO1

Section B
(4Qx5M=20 Marks)

Q 1	Examine how the resolution of optical microscope is significantly affected by the numerical aperture and not by the magnification.	5	CO1
Q2	a. Describe Beer-Lambert's law. b. A solution of tyrosine exhibits peak absorbance of 0.26 at 274 nm in a 1 cm length cuvette. Estimate the concentration of the solution if absorbance coefficient is 1400 L/Mol/cm?	5	CO1
Q3	Explain the working of a photomultiplier tube with the help of a suitable diagram.	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	Discuss the working principle of atomic absorption spectrophotometer with the help of a suitable diagram.	15	CO2
Q2	Explain why TEM yields detailed microstructural information of sample as compared to SEM.	15	CO1

Section D
(2Qx10M=20 Marks)

Q 1	Describe the various types of furnaces used in flame photometry.	10	CO2
Q2	Explain the functioning of an HPLC instrument.	10	CO3