Question Paper

Exam Date & Time: 07-Jan-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

SEVENTH SEMESTER B.TECH MAKE-UP EXAMINATIONS, JAN 2023

Biomaterial-characterization techniques [BME 4052]

Marks: 50 **Duration: 180 mins.**

A

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1)		Compare the mechanical properties of materials and predict the change in properties with the inclusion of crystal defects.	(4)
	A)		
	B)	Distinguish between the hardness of a material and the tensile strength of a material.	(3)
	C)	Drishti developed a core-shell nanostructure with silica forming the core and gold forming the shell. Drishti wants to confirm that the core-shell structure is only gold and silica. Choose an appropriate technique to characterize the core-shell structure and write in detail about the principle and working of your chosen method with suitable illustrations.	(3)
2)		Explain the use of FTIR spectroscopy to identify an organic compound. Write in detail the working of FTIR spectroscopy with a suitable example.	(4)
	A)		
	B)	Elaborate on the use of X-ray diffractometry to identify the crystallinity and size of biomaterial.	(2)
	C)	Dikshit wants to visualize a patterned surface with features of 0.5-1 nm. Suggest an imaging technique that Dikshit can utilize to visualize these features. Discuss the various parts and the working of the suggested instrument with suitable diagrams	(4)
3)		Compare the difference between UV-vis spectroscopy and FTIR spectroscopy. Explain the application of both techniques with a suitable example.	(4)
	A)		
	B)	Vineeth modified a surface with a polymer coating. Vineeth characterized the surface using contact angle measurement. The properties of the modified surface changed from hydrophobic to hydrophilic. Illustrate the contact angle of the surface before and after modification with the polymer.	(2)
	C)	A group of scientists is working on extracting a pharmaceutical compound from a plant extract. Propose a method that scientists can utilize to purify the sample. Write in detail about the purification method.	(4)
4)		Illustrate the autocorrelation trace for large (500 nm) and small particles (100 nm) and explain how the autocorrelation function helps in determining the hydrodynamic radius of a particle	(3)
	A)		
	B)	Elaborate on the role of differential scanning calorimetry (DSC) in determining the purity of a pharmaceutical compound with a suitable example.	(4)
	C)	Distinguish between thermogravimetric (TGA) and differential thermal analysis (DTA). Illustrate a sample TGA and DTA curve for a material.	(3)
5)		Compare the various ionization techniques used for ionization in Mass spectroscopy with illustrations.	(4)
	A)		

B)	Discuss elemental imaging and mapping using Secondary ion mass spectroscopy	(2)
C)	Elaborate on the parts of XPS instruments and their working.	(4)

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