Exam Date & Time: 23-May-2022 (10:00 AM - 01:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FIRST SEMESTER B.TECH END SEMESTER EXAMINATIONS, MAY 2022

INTRODUCTION TO NANOTECHNOLOGY AND CHARACTERIZATION TECHNIQUES [BME 4305]

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

A

Answer all the questions.

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

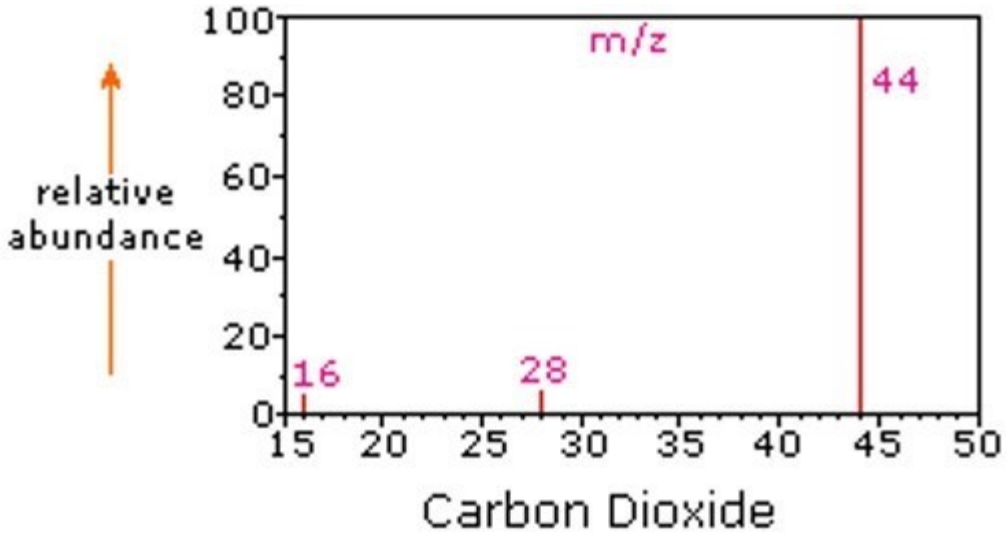
1)		You have prepared ZnO nanoparticles using Zinc nitrate and NaOH as reactants. Sample details are given below:	
	A)	Sample 1 :- contains ZnO nanoparticles with diameter 2 nm Sample 2 :- contains ZnO nanoparticles with diameter 5 nm Sample 3 :- contains ZnO nanoparticles with diameter 10 nm Which one of these samples will show maximum agglomeration of ZnO nanoparticles? Justify your answer with appropriate reasons	(2)
	B)	Instead of "shining yellowish colour", the gold nanoparticles prepared by Michael Faraday was having red colour. Discuss in detail the reason behind this color change.	(3)
	C)	Formulate a synthesis strategy to prepare ZnO/ZnS core/shell nanoparticles from La Mer's mechanism of nanoparticle growth	(5)
2)		Explain sonochemical method of nanoparticle synthesis	
	A)		(2)
	B)	Compare physical vapor deposition method (PVD) and chemical vapour deposition (CVD) for nanomaterial synthesis	(3)
	C)	Design "One-Microemulsion" nanomaterial synthesis method for the following reaction? $Zn(NO3)2 + 2NaOH$ à $ZnO + 2NaNO3 + H2O$ Zinc nitrate: - $Zn(NO3)2$, Sodium hydroxide: - NaOH, Sodium nitrate: - $2NaNO3$, Zinc oxide: - ZnO	(5)
3)		Describe the principle behind and operation modes of Scanning Tunnelling Microscopy	
	A)		(2)
	B)	Discuss the difference between absorption spectra and excitation spectra of a quantum dot	(3)
	C)	As a part of the Project work, a BTech student need to prepare Nano fiber mesh (cloth	(5)

like structure) of a polymer PVA (Poly(vinyl alcohol)). Student also need to embed gold nanoparticles inside each nano fiber. Propose a synthesis method and strategy for this objective.

4) Explain the principle of Surface enhanced Raman spectroscopy (2)

A)

B) Explain the working principle of mass spectroscopy and explain the mass spectra of CO_2.



(3)

C) You have 3 sets of gold nanoparticles dispersed in water (3 colloidal solutions of gold nanoparticles). Propose a characterization technique to find out the stability of the colloidal solution. Explain in detail the working principle of the characterization technique (5)

5) Explain the working principle of XPS spectroscope (2)

A)

B) The polymer composite should be stable for 2 hrs. minimum at 120oC for an aerospace application. Suggest an analysis method to study the thermal stability of the material. Explain the analysis method in detail (3)

C) Propose a characterization method to study the changes in the glass transition temperature of a polymer nanocomposite for different nanoparticle concentration. Explain the working principle of the instrument. (5)

-----End-----