Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – SUMMER 2022

Subject Code:3170509 Date:08/06/2022

Subject Name:Nanoscience and Technology

Time:02:30 PM TO 05:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

Q.1	**(a)**	Write down three unique features of a nanomaterial. What is the relationship between nanometer and micrometer?	**03**
	(b)	State advantages and disadvantages of top-down and bottom-up methods of synthesis of nanomaterials.	**04**
	(c)	Discuss the principle of lithographic process with schematic diagram. Can lithography be considered as a combination of top down and bottom up approach? Why?	**07**
Q.2	**(a)**	Why are the nanoparticles inherently unstable? How do they attain stability?	**03**
	(b)	State with examples surface chemistry and its effect on catalytic activities of nanomaterials.	**04**
	(c)	How do the concepts of quantum physics and chemistry help in understanding the unique physico-chemical behavior of material at nanoscale?	**07**
		OR	
	(c)	Discuss the role of nanomaterials in advances on catalysis.	**07**
Q.3	**(a)**	'The size of metallic colloids varies significantly with the type of reducing agents'- explain.	**03**
	(b)	State different stages of mechanism of nanocrystallite nanostructure formation during high energy ball milling. Name three materials used as MOC for vials and balls in a planetary ball mill.	**04**
	(c)	Explain the effect of nanometer length scale on diffusivity, melting point and solubility of materials.	**07**
		OR	
Q.3	**(a)**	State and explain various modes of nucleation in the deposition of thin film.	**03**
	(b)	Compare CVD and PVD methods of synthesis of nanomaterials.	**04**
	(c)	Explain various steps of chemical vapor deposition (CVD) process for synthesis of nanomaterials.	**07**
Q.4	**(a)**	Explain the principle of molecular self-assembly of synthesis of nanomaterials in brief.	**03**
	(b)	Discuss briefly the principle of Sol-gel method of synthesis of nanomaterials.	**04**
	(c)	Discuss the application of nanomaterials in drug delivery and diagnostics.	**07**
		OR	
Q.4	**(a)**	List out the major types of spectroscopy? Give examples for each.	**03**

	(b)	State and explain Stokes-Einstein relation in the context to dynamic light scattering (DLS) method for particle size distribution.	**04**
	(c)	Explain Beer-Lambert law in context with UV-VIS spectroscopy. State three important applications of UV-VIS spectroscopy.	**07**
Q.5	**(a)**	Explain the principle of Bragg's law for X-ray diffraction analysis.	**03**
	(b)	Explain the principle of FTIR analysis. Which type of spectral information can be obtained from FTIR analysis?	**04**
	(c)	Compare and contrast the salient features of scanning electron microscopy and transmission electron microscopy.	**07**

OR

Q.5	**(a)**	What is EDS analysis? State its application.	**03**
	(b)	Explain photocatalysis using nanomaterials photocatalysts such as titanium oxide for water purification.	**04**
	(c)	Discuss any one method of the synthesis of carbon nanotubes (CNT). Write down important applications of CNT.	**07**

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