Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2023

Subject Code:3170509 Date:08-12-2023

Subject Name: Nanoscience and Technology

Time: 10:30 AM TO 01:00 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.**

			MARKS
Q.1	**(a)**	Write down three unique features of a nanomaterial. What is the relationship between nanometer and micrometer?	**03**
	(b)	Compare and contrast the features of top-down and bottom-up approaches of synthesis of nanomaterials.	**04**
	(c)	Explain the effect of nanometer length scale on diffusivity, melting point and solubility of materials.	**07**
Q.2	**(a)**	Discuss steps of Nano-lithography.	**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 inert gas evaporation technique.	**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.	**04**
	(c)	Describe spray pyrolysis method for synthesis of ceramic nanopowder.	**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 the principle of lithographic process with schematic diagram. State the advantages and disadvantages of this process.	**07**
Q.4	**(a)**	Explain the principle of molecular self-assembly of synthesis of nanomaterials in brief.	**03**
	(b)	Discuss application of Nano oxide as protective coatings.	**04**
	(c)	Discuss the application of nanomaterials in drug delivery and diagnostics.	**07**
		OR	
Q.4	**(a)**	Show various types of structure of Carbon nano-tubes.	**03**
	(b)	State and explain Stokes-Einstein relation in the context to dynamic light scattering (DLS) method for particle size distribution.	**04**
	(c)	Discuss the differences between scanning electron microscopy (SEM) and transmission electron microscopy (TEM)	**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)	Discuss any one method of the synthesis of carbon nanotubes (CNT). Write down important applications of CNT.	**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 application of nanoscience and technology in dyes and coating industries.	**07**

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