

B.E. CHEMICAL ENGINEERING FOURTH YEAR FIRST SEMESTER - 2025**INTRODUCTION TO NANO-SCIENCE & ENGINEERING**

Time: 3 Hours

Full Marks: 100

*Answer Question No 1 and Any Four questions from rest**Clearly mention all the assumptions**Clearly mention your roll number on the answer script as well on the graphs*

Q. No 1		Q. No 2	Q. No 3	Q. No 4	Q. No 5	Q. No 6	Q. No 7
CO 1	4	10					10
CO2	4			10		10	10
CO3	4	10	10				
CO4	4		10		10	10	
CO 5	4			10	10		

1. a) Write about the significance of specific surface area of nanomaterials.
- b) How does size change affect the optical properties of NPs?
- c) Explain 0D, 1D, 2D and 3D nanomaterials.
- d) Describe Plasma deposition of ultra -thin functional films on nano materials.
- e) Explain the advantages of nanosensing.
- f) Explain use of XRD for nanomaterial characterisation.
- g) How the wavelength is related with resolution of microscopy
- h) Mention the function of positive and negative photoresist in lithography.
- i) Write the difference of thin film deposition and sputtering
- j) Explain the homogeneous and heterogeneous CVD technique.

2×10=20

2. a) Mention the differences of nanomaterial and nanostructured material.
 - b) Explain Chemical Vapor Deposition process of Carbon Nanotubes synthesis.
- 10+10**
3. a) Discuss the types of template based sol-gel method of nanomaterials synthesis.

[Turn over

b) Illustrate top down and bottom up approach of graphene synthesis.

10+10=20

4. a) Mention the working principle, imaging method of TEM analysis.

b) Discuss the differentiating features of SEM and AFM analysis of nanomaterial characterisation.

10+10=20

5. a) Present a clear schematics of graphene, graphene oxide, reduced graphene oxide with functional features.

b) Mention structural characteristic of quantum dot, working principle and application pattern.

10+10=20

6. a) Describe the working principle of ball mill for nanoparticle synthesis. Mention the parameters for ball mill efficiency optimisation.

b) Calculate the operating speed of a ball mill with dia of the ball mill 1800mm, and dia of ball 60mm and critical speed 40% less than the operating speed.

10+10=20

7. a) Compare the efficiency of X-Ray Lithography and Ion Lithography.

b) Mention the application and working principle of Molecular Beam Epitaxy technique.

10+10=20