

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.
3. a) Discuss the types of template based sol-gel method of nanomaterials synthesis.

10+10

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