

Total No. of printed pages = 3

63/2 (SEM-1) PHY 106 (OE)

2021

(held in 2022)

PHYSICS

(Theory Paper)

Paper Code : PHY-106 OE)

(Nanostructures)

Full Marks – 50

Time – Two hours

The figures in the margin indicate full marks for the questions.

1. Answer the following questions : 1×5=5
- (a) Why is thin film technology important ? 1
 - (b) Why vacuum is important in evaporation technique ? 1
 - (c) What are the parameters that affect the size of the nanomaterial in ball milling process ? 1
 - (d) What are microporous and macroporous materials ? 1
 - (e) Write Scherrer's formula for estimation of crystallite size. 1

[Turn over

2. Answer the following questions : $2 \times 5 = 10$

- (a) What are top-down and bottom-up approaches for the preparation of nanomaterials ? Mention at least two techniques for both the approach. 2
- (b) Explain how the grain size can be controlled in electron beam evaporation technique. 2
- (c) What is the significance of soft backing in photolithography ? 2
- (d) How many pentagons or hexagon structures are there in fullerene ? Mention two properties of C_{60} molecule. $1+1=2$
- (e) What is dislocation density in crystalline solids ? Give Williamson and Smallman's formula for estimation of dislocation density. 2

3. Answer any seven of the following : $5 \times 7 = 35$

- (a) Write down the working principle of thermal evaporation method for deposition of thin film with proper diagram. Mention its advantages and disadvantages. $3+2=5$
- (b) Explain the photolithography process. Write at least four major limitations of photolithography. $3+2=5$

(c) Discuss the hydrothermal method for synthesis of nanomaterial. Write its advantages and disadvantages. $3+2=5$

(d) What are different types of core shell ? Explain in details. 5

(e) Write notes on zeolites materials. Give some applications of zeolite materials. $3+2=5$

(f) What are Carbon Nanotubes ? Explain their properties. $1+4=5$

(g) What are quantum wire and quantum dot ? Write notes on quantum confinement effect. $2+3=5$