

Reg. No.:

Name:



W7188

University of Kerala

Third Semester FYUGP Degree Examination, November 2025

Discipline Specific Elective

PHYSICS

UK3DSEPHY202 - Basics of Nanoscience and Nanotechnology

Academic Level: 200-299

2024 Admission

Time: 2 Hours(120 Mins)

Max. Marks: 56

Part A.6 Marks:Time 5 Minutes.(Cognitive Level :Remember(RE)/Understand(UN)) Objective Type.1 mark each,
Answer all questions

Qn No.	Question	CL	CO
1	Define ionic bonding.	RE	1
2	Name two good conductors and poor conductors of electricity.	RE	4
3	Explain how attractive and repulsive forces vary with interatomic separation.	UN	1
4	Compare the atomic packing factors of FCC, BCC, and HCP structures.	UN	2
5	Explain the primary reason for the enhanced properties of nanomaterials over their bulk counterparts	UN	4
6	The chemical reactivity of a cluster depends mainly on — Options : A)Number of atoms B) Shape C) Surface area D)All of these	UN	5

Part B.10 Marks.Time:20 Minutes (Cognitive Level:Understand(UN)/Apply(AP))Two-three sentences.2 marks each.Answer all questions

Qn No.	Question	CL	CO
7	Outline the difference between FCC and HCP structures.	UN	2
8	Describe the three primary types of interatomic bonds	UN	1
9	Sketch various possible electron band structures in solids at 0k.	AP	4
10	Demonstrate how the electron mobility affects the electrical conductivity of a semiconductor	AP	4

Qn No.	Question	CL	CO
11	Demonstrate the relationship between atomic bonding strength and elastic properties in nanomaterials.	AP	5

Part C.16 Marks. Time: 35 Minutes. (Cognitive Level : Apply (AP) / Analyse (AN)) Short Answer. 4 marks each, Answer all 4 questions, choosing among options * within each question

Qn No.	Question	CL	CO
12	A) Find an expression for the volume of a hexagonal close-packed (HCP) unit cell in terms of its lattice constants a and c. OR B) Solve for the Atomic Packing Factor (APF) of the Body-Centered Cubic (BCC) crystal structure. Briefly demonstrate the steps taken to arrive at the final value	AP	2, 2
13	A) Derive the mathematical expression that relates the lattice parameter a to the atomic radius R for an FCC unit cell. OR B) A plane makes intercepts of 1, 2 and $0.5\text{\AA}$ of the crystalline axes of an orthorhombic crystal with $a:b:c=3:2:1$. Determine the miller indices of the plane.	AP	3, 3
14	A) Analyze the reasons behind the stability of clusters with different number of atoms and examine the concept of magic numbers. OR B) Analyse the interaction of light with solids and hence differentiate transparent and translucent materials	AN	4, 3
15	A) Investigate how the formation of excitons affects the optical absorption and emission properties of semiconductors OR B) Determine atomic packing factors of FCC, BCC.	AN	5, 1

Qn No.	Question	CL	CO

Part D.24 Marks. Time: 60 Minutes. (Cognitive Level :Analyse(AN)/Evaluate(EV)/Create(CR)) Long Answer 6 Marks each. Answer all 4 questions choosing among options * within each question

Qn No.	Question	CL	CO
16	A) "Nature is the best nanotechnologist." — Examine the statement with suitable examples. OR B) Analyse how light changes direction when it passes from air into water. Explain why refraction happens and how it depends on the refractive index of the two media.	AN	4, 4
17	A) Evaluate how the optical properties of non metals are modified with size reduction to nano dimensions. OR B) Validate the electrical conduction in solids in terms of the band theory and atomic bonding models.	EV	4, 4
18	A) Justify the importance of carbon nanostructures in modern nanotechnology. OR B) Evaluate how particle size affects various physical properties of nanomaterials	EV	5, 5
19	A) Design an experiment to distinguish between a conductor and a semiconductor using a battery, rheostat, ammeter, voltmeter and a heating arrangement. OR B) 1. Construct a neat diagram showing the generation of electron-hole pairs in an intrinsic semiconductor and explain it. 2. Formulate a simple method to improve the conductivity of an intrinsic semiconductor without doping.	CR	4, 4