

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION MO2022)

CLASS: IMSc
BRANCH: PHYSICS

SEMESTER : V
SESSION : MO/2022

SUBJECT: PH306 MATERIALS SCIENCE AND NANOTECHNOLOGY
TIME: 03 Hours FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates
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- Q.1(a) Define lattice point and space lattice. [2]
Q.1(b) Calculate the number of atoms/m³ for diamond. Also, calculate the density of the diamond. (Given the cube edge of the diamond 0.356 nm; the Molar mass of the diamond 12.01 kg/kmol) [3]
Q.1(c) Calculate the atomic packing fraction of the hexagonal close-packed structure. [5]
- Q.2(a) What is plastic deformation? [2]
Q.2(b) Discuss the role of dislocation in plastic deformation. [3]
Q.2(c) What is hardening? Discuss the different types of hardening mechanisms. [5]
- Q.3(a) What are ceramics? [2]
Q.3(b) Explain refractory ceramics in detail. [3]
Q.3(c) Discuss AX, A_mX_p and A_mB_nX_p types of ceramics structure. [5]
- Q.4(a) Classify the polymers on the basis of their structure. [2]
Q.4(b) Write down the important characteristics and applications of two commercial elastomers. [3]
Q.4(c) Explain fibre-reinforced composites. Discuss the effect of fibre length on the mechanical properties of the composites. [5]
- Q.5(a) What do you understand by quantum well structure? [2]
Q.5(b) Explain how the mechanical properties of the nanomaterials are affected by the size. [3]
Q.5(c) What are top-down and bottom-up approaches for the synthesis of nanomaterials? Discuss the photolithography technique for the growth of the nanostructure. [5]

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