Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 20690

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Sixth/Seventh/Eighth Semester

Aeronautical Engineering

GE 8073 — FUNDAMENTALS OF NANO SCIENCE

(Common to : Aerospace Engineering/ Agriculture Engineering/ Automobile Engineering/ Biomedical Engineering/Civil Engineering/ Computer Science and Engineering/ Computer and Communication Engineering/ Electrical and Electronics Engineering/Electronics and Communication Engineering/Electronics and Instrumentation Engineering/Electronics and Telecommunication Engineering/ Environmental Engineering/ Geoinformatics Engineering/Industrial Engineering/ Industrial Engineering and Management/ Instrumentation and Control Engineering/Manufacturing Engineering/Marine Engineering/Material Science and Engineering/Mechanical Engineering/ Mechanical Engineering (Sandwich)/ Mechanical and Automation Engineering/Mechatronics Engineering/Medical Electronics/Petrochemical Engineering/ Production Engineering/ Robotics and Automation/ Bio Technology/Chemical Engineering/ Fashion Technology/ Food Technology/ Handloom and Textile Technology/Information Technology/ Petrochemical Technology/ Petroleum Engineering/ Pharmaceutical Technology/Plastic Technology/ Polymer Technology/ Textile Chemistry/Textile Technology)

(Regulations 2017)

Time : Three hours — Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. How does particle size affect the surface area?

2. Discuss the information storage applications of nanostructured magnetic materials.

3. Distinguish the top-down and bottom-up approaches for the synthesis of nanomaterials with examples.

4. Sputtering is better than vapor phase deposition. Justify.

5. Describe the functionalization of nano clays.

6. What are the characteristics of Nanophotocatalyst used for visible light active dye degradation.

7. While analysing graphene oxide, the interplanar distance between the layers is found to be 1.4 Å, Calculate the wavelength of the second order diffracted line which has a glancing angle of 45?

8. Why electrons are used in electron micrscopy? What is the resolution achieved here?

9. Explain the antibacterial activity of silver nanoparticles?

10. How do nanomaterials amplify the biosensors signal?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Classify the nanomaterials depending on the number of dimensions.

(ii) How does the optical properties of nano materials differ from their bulk materials? (5+8)

Or

(b) (i) Explain the applications of nanomaterials in biological engineering.

(ii) How quantum confinement of zero- dimensional nanomaterials is useful for the fabrication of optical devices? (5+8)

12. (a) (i) Explain the principle involved in nanoparticle synthesis by vapour phase deposition method?

(ii) Discuss the high energy ball milling in detail with a few merits of the method. (6+7)

Or

(b) Discuss the nanomaterials growth by molecular beam epitaxy with a neat sketch and also highlight the merits and demerits of the technique. (8+5)

13. (a) Explain the Arc discharge growth of carbon nanotubes along with growth modes of CNT in the presence of Metal catalyst. How do diameter and dopant affect the electrical properties of carbon nanotubes? (7+6)

Or

(b) Discuss the mechanism and growth involved in the preparation of graphene by CVD method? (15)

14. (a) Derive Bragg's law and how XRD is useful to identify the crystal phases. (6+7)

Or

(b) (i) Explain the principle of selected area electron diffraction technique in TEM analysis.

(ii) Interatomic attraction forces play a vital role during the image recording by atomic force microscopy. Justify the comment. (6+7)

15. (a) How the introduction of nanomaterials-based electronic devices lead to revolutionary advances in technology. How MEMS are different from NEMS? (6+7)

Or

(b) Low volume and high surface area of nanoparticles is advantageous for the fabrication of recording tapes. Justify the statement with examples. Explain the applications of nanoparticles for targeted drug delivery by chemotherapy? (8+5)

PART C — (1 × 15 = 15 marks)

16. (a) (i) How quantum dots are different from nanoparticles and explain the quantum confinement effect on the optical properties of CdS? (5+10)

(ii) Explain the principle of sputtering and what type of sputtering you would use for nonconducting and conducting samples.

Or

(b) (i) How does accelerating voltage and working distance affect the image quality while analysing a non-conducting sample using a scanning electron microscope?

(ii) Discuss the role of nanomaterials in electronics fabrications and how 'molecular switch' functions?

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