

2017

OPTION—D

Paper : 60440

(MATERIAL SCIENCE AND NANOMATERIALS)

1. What are engineering materials? How are they classified? Explain. 2+4
2. What are semiconductors? Why are they so important as engineering material? Discuss with example an important area of application of semiconducting materials. 1+1+4
3. (a) What are biomaterials? What are their advantages and disadvantages as engineering material? Mention one important application of biomaterial. 1+4+1

Or

- (b) Compare biomaterial with inorganic and organic engineering materials with reference to their abilities and limitations as engineering material. 6
4. What are the advantages that a composite material can possess? Give an example of a potential composite material discussing its applications. 3+3
5. What is a quantum dot? What is band gap engineering associated to a quantum dot? 1+1

6. What are nanostructured materials (NSMs)? Why do they show significantly different behaviour in comparison to their bulk counterpart? 2+3

7. (a) What is the major consequence of confining an electron in a quantum dot? How is the behaviour of an electron under this confinement is different from a free electron? 3+2

Or

(b) What are carbon nanotubes (CNTs)? Why are they so important now-a-days as engineering material? Explain with examples. 2+3

8. What is sol-gel technique? Why is it so called? Discuss the advantages and disadvantages associated with the preparation of nanostructured materials (NSMs) by this method. 1+2+3

9. (a) Discuss the plasma arcing method for the fabrication of nanostructured materials (NSMs) 4

Or

(b) What is chemical bath deposition technique? Explain in brief the production of nanostructured materials (NSMs) by this method. 4

10. What do you understand by top-down and bottom-up approach of production of nanostructured materials? 2
11. What is Bragg's law of X-ray diffraction? Why is it not possible to use visible light for crystal structure determination? 2+2
12. (a) What is the basic principle of Scanning Electron Microscope (SEM)? What are the interactions that the incident electron encounters in an SEM image recording? Mention one important advantage of this characterization technique. 3+2+1
- Or*
- (b) How Transmission Electron Microscope (TEM) is different from SEM? Why is the typical energy for incident electrons in usual TEM analysis? Explain its basic principle. 2+1+3
13. Explain why nanostructured materials (NSMs) are better catalysts in comparison to their bulk counterparts. 2