

11. (a) What are the steps involved in design and fabrication of nanosystem? Explain with a neat sketch. (13)

Or

(b) Explain the working principle and applications of a typical nanosystem with an example. (13)

12. (a) Discuss in detail about the principle and applications of ion implantation method with a neat sketch. (13)

Or

- (b) Extrapolate the working principle and capabilities of physical vapour deposition technique with a neat sketch. (13)
13. (a) Describe the principle of electron beam and ion beam lithography techniques with a neat sketch. (13)

Or

- (b) How focused ion beam is helpful in nanoimprinting of structures? Describe in detail with a neat sketch. (13)
14. (a) Explain the effect of nanoscale dimensions on physical and mechanical properties of a material with an example. (13)

Or

- (b) Explain in detail about solid carbon based production techniques for synthesis of carbon nanotubes with a neat sketch. (13)
15. (a) What is the principle transmission electron microscopy? Explain the construction and capabilities with a neat sketch. (13)

Or

- (b) How scanning electron microscope is useful in characterization of nanomaterials? Explain the procedure involved in it with a flowchart. (13)

PART C — (1 × 15 = 15 marks)

16. (a) In a machine tool industry, tungsten carbide cutting tool undergoes frequent failure due to crater wear while machining of carbon steel work material. It is observed that failure due to work and tool material interaction and all other process variables are within the control. In this scenario, as an Engineer provide answer to the following:

- (i) What may be the reason for the failure of tool due to crater wear?
(ii) Write down the methods by which the problem can be resolved.
(iii) Discuss the steps involved in it. (15)

Or

- (b) A typical R & D company is interested in characterization of nanocomposite materials for aerospace application. In this situation, As an Engineer provide decision support in the following aspects:

- (i) Identification of various characterization techniques and their capabilities.
(ii) Selection of suitable characterization techniques.
(iii) Preparation of specimen for characterization and exploring the steps involved in it. (15)