Reg. No. ☐☐☐☐☐☐☐☐

MSH 552

IV Semester M.Sc. Examination, Sept./Oct. 2022
MATERIALS SCIENCE
Solid State Engineering Materials – II

Time : 3 Hours   Max. Marks : 70

1. a) Draw the energy level diagrams to represent tunneling across MIS and SIS junctions. Show the I-V curves in each case and explain briefly.

   b) Obtain an expression for current density in a dc Josephson tunneling effect.   **(8+12)**

                   OR

2. a) Explain the different classes of thermotropic liquid crystals.

   b) Distinguish between 'micelle' and 'reverse micelle' in lyotropic liquid crystals.   **(12+8)**

3. a) Define 'fill factor' of a solar cell and obtain an expression for efficiency of a solar cell.

   b) Explain the factors affecting the efficiency of a solar cell.   **(8+12)**

                   OR

4. a) Explain the working principle of He-Ne laser.

   b) Explain how a three dimensional image of an object is generated by holography technique.   **(12+8)**

5. a) What is glass transition temperature ? How is it related to the rate of cooling as well as the viscosity of liquid phase being cooled ?

   b) Explain the term critical cooling rate for glass forming liquids. Illustrate with examples, how the critical cooling rates are related to the glass forming ability of materials.   **(10+10)**

                   OR

6. a) Describe the different types of optical fibers. Derive the relation between numerical aperture and relative refractive index change.

   b) The numerical aperture of an optical fiber is 0.39. If the difference in the refractive indices of the material of its core and cladding is 0.05, calculate the refractive index of core. **(16+4)**

7. Answer the following questions. **Each** question carries **two** marks : **(2×5=10)**

   a) Define a Cooper pair.

   b) What is Silsbee effect ?

   c) Heterojunction semiconductor lasers are widely used – Give reason.

   d) What is meant by liquid phase sintering of ceramics ?

   e) How do you characterize a metallic glass ?

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