ST. JOSEPH'S COLLEGE (AUTONOMOUS), BENGALURU-27
M.Sc. PHYSICS - IVSEMESTER
SEMESTER EXAMINATION: APRIL 2022
(Examination conducted in July 2022)
PHDE-0520 – MATERIAL SCIENCES (ELECTIVE)

Time- 2 ½ hrs   Max Marks-70

This question paper contains Two printed pages and Two parts

Part A
Answer any FIVE questions. Each question carries 10 marks

[5 x 10 = 50]

1. (a). With a suitable diagram, describe the Vander Pauw Method. Obtain the horizontal resistance and vertical resistance and resistivity.

    (b). Describe the Seebeck effect with a neat sketch.   [6+4]

2. (a). Compare the band model and bond model for the following system. (i). intrinsic silicon (pure semiconductor) and (ii). Extrinsic silicon (P and N type semiconductor).

    (b). Define shape memory effect. Explain with a neat sketch the principle and phase transformation (Austenite to Martensite) of Shape Memory Alloys.   [5+5]

3. (a). With a neat sketch, explain the working principle of solar cell.

    (b). With a suitable diagram, describe the structure of CdTe solar cells. Draw the crystal structure of CdTe system.   [4+6]

4. (a). Describe the various approaches to form $CuInGaSe_2$ absorber layer with a suitable diagram.

    (b). With a suitable diagram, compare the construction of giant magnetoresistance (GMR) and tunneling magneto resistance (TMR) device.   [5+5]

5. With a suitable diagram, describe the construction and working principle of Lithium-ion-battery.

6. (a). Explain the Fluorescence and phosphorescence mechanism with the help of Jablonski diagram.

    (b). Describe the working mechanism of organic light emitting diodes device with a neat sketch.   [5+5]

7. (a). Describe the Quantum Hall effect with a necessary sketch.

    (b). With a suitable sketch, describe the Mott model to explain Giant Magnetoresistance in ferromagnetic materials.   [5+5]

Part B

Answer any Four questions. Each question carries 5 marks

[4 x 5 = 20]

8. Display the phase diagram for iron-carbon alloys with the function of temperature.

9. With a suitable diagram describe the optical lithography process.

10. Explain the phenomenon of topological insulators and superconductors with necessary diagram

11. With a neat sketch, explain the RKKY interaction.

12. Explain the following process (i). Rapid Thermal Annealing and (ii). Selenization.

13. Using the given current-voltage curve (figure), determine the the following paramter (i). Maximum power point, (ii). Fill factor and (iii). Efficiency.