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AOI1302

Engineering Physics - I (101101)

P. Pages : 3

Time : Three Hours

Max. Marks : 80

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** sub-questions from each unit.
5. Assume suitable data wherever necessary and state the assumptions made.
6. Diagrams/ sketches should be given wherever necessary.
7. Use of non-programmable calculator is allowed.
8. Figures to the right indicate full marks.

UNIT - I

1. a) i) Draw the construction of solar cell ? Explain its principle. State its merits and demerits. 4
ii) Define : 4
 - 1) Nuclear fission.
 - 2) Nuclear fusion
 - 3) Nuclear chain reaction
 - 4) Nuclear reactor.
- b) i) Explain the power generation by wind energy. 4
ii) A group of four solar cells are connected in series, and such two groups are connected in parallel. Drawing this arrangement find output voltage and current at the output. [Given : Each solar cell provides 0.5 volt and current 50mA continuously]. 4
- c) i) Explain construction and working of biogas plant. 4

- ii) A nuclear reactor consumes 20.4 kg of V-235 in 1000 hrs of operation. Assuming that on an average 200 MeV of energy is released per fission of a single V - 235 molecules, determine the power developed by the reactor. 4

UNIT - II

2. a) What is Laser ? Explain the mechanism of production of Laser. 8
- b) i) State the applications of laser. 4
- ii) Calculate the refractive indices of the core and cladding material of a fiber. [Given : NA = 0.22, Relative refractive index difference $\Delta = 0.012$] 4
- c) i) State the advantages of optical fiber over mettalic cables. 4
- ii) A glass clad fiber is made with core glass of refractive index 1.5 and the cladding is doped to give a fractional index difference of 0.0005. Find:
 1) The cladding index.
 2) The critical internal reflection angle. 4

UNIT - III

3. a) Draw a neat labelled diagram of coolidge tube. Explain how x-rays are produced by it. State any four properties of x - ray. 8
- b) i) Define :
 1) Unit cell.
 2) Packing factor.
 3) Co-ordination number.
 4) Atomic radius. 4
- ii) A beam of x-ray of wavelength 1\AA strike a crystal at a glancing angle of 8.58° when the first order Bragg's reflection occurs. Calculate the glancing angle for the third order reflection. 4
- c) i) State important features of miller indices. 4
- ii) A crystal with body centered cubic structure having lattice constant of the unit cell is 3.04 AO. Calculate the radius of the crystal. 4

UNIT - IV

4. a) Define fermi level ? Derive the expression $E_F = \frac{E_V + E_L}{2}$. Show the position of fermi level in extrinsic semiconductor. 8
- b) i) What do you understand by : 4
- 1) Valence band
 - 2) Conduction band
 - 3) Forbidden gap.
- ii) The resistivity of a doped silicon crystal is 9.25×10^{-3} ohm-m and the hall coefficient is $3.84 \times 10^{-4} \text{ m}^3/\text{C}$. Assuming that the conduction is by single type of charge carriers, calculate the density and mobility of the carriers. 4
- c) i) Distinguish between intrinsic and extrinsic semiconductor. 4
- ii) The intrinsic carrier density at room temperature in Ge is $2.37 \times 10^{19} / \text{m}^3$. If the electron and hole mobilities are 0.38 and $0.18 \text{ m}^2 \text{V}^{-1} \text{s}^{-1}$ respectively calculate its resistivity. 4

UNIT - V

5. a) State Rayleigh's criterion of resolution ? Define resolving power of grating. Obtain an expression for resolving power of grating. 8
- b) i) Draw the neat labelled diagram of Michelson's interferometer. State engineering applications of interference. 4
- ii) A soap film of refractive index 1.33 is introduced normally in the path one of the interfering rays' in Michelson's interferometer. Which is illuminated by a light of wavelength 6600 \AA . If 45 fringes cross the field of view find the thickness of the film. 4
- c) i) What is polaroid ? Describe its construction and state its uses. 4
- ii) Calculate the angle between polarizer and analyzer so that intensity transmitted is 25% of the maximum intensity. 4
