Hall Ticket No | | | | | | | | | | | Question Paper Code: AHS008

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech II Semester End Examinations (Regular/Supplementary) - May, 2018

Regulation: IARE – R16

MODERN PHYSICS

Time: 3 Hours **(Common to AE | ME | CE)** **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Explain the terms
   i. Basis
   ii. Space lattice
   iii. Unit cell.
   For the Orthorhombic and Triclinic crystal systems, write the expression of lattice parameters along with example. **[7M]**

   (b) Describe in detail the structure of Diamond by calculating its
   i. Number of atoms per unit cell,
   ii. Lattice constant
   iii. Coordination number
   iv. Atomic packing factor **[7M]**

2. (a) What do you understand by Miller indices of a crystal plane and sketch the following planes in a simple cubic unit cell (010), (110) and (111). **[7M]**

   (b) For the hypothetical metal shown
   i. Identify the crystal system to which it belongs to

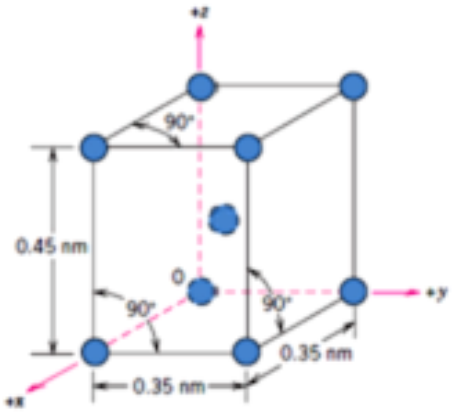

Figure 1

   ii. Calculate the density of the material given its atomic weight is 141 g/mol and lattice constant of 0.45 nano meters of a BCC crystal. **[7M]**

UNIT – II

3. (a) State why X rays are suitable for crystal diffraction. Derive Bragg's law for crystal diffraction. **[7M]**

   (b) List any three differences between Laue and Powder diffraction method. A beam of X rays is incident on a NaCl crystal with lattice spacing 0.282 nm. Calculate the wavelength of X rays if the first order Bragg's reflection takes place at a glancing angle of $8^0 35^|$. **[7M]**

4. (a) Explain in detail about edge and screw dislocations in crystals with a neat sketch. **[7M]**

   (b) In an X ray diffraction pattern for a powder crystal of Cr (BCC with lattice constant 0.2884nm) three diffraction peaks corresponding to (110), (200), (211) planes are observed. For the above planes compute interpalnar distance and diffraction angle. The wavelength of the X rays is 0.1542nm. **[7M]**

UNIT – III

5. (a) With necessary theory and energy level diagram explain the working of a RUBY LASER. **[7M]**

   (b) List different types of pumping mechanisms to achieve population inversion. The GaAsP diode LASER has peak emission at a wavelength of 1.55 μm. Calculate its energy gap in eV. **[7M]**

6. (a) What is a thermal sensor? Explain in detail any one thermal sensor with a neat diagram. **[7M]**

   (b) Explain any one application of optical sensor and acoustic sensor. **[7M]**

UNIT – IV

7. (a) Draw a schematic layout of step - index and graded - index optical fibre and compare them. **[7M]**

   (b) List any four applications of optical fibre. The cladding of a step - index fibre has a refractive index of 1.40. If the numerical aperture of the fibre is 0.25, calculate the refractive index of the core material. **[7M]**

8. (a) Explain various losses that usually occur in optical fibres. **[7M]**

   (b) Define acceptance angle. A glass fibre is made with core material whose refractive index is 1.5 and a cladding is doped to give a fractional index difference of 0.0005. Calculate the external critical acceptance angle and the numerical aperture. **[7M]**

UNIT – V

9. (a) Derive the equations for the diameter of bright and dark rings formed to interference in Newton's rings experiment. **[7M]**

   (b) Can two electric bulbs with point like filament of the same material each 15 W and lying close to each other produce interference? Two coherent sources produce interference fringes. Show that the maximum and minimum fringe width are same. **[7M]**

10. (a) Discuss the Phenomenon of Fraunhofer diffraction and derive the expression for intensity due to n-parallel slits. **[7M]**

    (b) List any three differences between interference and diffraction. Fraunhofer diffraction is obtained with a slit of width 0.25 mm with a monochromatic light. The angle at which first order band is formed at 0.1^0. Calculate the wavelength of the light used. **[7M]**

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