INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)

B.Tech I/II Semester Supplementary Examinations - July, 2017
Regulation: IARE – R16
MODERN PHYSICS
[Common for : II Semester (AE, ME and CE)]

Time: 3 Hours   **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) Illustrate FCC crystal structure. Distinguish between SC and BCC crystal structures. **[7M]**

   (b) Show that the maximum radius of the sphere that can just fit into the void at the body center of FCC structure coordinated by the facial atoms is 0.414 r where r is the radius of the atom.**[7M]**

2. (a) Derive an expression for the interplanar spacing between two adjacent planes of Miller indices (h k l) in a cubic lattice of edge length 'a'. **[7M]**

   (b) Explain the unit cell and bravias lattice with neat figures. Sketch the following plane in a cubic unit cell (1 1 2), (1 2 1), (1 0 1). **[7M]**

UNIT – II

3. (a) Describe with suitable diagram the powder method of determination of crystal structure. **[7M]**

   (b) A beam of X-rays of wavelength 0.071 nm is diffracted by (110) plane of rock salt with lattice constant of 0.28 nm. Find the glancing angle for the second order diffraction. **[7M]**

4. (a) What is Burger's vector? Distinguish between edge dislocation and screw dislocation. **[7M]**

   (b) What is the angle at which the third order reflection of X-rays of 0.79 A^0 wavelength can occur in a calcite crystal of $3.08 \times 10^{-8}\,cm$ spacing? **[7M]**

UNIT – III

5. (a) Explain the construction and working of a semiconductor diode laser. **[7M]**

   (b) Calculate the ratio of the stimulated emission rate to the spontaneous emissionrate for an incandescent lamp operating at a temperature of 1000K assuming the average operating wavelength to be $0.5\,\mu m$. **[7M]**

6. (a) Explain the three major engineering applications of laser. **[7M]**

   (b) What are principles of sensors. Find the ratio of population of two energy levels in a laser if the transition between them produces light of wavelength 694.3nm. Assume the ambient temperature to the 27^0C. **[7M]**

UNIT – IV

7. (a) What is the principle of optical fiber? Distinguish between Step index and graded index fibers.
   [7M]

   (b) Calculate the refractive indices of core and cladding materials of an optical fiber if its numerical aperture is 0.22 and relative refractive index difference is 0.012. **[7M]**

8. (a) What is attenuation? Explain the factors contributing to the fibers loss. **[7M]**

   (b) Define the terms **[7M]**
       i. refractive index of profile.
       ii. fractional index change.
       iii. angle of acceptance.
       iv. The refractive indices of core and cladding are 1.5 and 1.48 respectively in an optical fibre. Find the numerical aperture and angle of acceptance.

UNIT – V

9. (a) Explain interference in thin films and obtain conditions for bright band and dark band. **[7M]**

   (b) Newton's rings are observed in the reflected light of wavelength 5000 A^0. The diameter of the 10th dark ring is 0.5 cm. Find the radius of curvature of the lens used. **[7M]**

10. (a) Obtain an expression for the radius of the nth dark ring in case of Newton rings. **[7M]**

    (b) In a grating show that only first order is possible if the width of the grating element is less than twice the wavelength of light. **[7M]**

$- \circ \circ \bigcirc \circ \circ -$