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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

- Illustrate FCC crystal structure. Distinguish between SC and BCC crystal structures. [7M]
 - 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]
- 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]
 - 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

- Describe with suitable diagram the powder method of determination of crystal structure. [7M]
 - 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]
- What is Burger's vector? Distinguish between edge dislocation and screw dislocation. [7M]
 - What is the angle at which the third order reflection of X-rays of 0.79 \AA wavelength can occur in a calcite crystal of $3.08 \times 10^{-8} \text{ cm}$ spacing? [7M]

UNIT – III

- Explain the construction and working of a semiconductor diode laser. [7M]
 - Calculate the ratio of the stimulated emission rate to the spontaneous emission rate for an incandescent lamp operating at a temperature of 1000K assuming the average operating wavelength to be $0.5 \mu\text{m}$. [7M]
- Explain the three major engineering applications of laser. [7M]
 - 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 be 27°C . [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 \AA . The diameter of the 10^{th} 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 n^{th} 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]

