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**INSTITUTE OF AERONAUTICAL ENGINEERING****(Autonomous)**

B.Tech II Semester End Examinations (Regular) - May, 2017

**Regulation: IA-R16****MODERN PHYSICS**  
**(Common for AE/CE/ME)****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) Define coordination number and atomic packing factor. Calculate the atomic packing factor for SC and BCC structures. [7M]
- (b) Draw and explain the structure of diamond with a neat sketch and show that atomic packing factor of diamond is 0.34. [7M]
2. (a) How do you find Miller indices of a given plane? An X-ray beam of wavelength  $0.7 \text{ \AA}$  undergoes minimum order, Bragg reflection from the plane (3 0 2) of cubic crystal at glancing angle  $35^\circ$ . Calculate the lattice constant. [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) State and prove the Bragg's law. [7M]
- (b) Explain the Frenkel defect and Schottky defect with figures. [7M]
4. (a) Discuss the Laue equations with figure. [7M]
- (b) What are the major applications of X-ray techniques in different fields. [7M]

**UNIT – III**

5. (a) Explain the construction and working of a semiconductor diode laser. [7M]
- (b) Explain the two conditions for laser action. A ruby laser emits a pulse of 20ns duration with average power per pulse being 100 KW. If the numbers of photons in each pulse is  $6.98 \times 10^{-14}$ , calculate the wavelength of photons. [7M]
6. (a) Explain the working of a pressure sensor with a diagram. [7M]
- (b) What are active and passive sensors? What are the advantages of optical fiber sensors? [7M]

#### UNIT – IV

7. (a) What is acceptance angle? Obtain an expression for acceptance angle. [7M]  
(b) Calculate the numerical aperture and acceptance angle for an optical fiber with core and cladding refractive indices being 1.563 and 1.498 respectively. [7M]
8. (a) What is attenuation? Explain the factors contributing to the fibers loss. [7M]  
(b) Explain the modes of propagation of optical fibers with figure. A fiber with an input power of 9 dBm has a loss of 1.5 db/km. If the fiber is 3000 m long, what is the output power. [7M]

#### UNIT – V

9. (a) Obtain the expression for interference due to reflected light in thin films. [7M]  
(b) what is diffraction of light? A diffraction grating used at normal incidence gives a line ( $5400 \text{ \AA}$ ) in a certain order superposed on the violet line ( $4000 \text{ \AA}$ ) of the next higher order. If the angle of diffraction is  $30^\circ$ , how many lines per cm are there in the grating? [7M]
10. (a) Distinguish between interference and diffraction. In a Newton's rings experiment, show that the rings get closer as the order increases. [7M]  
(b) Calculate the thickness of the air film at  $10^{\text{th}}$  dark ring in a Newton's rings system viewed normally by a reflected light of wavelength 500 nm. The diameter of the  $10^{\text{th}}$  dark ring is 2 mm. [7M]