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Name.....

Reg. No.....

COMBINED FIRST AND SECOND SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2006

EN 04 103 A—ENGINEERING PHYSICS (A)

(2004 admissions)

[For AI, CS, EE, EC, IT, IC, BM, BT, PT]

Time : Three Hours

Maximum : 100 Marks

Answer **all** *the questions.*

Section A

I. 1 Compare LED and LCD.

2 What are the difference between direct band gap and indirect band gap semiconductors ?

3 Give the difference between interference and diffraction.

4 How do you determine the wavelength of light using diffraction grating ? Explain.

5 Give the construction and theory of quarter wave plate.

6 Explain briefly the optically active substance and specific rotation.

7 An electron is bound by a potential which closely approaches an infinite square well of width 2.5 Å Calculate the lowest three permissible quantum energies the electron can have.

8 Distinguish between Newtonian and quantum mechanics.

(8 × 5 = 40 marks)

Section B

II. (i) (a) Derive the expression for the fermi energy at any temperature for an *n*-type semiconductor. (10 marks)

(b) For an intrinsic semiconductor with the gap width E_g= 0.7 ev, calculate the concentration of intrinsic charge carriers at 300 K assuming that $m_e = m_0$ (rest mass of electron).

Or

(ii) (a) Explain what is meant by avalanche breakdown and zener breadown. (4 marks)

b) Explain the formation of energy bands in semiconductors and briefly explain how solids are classified on the basis of energy band gap. (11 marks)

III. (i) (a) Explain the formation of Newton's rings. Determine the wavelength of sodium light using Newton's rings experiment. (12 marks)

(b) A parallel beam of light ($\lambda = 5890 \times 10^{-8}$ cm) is incident on a thin glass plate ($\mu = 1.5$) such that the angle of refraction into the plate is 60°. Calculate the smallest thickness of the glass plate which will appear dark by reflection. (3 marks)

Or

Turn over

(ii) (a) Describe and explain the Fraunhoffer diffraction pattern obtain by narrow slit and illuminated by a parallel beam of monochromatic light.

(11 marks)

(b) Calculate the least width of plane diffraction grating having 500 lines /cm. which will just resolve in the second order of the sodium lines of wavelength 5890 and 5896 Å.

(4 marks)

IV. (i) (a) Describe a Nicol prism and explain how it acts as an analyzer. (8 marks)

(b) Explain the phenomenon of double refraction in uniaxial crystals. (7 marks)

Or

(ii) (a) Give the construction and theory of quarter wave plate and half wave plate.

(13 marks)

(b) Plane polarized light passes through a quartz plate with it's optic axis parallel to the faces. Calculate the least thickness of the plate when the emergent beam will be plane polarized ($\mu_e = 1.553$, $\mu_0 = 1.5442$, and $\lambda = 5 \times 10^{-5}$ cm).

(2 marks)

V. (i) (a) Derive the plank's law for black body radiation. (13 marks)

(b) Calculate the surface temperature of the sun, given $\lambda_m = 4573$ Å, where λ_m corresponds to maximum intensity of emission.

(2 marks)

Or

(ii) (a) Determine the velocity of sound in a liquid with a neat sketch. (10 marks)

(b) What are the applications of ultrasonics ? (5 marks)