D 51234 (Pages 2) Name.....

Reg. No.....

COMBINED FIRST AND SECOND SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2008

EN 04 103 (A)—ENGINEERING PHYSICS (A)

(AI, CS, EE, EC, IT, IC, BM, BT, PT)

[2004 Admissions]

Time : Three Hours Maximum : 100 Marks

Answer **all** *the questions.*

Section A

I. 1 Sketch the band diagram of a p-n junction for (i) no bias condition ; (ii) forward bias condition and (iii) reverse bias condition.

2 Describe BCS theory of superconductivity.

3 In Newton's rings experiment, the diameter of the 4^{th} and 12^{th} dark rings are 0.4 cm and 0.7 cm respectively. Calculate the diameter of the 20^{th} dark ring.

4 Discuss the usefulness of the Rayleigh's criteria for the resolving power of an optical instrument.

5 What are positive and negative crystals ? Give examples.

6 Obtain an expression for the numerical aperture of an optical fiber.

7 Explain the distribution of energy in the spectrum of a black body.

8 Explain the method of determination of velocity of ultrasonic waves using ultrasonic diffractometer.

(8 × 5 = 40 marks)

Section B

II. (i) (a) Derive an expression for the electrical conductivity of an *n*-type semiconductor and discuss how it varies with temperature.

(11 marks)

(b) For silicon semiconductor with a band gap of 1.12 ev, find the position of the Fermi level at 300 k. Given $m_e^* = 0.12\ m_0$, $m_h^* = 0.28\ m_0$ and $k = 1.38 \times 10^{-23}$ JK^{-1}.

(4 marks)

Or

(ii) (a) What is Hall effect ? Obtain an expression for Hall coefficient and also describe an experimental arrangement used for measuring Hall voltage.

(11 marks)

(b) The superconducting transition temperature of lead is 7.2 K. The critical magnetic field at zero Kelvin is 64×10^3 amp/m. Calculate the critical field at 5K.

(4 marks)

Turn over

III. (i) (a) Describe Michelson's interferometer and explain the formation of fringes in it. Also explain how this can be used to determine the wavelength of monochromatic light.

(11 marks)

(b) Light of wavelength 589.3 nm falls normally on two glass plates enclosing a wedge shaped air film. The plates are in contact with one another at one end and are separated at a point of 10 cm from the end by a wire 0.05 mm diameter. Determine the fringe width of the formed fringes.

(4 marks)

Or

(ii) (a) Discuss the phenomenon of diffraction at straight edge and obtain an expression for maximum and minimum intensities.

(11 marks)

(b) A plane transmission grating having 5000 lines/cm is being used under normal incidence of light. Find the longest wavelength of light which can be diffracted using the grating.

(4 marks)

IV. (i) (a) What is double refraction ? Explain Huygen's theory of double refraction in uniaxial crystals.

(11 marks)

(b) Give an account on the principle of holography. (4 marks)

Or

(ii) (a) Explain the working of an optical communication system using a block diagram. Mention its advantages.

(11 marks)

(b) What are step and graded index optical fibers ? (4 marks)

V. (i) (a) State Planck's hypothesis and derive the expression of Planck's radiation law.

(11 marks)

(b) Explain : (i) absorption power ; (ii) reflecting power of a surface. (4 marks)

Or

(ii) (a) Deduce Schröedinger's time independent and time dependent equations for matter waves.

(11 marks)

(b) List the properties of ultrasonic waves and mention some of its applications. (4 marks)

(4 × 15 = 60 marks)