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Paper ID and Roll No. to be filled in your Answer Book

Roll No.

B. Tech.

(SEM. I) (ODD SEM.) (REG. & BACK) EXAMINATION, 2012-13

ENGINEERING PHYSICS

Time : **3** Hours] [Total Marks : **100**

UNIT - I

Answer any four questions : **5×4**

1 What do you understand by absolute motion; define inertial and non inertial frames? Explain the Newtonian principle of relativity.

2 Discuss the non existence of aether using Michelson Morley experiment.

3 An event occurs at x=100 m, y=10 m, z=5 m and t = 100μ sec in a frame S. Find the coordinates of this event in a frame S' which is moving with velocity 2.7×10^8 m/s w.r.t. the frame S along the common XX' axis using 1) Galilean transformation 2) Lorentz transformation.

4 State the fundamental postulate of the special theory of relativity and write down Lorentz's direct and inverse transformation equations. Discuss how these accounts for the phenomenon of length contraction by explaining the concept of proper length.

5 An iron furnace radiates 1.53×10^5 calories per hour through an opening of the cross section 10^{-4} sq meter. If the radiation emittance of the furnace is 0.80, calculate the temperature of the furnace. Given $\sigma = 1.36 \times 10^{-8} cal/m^2\text{-}s\text{-}K^4$.

6 State Stefan's law of heat radiation. Describe an experiment to determine Stefan's law.

UNIT - II

Answer any **two** questions : **10×2**

7 (a) Obtain the condition of the interference of the light reflected by a thin parallel film. Explain how you device a non reflecting film.

(b) If the angle of the wedge is 0.25^o and the wavelength of the sodium lines are 589 nm and 589.9 nm, find the distance from the apex at which the maxima due to two wavelengths first coincides when observed in reflected light.

18 (a) Derive the relation for energy levels of a particle confined within one dimensional rigid wall with infinitely high sides.

(b) Calculate the uncertainty in the angle of emergence of 1 MeV electron passing through a hole of 20 micron.

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15 (a) Find the Poynting vector on the surface of a long, straight conducting wire (of radius b and conductivity σ) that carries a direct current I. Verify the Poynting's theorem.

(b) State and prove Poynting's theorem and explain each term.

UNIT - V

Answer any **two** questions : **10×2**

16 (a) Derive the London equations of superconductivity. Show that the second London equation explains Meissner effect.

(b) Calculate the critical current density for 1 mm diameter wire of lead at (a) 4.2 K and (b) 7 K. Given: T_c for lead is 7.18 K and H_o for lead is 6.5×10^4 A/m.

17 (a) The London penetration depths for Pb at 3K and 7.1 k are respectively 39.6 nm and 173 nm. Calculate its transition temperature as well as the depth at 0K.

(b) A nucleon is confined to a nucleus of diameter 5×10^{-4}m. Calculate the minimum uncertainty in the momentum of nucleon. Also calculate the minimum kinetic energy of the nucleon.

8 (a) In the second order spectrum of a plane diffraction grating, a certain spectral line appears at an angle of 10°, while other line of wavelength 0.05 nm greater appears at an angle 3" greater. Find the wavelength of the lines.

(b) Explain the term coherence and write the method to produce coherent sources of light. Also write down the suitable method to find out the thickness of the thin film by using the biprism.

9 (a) A grating with 1500 rulings per inch is illuminated normally with white light from 400-700 nm. Show that only the first order spectrum is isolated but the second and third orders overlap.

(b) Drive the formula for the wavelength of the light used and refractive index of a liquid in Newton's ring experiment.

UNIT - III

Answer any **two** questions : **10×2**

10 (a) How can you produce plane, circularly and elliptically polarized light? Also explain how to distinguish between circularly polarized light and unpolarized light experimentally.

(b) Explain the principle of LASER. Drive the relation between the Einstein's coefficients.

11 (a) Draw the schematic diagram of the He-Ne laser. Using energy level diagram explain its working.

(b) A plane polarized light of wavelength 600 nm is incident on a thin quartz plate cut with faces parallel to the optic axes. Calculate the ratio of the intensity of ordinary and extra-ordinary light if the plane of vibration of two incident light makes an angle 30^{o} with the optic axis. Refractive index of the ordinary and extra-ordinary rays = 1.633

12 (a) A plane polarized light of wavelength 600 nm is incident on a thin quartz plate cut with faces parallel to the optic axes. Calculate 1) the minimum thickness of the plate which introduces a phase difference of 60^{o} between ordinary and extra-ordinary rays, 2) the minimum thickness of the plate for which ordinary and extra-ordinary rays will combine to produce plane polarized beam. Refractive index of the ordinary and extra-ordinary rays = 1.633.

(b) What are optically active substances? Explain the working of a polarimeter to find the specific rotation of cane sugar solution with suitable diagram.

UNIT - IV

Answer any **two** questions : **10×2**

13 (a) A paramagnetic material has a magnetic field intensity of 10^{4} Am^{-1}. If the susceptibility of the material at room temperature is 3.7×10^{-3}, calculate the magnetization and flux density of the material.

(b) A system of electron spins is placed in a magnetic field of 2 Wb/m^{2} at a temperature T. The number of spins parallel to the magnetic field is twice as large as the number of antiparallel spins. Determine T.

14 (a) A magnetic material has a magnetization of 2300 Am^{-1} and produces a flux density of 0.00314 Wb m^{-2}. Calculate the magnetizing force and the relative permeability of the material.

(b) A positive point charge Q is at the center of a spherical conducting shell of an inner radius R_i and the outer radius R_o. Determine E and V as the function of the radial distance R.