Printed Pages : 8 AS-102

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

PAPER ID : 1107 Roll No. | | | | | | | | | | |

B. Tech.

(Semester-I) Theory Examination, 2012-13

ENGINEERING PHYSICS–I

Time : 3 Hours] *[Total Marks : 80*

Note : Attempt questions from each Section as per instructions.

Section-A

Attempt all the *eight* parts of this question. Each part should be answered in not more than 50 words. Each part carries 2 marks. 2×8=16

1. (a) What was the objective of Michelson-Morley experiment?

   (b) What is an inertial frame of reference? Is the earth an inertial frame?

   (c) Write down the dimensions of the magnitude of Poynting vector.

(d) Why two independent sources of light can not produce interference pattern?

(e) State clearly Rayleigh's criterion of resolution.

(f) What is the difference between linearly (or plane) polarized and partially polarized lights?

(g) Define the term 'specific rotation' of an optically active solution.

(h) What is the difference between spontaneous emission and stimulated emission of radiation?

Section-B

Attempt any *three* parts of this question. Each part should be answered in 75 to 150 words. Each part carries 8 marks. 8×3=24

2. (a) Is displacement between two fixed points in space variant under Galilean transformation? Prove your answer. Is acceleration variant under Galilean transformation?

(b) Electric field intensity vector associated with an electromagnetic wave is given by :

$$\overline{E} = \hat{i}E_1 \cos(kz - \omega t) - \hat{j}E_2 \cos(kz - \omega t) .$$

The symbols have their usual meanings. What is the state of polarization of the wave, i.e., is it unpolarized, partially polarized, plane polarized, circularly polarized on elliptically polarized? Give justification for your answer.

(c) What are anti-reflection coatings? What is the principle on which their working is based?

In which situation a light reflected from a surface will undergo a phase shift of π ?

(d) Explain briefly how a hologram of an object made.

The mean optical power launched into a 4-km. long optical fibre is 120 μW. The mean power reaching the end of the fibre is 4 μW. Calculate the attenuation constant of the fibre.

(e) Show that the vectors $\vec{E}, \vec{H}$ and the direction vector of propagation of the electromagnetic wave are all mutually perpendicular.

Section-C

Attempt all the five questions of this Section. Answer only one part (a) or (b) of each question. Each part should be answered in 300 to 500 words. Each part carries 8 marks. $8 \times 5 = 40$

3. (a) Given the kinetic energy of a relativistic particle, how will you calculate its linear momentum? Only give the essential steps. A photon in the s-frame is moving in the x-y plane such that its direction of motion makes an angle of θ with the x-axis. Calculate its speed in the s'-frame which moves with a constant velocity $\vec{v}$ with respect to the s-frame and along the x-axis of the s-frame.

Or

(b) A person observes two men, each of rest mass 60 kg, moving towards each other, each with a velocity of 0.5 c. What is the mass of one man as observed by the other?

4. (a) State the principle of superposition with reference to interference of light waves. Interference pattern in Newton's ring experiment with a light source emitting two wavelengths, 4500 Å and 6000 Å, is created. It is observed that $(n+1)$th dark ring due to 4500 Å coincides with the nth dark ring due to the 6000 Å light. The radius of curvature of the curved surface is 90 cm. Calculate the value of n.

Or

(b) Diffraction of light is caused by a grating having 5000 lines/cm. What is the longest wavelength for which diffraction pattern is observed? What is the highest order that will be observed is light of wavelength 6000 Å is used ?

5. (a) Starting from Ampere's circuital law, obtain the Maxwell's 4th electromagnetic field equation in its differential form.

Assuming that all the energy from a 100-watt bulb is radiated uniformly, calculate the average values of E (electric field intensity) and H (magnetic field intensity) at a distance of 1 m from the bulb.

Or

(b) Write down Maxwell's electromagnetic field equations in free space. Hence prove that the electromagnetic waves travel in free space with the velocity 3×10^8 m/s.

Assuming permeability of a medium to be equal to that of vacuum, find the refractive index of the medium if its relative permittivity is 25.

6. (a) Describe the essential components of a Ruby laser. Explain its working on the basis of the relevant energy diagram.

Or

(b) A Wicol polarizer and a Nicol analyser are so oriented to give the maximum transmitted light. Through what angle should the analyser be rotated to give the transmitted intensity equal to $\frac{1}{3}$rd. The maximum intensity?

Draw a diagram of a calcite crystal. Identify the optic axis in this diagram.

7. (a) With reference to optical fibres, obtain an expression for the acceptance angle in terms of the refractive indices of the core material, cladding material and that of the medium outside the fibre.

What is the difference between step index and graded index fibres? Explain briefly.

Or

(b) The fraction change of refractive index between the core material and the cladding

material of a fibre is 1%. If the refractive index of the core material is 1.46, calculate the numerical aperature and the acceptance angle.

Explain briefly, how is the image of an object created from a hologram.