COURSE CODE: PH 1101   COURSE NAME: Engineering Physics
Branch: MMT   Duration: 02 Hrs.
Date of Examination: 16.10.2023   FULL MARKS: 30 (THIRTY)
COURSE TEACHER: DR. RAJEEV RANJAN

Instruction

Attempt all the questions and write your answers at one place of each questions

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Q1

(a) Taking solenoidal vectors $\vec{A} = (x + 3y)\hat{\imath} + (2y + 3z)\hat{\jmath} + (x + az)\hat{k}$, find the value of constant a.   [3]

(b) Electromagnetic waves in form of visible light travelling in air falls normally on a glass slab (n_g = 1.5), Find intensity of reflected and transmitted light if intensity of incident light is 20 mW/mm².   [3]

(c) What is double refraction? Explain it on the basis of Huygen's principle.   [4]

Q2.

(a) Define Poynting theorem and prove that it is consistent with energy conservation law.   [6]

(b) In free space electric field intensity is given by $\vec{E} = \hat{\jmath}\, 20\, \cos(\omega t - 5x)\, V/m$ Calculate displacement current density.   [2]

(c) How can you distinguish between an elliptically polarised light and a partially polarised light?   [2]

Q3.

(a) The velocity of light in air is 3×10^8 m/s and that in water is 2.2×10^8 m/s. Find the polarizing angle of incidence.   [2.5]

(b) Three identical polaroid P_1, P_2 and P_3 are oriented so that the transmission axis of P_2 and P_3 are inclined at 60^0 and 90^0 respectively with transmission axis of P_1 A monochromatic light of intensity I_0 is incident on Polaroid P_1 Find the intensity of light emerging from P_3.   [3]

(c) A plane polarized light of wavelength 600 nm changes to a circularly polarized light on passing through a quartz crystal cut parallel to optic axis. Calculate the minimum thickness to produce such effect. Given, $\mu_0 - \mu_e = 0.005$ [2.5]

(d) Write differential form of Maxwell's equation in free space.   [2]

Answer all the questions

1.(a) Write Maxwell's equations in integral and differential form.
   (b) Write the expression for the Poynting theorem. Define Poynting vector.
   (c) Establish equation of continuity.   (4+3+3)

2.(a) Derive an expression for compton shift. What is its maximum value?
   (b) An X-ray photon is found to have its wavelength doubled on being scattered
       through 90 degrees. Find the wavelength of the scattered photon.   (7+3)

3. (a) Explain the terms : spontaneous emission , stimulated emission
    (b)Establish the relation between Einstein's A and B coefficients.
    (c) What are three magnetic vectors? Write their units.Derive the relation between
        three magnetic vectors.   (2+5+3)

4. (a) Derive the expression for phase velocity $v_p = c^2 / v$ and group velocity $v_g = v$
        for de Broglie waves associated with a moving body.
   (b) State and derive Uncertainty principle.
   (c) Calculate the wavelength associated with an electron subjected to a potential
       difference of 125 Volts   (4+4+2)

5. (a) Establish Schrodinger's equation in time dependent form and hence obtain its
        time independent form.   (5+5)
   (b) Using time independent Schrodinger's equation derive expressions for eigen
       functions and energy eigen values for a particle in a box in one dimension.