TPH-101 **1245**

Odd Semester Examination, 2017-18

B.TECH. (SEMESTER-I)

ENGINEERING PHYSICS

Time: 03:00 Hours **Max Marks : 100**

Note: Attempt **all** questions. All questions carry equal marks.

1. Attempt **any four** of the following: [5x4=20]

   (a) What is length contraction? Derive expression for length contraction using Lorentz transformation equations.

   (b) Deduce the relativistic velocity addition formula and hence show that no signal can travel faster than light.

   (c) Establish Einstein's mass-energy relation $E= mc^2$ and show that $E^2 = p^2c^2 + m_o^2c^4$, where symbols have their usual meaning.

   (d) The kinetic energy of an electron is 5 times its rest mass energy. Find its velocity, momentum and total energy.

   (e) State Compton effect? X-rays of energy 10 keV are scattered by a material at an angle 90°. Find the wavelength and energy of the scattered X-rays.

   (f) Discuss the distribution of energy spectrum of black body radiation.

2. Attempt **any four** of the following: [5x4=20]

   (a) What are the coherent sources? Gives various methods for production of coherent sources.

   (b) What are Newton's rings? Show that the diameter of n^{th} bright ring in reflected light is proportional to the square root of odd natural numbers.

   (c) Newton's rings are observed in reflected light of wavelength 5900 A^0. The diameter of 10^{th} dark ring is 5 mm. Find the radius of curvature of lens and the thickness of the air film.

(d) Discuss the Fraunhoffer diffraction due to single slit and hence find the intensity ratios of successive maxima.

(e) A diffraction grating used at normal incidence, gives a yellow line (λ=600nm) in certain order superimposed on a blue line (λ=480nm) of next higher order. If the angle of diffraction is $\sin^{-1}(0.75)$, calculate the grating element.

(f) State Rayleigh criterion of resolution and use it to find the resolving power of a grating.

A grating has 1500 lines on it. What is the difference between the two wavelengths that are just resolved in the second order spectrum in the region of wavelength 600nm?

3. Attempt **any two** of the following: [10x2=20]

(a) What is double refraction? Give construction, working and limitations of Nicol prism.

A plane polarized light of wavelength 550nm is passed through a calcite plate with its optic axis parallel to its faces. Calculate the thickness of the plate for which the emergent light elliptically polarized. Given μ_o= 1.658 and μ_E=1.48

(b) Define optical rotation and specific rotation? Describe the construction working of a half shade polarimeter.

A sugar solution is prepared by dissolving 10 gm of impure sugar in 100ml of water. This solution produces optical rotation of 8.8 degrees when placed in a tube having length 20 cm. If the specific rotation of pure sugar solution is 66°/dm/(gm/cc), find the percentage purity of the solution.

(c) What do you understand by spontaneous and stimulated emissions? Establish relation between Einstein's A and B coefficients. Describe construction and working of He-Ne laser. How it is superior to ruby laser?

4. Attempt **any two** of the following: [10x2=20]

(a) Write Maxwell's equations in free space and using these equation obtain electromagnetic wave equation in free space. And also show that electric and magnetic vectors are normal to each other and to the direction of propagation of the wave.

(b) What is Poynting vector? Deduce Poynting theorem for flow of energy in electromagnetic wave.

Assuming that the energy is radiated uniformly in all directions by a 100W bulb, calculate the intensities of electric and magnetic fields of the radiation at 2 m from the bulb.

(c) Distinguish between dia-, para- and ferro-magnetic materials.

An iron rod of volume 10^{-3} m^3 and relative permeability 1200 is placed inside a long solenoid wound with 5 turns per cm. If a current of 0.5 amp is passed through the solenoid, find the magnetic moment of the rod.

[10x2=20]

5. Attempt **any two** of the following:

(a) What are superconductor and Mesissner effect. Explain the difference between type I and type II superconductors.

A superconducting specimen have critical fields 0.176 T and 0.528 T for 14 K and 13 K respectively. Calculate the critical temperature of specimen and critical field at 0 K.

(b) Derive Schrodinger time independent and time dependent wave equation. Give the physical significance of wave function ψ.

An electron is confined into an infinite box of size 4 A^0. Find the energy and de-Broglie wavelength of the waves associated with of the first 2 energy states. Can an electron with energy 100.2 eV exist in the box?

(c) What is uncertainty principle? Apply it to show that electrons are not part of atomic nucleus.

The speed of an electron is measured to be 500 m/s to an accuracy of 0.002%. Find the uncertainty in determining its position.

Physical constants:

Planck's constant, h $= 6.63 \times 10^{-34}$ J-s

Electronic charge, e $= 1.6 \times 10^{-19}$ C

Rest mass of electron, m_0 $= 9.1 \times 10^{-31}$ Kg

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