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

Roll No.

B. Tech.

(SEM. II) EXAMINATION, 2012

PHYSICS

Time : 3 Hours] [Total Marks :

Note : (1) Attempt all questions.
(2) Marks of each question are mentioned against it.
(3) Use of calculator is permitted.

1 Answer any four parts : **4×5-=20**

(a) Derive the Einstein mass-energy relation $E = mc^2$

(b) Calculate the length of a rod moving with a velocity of 0.8c in a direction inclined at 60° to its own length. The proper length of the rod is 100 cm ($C = 3 \times 10^8$ m/s)

(c) Find the angle at which first dark band and the next bright band are formed in Fraunhofev diffraction pattern of a slit 0.3 mm wide and $\lambda = 5890\ \dot{A}$.

(d) Give the construction and working of NiCol prism as polariser and analyzer.

(e) Derive the Maxwell 1st equation Div $\vec{D}=\rho$

(f) Discuss the effects of the magnetic field on superconductors.

2 Answer any four parts : **4×5=20**

(a) Derive an expression for the variation of mass with velocity.

(b) State and prove Kirchoff's Law connecting to emissive and absorptive power of bodies for heat radiation.

(c) Derive an expression for the diameter of n^{th} bright Newton's ring.

(d) Explain how you can produce and detect different kinds of polarized light with the help of NiCol prism and quarter wave plate.

(e) Deduce Poynting theorem for the flow energy in an electromagnetic field.

(f) Explain the concept of de Broglie waves.
A particle of charge q and mass m is accelerated from rest through a potential difference V. Calculate its de-Broglie wavelength, also calculate wavelength if the particle is an electron and Potential difference V = 50 Volt.

$m_e = 9.1 \times 10^{-31}$ kg, $C = 3 \times 10^8$ m/s,

$h = 6.62 \times 10^{-34}$ j-s)

3 Answer any two parts : **2×10=20**

(a) State the fundamental postulates of the special theory of relativity. Derive the Lorentz transformations equations.

(b) Describe the Fraunhofer diffractions due to a single slit and derive an expression for its intensity.

(c) Describe giving experimental details, Fresnel's biprism method for determining the wavelength of light. Also derive the formula used.

4 Answer any two parts : **2×10=20**

(a) Explain what do you understand by a quarter and a half wave plates.

Plane polarised light passes through a quartz plate with its optic axis parallel to the faces. Calculate the least thickness of the plate for which the emergent beam will be (i) plane polarised (ii) circularly polarised.

Given $\mu_O = 1.5542$m $\mu_E = 1.5533$, $\lambda = 5000$ A°.

(b) Explain spontaneous emission and stimulated emission. Obtain a relation for Einstein's coefficient.

(c) Using Maxwell's equation, derive electromagnetic wave equation in free space.

5 Answer any two parts : **2×10=20**

(a) Explain hysteresis loop and discuss hysteresis loss. Describe how you can use hysteresis curve for selecting the material for permanent magnets.

(b) What is meant by optical rotation ? Give Frosenel's theory of optical rotation. Discuss the dependence of rotation on wavelength.

(c) Obtain time-dependent and time independent Schrodinger wave equation. What is the physical significance of the wave function Ψ.