Printed Pages : 4 TAS101

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

PAPER ID : 9913 Roll No.

B.Tech

(SEM I) ODD SEMESTER THEORY EXAMINATION 2009-10

PHYSICS

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

Note : (1) Attempt all questions.
(2) All questions carry equal marks.
(3) Standard data are given in the end of the question paper.

1 Do any four of the following : 5×4=20

(a) Discuss briefly Michelson-Morley experiment and mention its outcome.

(b) Deduce an expression for time dialation on the basis of Lorentz transformation equations.

(c) Obtain the volume of a cube, the proper length of each edge of which is L_o, when it is moving with velocity v along one of its edges.

(d) How fast an electron must move in order that its mass equal to the rest mass of the proton ?

(e) Show that the relativistic form of Newton's second law when $\vec{F}$ is parallel to $\vec{v}$ is

$$\vec{F}=m_o \frac{dv}{dt}\left[1-\frac{v^2}{c^2}\right]^{-\frac{3}{2}}.$$

(f) If the kinetic energy of a body is twice of its rest mass energy, find its velocity.

2 Do any four of the following : 5×4=20

(a) What do you understand by coherent sources? How are these obtained is practice ? Give examples.

(b) Explain that in biprism expt. the central fringe is achromatic when white light is used.

(c) Light of wavelength $6000\,\overset{o}{A}$ is incident normally on a wedge shaped film $(\mu = 1.35)$. The fringes are formed to be 2.0 mm apart from each other. Calculate the angle of wedge.

(d) What is meant by diffraction of light ? Distinguish between Fresnel and Fraunhofer class of diffraction giving examples.

(e) Calculate the angle between the central image of a lamp filament and its first diffracted image produced by a fabric with 160 threads per cm $(\lambda = 6000\,\overset{o}{A})$.

(f) Obtain the design of a plane transmission diffraction grating capable of resolving a wavelength difference of $6\,\overset{o}{A}$ at a mean wavelength of $6000\,\overset{o}{A}$ in second order spectra.

3 Do any two of the following : 10×2=20

(a) What do you understand by double refraction ? Explain Huygens theory of double refraction in an uniaxial crystal.

(b) (i) Calculate the thickness of a doubly refracting crystal plate required to introduce a path difference of $\lambda/2$ between the ordinary and extraordinary rays when $\lambda = 6000\,\overset{o}{A}$. $\mu_o = 1.55$ and $\mu_e = 1.54$.

(ii) The specific rotation of quartz at $5086\,\overset{o}{A}$ is 29.73 deg/mm. Calculate the difference in the refractive indices.

(c) What are the requirements for producing laser action ? How are they achieved ?

4 Do any two of the following : **10×2=20**

(a) Explain the concept of Maxwell's displacement current and show how it led to the modification of the Ampere's law.

(b) (i) What is Poynting vector ? If the electric amplitude of the wave is 5 V/m, what is the magnetic amplitude of this wave ?

(ii) Write four Maxwell's equation in conducting medium and derive wave equation.

(c) (i) A material has 10 turns per cm of wire wound uniformly upon it which carries a current of 2.0 amp. The flux density in the material is 1.0 Weber/m^2. Calculate the magnetising force and magnetisation of the material.

(ii) What is meant by Hystersis and Hysteresis curve ? How would you use the hysteresis curves to select the material for construction of permanent magnet.

5 Do any four of the following : 5×4=20

(a) Discuss the diffraction of X-rays and Bragg's law. Describe also functioning of a Bragg Spectrometer.

(b) What are modified and unmodified radiation in Compton scattering ? How Compton explained unmodified radiation ? How Compton effect is measured ?

(c) A proton is moving with a speed of 2×10^{8} m/s. Find the wavelength of matter wave associated with it.

(d) State and give physical meaning of Heisenberg's uncertainty principle.

(e) What is physical significance of wavefunction ψ used in time independent Schrodinger wave equation ?

(f) A particle is moving in one dimensional potential box of width $25\,\overset{o}{A}$. Calculate the probability of finding the particle within an interval of $5\,\overset{o}{A}$ at the centre of the box when it is in its state of least energy.

Physical constants :

Planck's constant $h=6.63\times10^{-34}$ J.s

Velocity of light in free space $C=3\times10^{8}$ m/s

Electronic charge $e=1.6\times10^{-19}$C

Permittivity of free space $G_o=8.85\times10^{-12}$ F/m

Permeability of free space $\mu_o=4\pi\times10^{-7}$H/m

Rest mass of electron $m_e=9.1\times10^{-31}$kg

Mass of proton $m_p=1.67\times10^{-27}$kg.