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.

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(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 : $10 \times 2 = 20$

(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 Hysterisis 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 $h = 6.63 \times 10^{-34}$ J.s

Velocity of light in free space $C = 3 \times 10^8$ m/s

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

Permittivity of free space $G_0 = 8.85 \times 10^{-12}$ F/m

Permeability of free space $\mu_0 = 4\pi \times 10^{-7}$H/m

Rest mass of electron $m_e = 9.1 \times 10^{-31}$kg

Mass of proton $m_p = 1.67 \times 10^{-27}$kg.