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Printed Pages : 7 **TAS-101**

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

PAPER ID : 9913 Roll No. | | | | | | | | | | |

B. Tech.

(SEM. I) EXAMINATION, 2007-08

PHYSICS

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

Note : *(1) Attempt* ***all*** *questions.*

(2) Marks of each question are shown against it

(3) The physical constants are given at the end of the question paper.

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

(a) What do you understand by a frame of reference? Is earth an inertial frame of reference? If not, why?

(b) Calculate the percentage contraction in the length of rod in a frame of reference, moving with velocity 0.8 C in a direction parallel to its length.

(c) Obtain the relativistic formula for addition of velocities and also show that the speed of light is constant.

(d) A circular lamina moves with its plane parallel to the x-y plane of a reference frame *s*, at rest. Assuming its motion to be along the axis of x (or y), calculate the velocity at which its surface area would appear to be reduced to half to an observer in frame *s'*.

(e) What was the objective of Michelson-Morley experiment ? Discuss the negative result of this experiment.

(f) Show, from Lorentz transformation that two events simultaneous $(t_1 = t_2)$ at different positions $(x_1 \neq x_2)$ in a reference frame *s* are not, in general, simultaneous in another reference s' moving with constant velocity v w.r.t. *s*.

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

(a) What are the coherent sources of light? Is it possible to obtain coherent sources from two separate sources? If not, why?

(b) A man whose eyes are 150 cm above the oil film on water surface observes greenish colour at a distance of 100 cm. from his feet. Calculate the probable thickness of the film.

$(\lambda_{green} = 5000\ A^{\circ},\ \mu_{oil} = 1.4,$

$\mu_{water} = 1.33)$

(c) In Newton's ring experiment what happens when

(i) a point source of light is used

(ii) light is not monochromatic

(iii) plane glass plate is replaced by plane mirror.

(d) A diffraction grating used at normal incidence gives a green line (5400 $\mathring{A}$) in a certain order superimposed on the violet line (4050 $\mathring{A}$) of the next higher order. If the angle of diffraction is 30°, how many lines per cm are there in the grating ?

(e) What do you understand by missing order spectrum? What particular spectra would be absent if the width of transparencies and opacities of grating are equal ?

(f) Two pin holes 1.5 mm apart are placed in front of a source of light of wavelength 5.5×10^{-5} cm and seen through a telescope with its objective stopped down to a diameter of 0.4 cm. Find the maximum distance from the telescope at which the pin holes can be resolved.

3 Attempt any **four** of the following : **5×4=20**

(a) The values of μ_E and μ_O for quartz are 1.5508 and 1.5418 respectively. Calculate the phase retardation for $\lambda = 5000\ \mathring{A}$ when the plate thickness is 0.032 mm.

(b) Show that the plane polarised and circularly polarised light are the special cases of elliptically polarised light.

(c) Explain the phenomenon of double refraction in calcite or quartz and give the main reason for this phenomenon.

(d) The indices of refraction of quartz for right-handed and left-handed circularly polarised waves of wavelength 7620 $\mathring{A}$ travelling in the direction of optic axis have the following values : $\mu_R = 1.53914$ and $\mu_L = 1.53920$.

Calculate the rotation of the plane of polarization of light in degrees produced by a plate 0.5 mm thick.

(e) Discuss the application of laser in holography and optical communication.

(f) Describe the principle and working of three-level laser system.

4 Attempt any **two** of the following : **10×2**

(a) Explain the origin of diamagnetism in materials. Obtain an expression for diamagnetic susceptibility using the Langevin's theory. What is the significance of negative susceptibility?

(b) (i) Discuss the physical significance of Poynting theorem.

(ii) Assuming that all the energy from a 1000 watt lamp is radiated uniformly, calculate the average values of the intensities of electric and magnetic fields of radiation at a distance of 2 meter from the lamp.

(c) Deduce four Maxwell's equations in free space. Explain the concept of Maxwell's displacement current and show how it led to the modification of Ampere's law.

5 Attempt any **two** of the following : **10×2**

(a) What is the Compton Effect? Derive the expression for the direction of recoiled Compton electron. Show that the Compton electron can recoil only in the onward direction at angles less than 90°.

(b) (i) Using uncertainty principle show that electron cannot exist in the nucleus.

(ii) Solve Schrodinger's wave equation for a particle in a one dimensional rigid box of side L and having potential energy (V) as follows:

$V(x) = \infty$, for $x < 0$ and $x > L$

$V(x) = 0$, for $0 \leq x < L$

(c) (i) What is the physical significance of wave function ψ ?

(ii) Determine the probabilities of finding a particle trapped in a box of length L in the region from 0.45 L to 0.55 L for the ground state.

Plack'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 $\in_0 = 8.85 \times 10^{-12}\ F/m$

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

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