



Printed Pages : 7

EAS-101

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

PAPER ID : 9602

Roll No. **B. Tech.**

(Only for the candidates admitted/Readmitted in the session 2008-09)

(SEM. I) EXAMINATION, 2008-09
ENGG. PHYSICS - I

Time : 2 Hours]

[Total Marks : 50

Note : This question paper contains 3 sections.

SECTION - A

1 Attempt all parts. All parts carry equal marks : (10×1=10)

(a) The volume of a cube, the proper length of each edge of which is l_0 when it is moving with a velocity v along one of its edges can be given as _____.(b) A particle of rest mass m_0 moves with speed $\frac{C}{\sqrt{2}}$. Its mass can be given _____.

Pick The correct choice from following :

(c) In Young's double slit experiment, the separation between the slits is halved and the distance between the slits and screen is doubled. The fringe width is :

- (i) Unchanged (ii) Halved
(iii) Doubled (iv) Quadrupled.

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- (d) Ray optics is valid when characteristic dimensions are :
- (i) Much smaller than the wavelength of light
 - (ii) Much larger than the wavelength of light
 - (iii) Of the same order as the wavelength of light
 - (iv) Of the order of 1 millimeter.
- (e) The specific rotation of an optically active substance of length l_{cm} and concentration c with an optical rotation θ is :
- (i) $\frac{l_c}{10\theta}$
 - (ii) $\frac{\theta l_c}{10}$
 - (iii) $\frac{10\theta}{l_c}$
 - (iv) $\frac{10}{\theta l_c}$
- (f) In He-Ne laser, the helium and neon are in the ratio
- (i) 1 : 7
 - (ii) 7 : 1
 - (iii) 1 : 10
 - (iv) 10 : 1.
- (g) The directionality of a laser beam is measured by
- (i) Visibility of interference fringes
 - (ii) The size and aperture of the laser source
 - (iii) The divergence angle of the beam with the distance from the source
 - (iv) Nature of the lasing medium.



- (h) Optical filters are made of
- Metallic conductor
 - Plastics doped with metallic impurities
 - Dielectric material
 - Magnetic oxides.
- (i) Angle of acceptance is maximum for a filter of
- The critical angle is minimum
 - The critical angle is maximum
 - The critical angle is zero
 - The critical angle is negative.
- (j) When a Polaroid is rotated, the intensity of light is not formed to vary. The incident light may be
- Completely plane polarized
 - Partially plane polarized
 - Unpolarized
 - None of these.

SECTION - B

2 Attempt any **three** parts. All parts carry **(5×3=15)** equal marks :

- (a) Calculate the percentage contraction of a rod moving with a velocity of $0.8c$ in a direction inclined at 60° to its own length.



- (b) A thin film of soap solution is illuminated by white light at an angle of incidence, $i = \sin^{-1}\left(\frac{4}{5}\right)$. In reflected light, two dark consecutive overlapping fringes are observed corresponding to wavelength 6.1×10^{-7} m. The refractive index for soap solution is $\frac{4}{3}$. Calculate the thickness of the film.
- (c) A light of wavelength 6000 \AA falls normally on a straight slit of width 0.10mm. Calculate the total angular width of the central maximum and also the linear width as observed on a screen placid 1 meter away.
- (d) The indices of refraction of quartz for right handed and left handed circularly polarized lights of wavelength 6500 \AA traveling 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 0.2mm thick.
- (e) A silica glass optical filter has a core refractive index of 1.500 and cladding refractive index of 1.450. Calculate the numerical aperture of the filter.



SECTION - C

Note : Attempt **all** questions. All questions carry **5×5=25 equal marks.**

- 3** Attempt any **one** part of the following :
- (a) 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 frame S' .
 - (b) What was the objective of conducting the Michelson Morley experiment ? Describe the experiment. How is the negative result of the experiment interpreted ?
- 4** Attempt any **one** part of the following :
- (a) Discuss the phenomena of interference of light due to thin films of uniform thickness in reflected light and find the conditions of maxima and minima.
 - (b) What do you understand by missing order spectrum ? What particular spectra would be absent if the width of the transparencies and opacities of the grating are equal. Show that only first order spectra is possible if the width of the grating element is more than wavelength of light and less than twice the wavelength of light.



5 Attempt any **one** part of the following :

- (a) Describe and explain the formation of Newton's rings in reflected monochromatic light. Prove that in reflected light diameters of the dark rings are proportional to the square root of natural numbers.
- (b) Discuss the phenomena of Fraunhofer diffraction at a single slit and show that the relative intensities of successive maxima are nearly

$$1 : \frac{4}{9\pi^2} : \frac{4}{25\pi^2} : \frac{4}{49\pi^2} \dots\dots\dots$$

6 Attempt any **one** part of the following :

- (a) Define specific rotation. Describe the construction and working of Laurent's half-shade polarimeter.
- (b) Explain the principle of optical pumping and stimulated emission of radiation. Discuss the properties of laser radiation and mention some of its applications.

7 Attempt any **one** part of the following :

- (a) Explain basic principle of optical fiber. Discuss fiber classification.
- (b) Explain acceptance angle and acceptance cone of a fiber. What do you mean by numerical aperture of a fiber. Derive expressions for

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them.

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

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

