Physical constants

Mass of electron	$m_e = 9.1 \times 10^{-31}$ kg
Speed of light	$c = 3 \times 10^8$ m/s
Plank's constant	$h = 6.63 \times 10^{-34}$ J-S
Mass of proton	$m_p = 1.67 \times 10^{-27}$ kg
Permeability of free space	$\mu_0 = 4\pi \times 10^{-7}$ H/m
Permittivity of free space	$\varepsilon_0 = 8.854 \times 10^{-12}$ F/m
Avogadro's number	$N = 6.023 \times 10^{23}$ per mole

—x—

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NAS101

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

PAPER ID : 199123

Roll No.

B.Tech. (Semester-I)

SPL. THEORY EXAMINATION, 2014-15

ENGINEERING PHYSICS-I

Time : 2 Hours] *[Total Marks : 50*

Note: Attempt questions from each section as per instructions.

Section – A

1. Attempt all parts of this question. Each part carries 2 marks: 5×2=10

   (a) What are the conclusions of Michelson-Morley experiment?

   (b) What do you understand by wave function ψ?

   (c) Why are fringes circular in Newton's ring experiment?

   (d) What is stimulated emission of radiation in a laser?

   (e) What is Rayleigh's criterion of resolution for optical instruments?

Section – B

2. Attempt any three parts of this question. Each part carries 5 marks. 3×5=15

(a) A train of length 150 m at rest has to pass through a tunnel of length 125 m with a uniform speed of 0.8 times the speed of light towards the tunnel. Find the length of train and that of tunnel as observed by observer at the tunnel.

(b) Calculate the de-Broglie wavelength of an α-particle accelerated through a potential difference of 200 volts.

(c) In Newton's ring experiment the diameter of 4th and 12th dark rings are 0.400 cm and 0.700 cm respectively. Deduce the diameter of 20th dark ring.

(d) Find out if a diffraction grating will resolve the lines 8037.20 Å and 8037.50 Å in the second order given that the grating is just able to resolve two lines of wavelengths 5140.34 Å and 5140.85 Å in the first order.

(e) If refractive indices of core and cladding of an optical fiber are 1.50 and 1.45 respectively, determine the values of numerical aperture, acceptance angle and critical angle of the fiber.

Section – C

Attempt any one part of all the questions. Each question carries five marks. 5×5=25

3. (a) What do you understand by time dilation? Establish a relation for it.

(b) Deduce the Lorentz transformation equations from Einstein's postulates. Also show that at low velocities, the Lorentz transformations reduce to Galilean transformations.

4. (a) What was the aim of conducting the Davisson-Germer experiment? Describe the experiment and discuss the results.

(b) Obtain expressions for the energy Eigenvalues and normalized wave function for a particle confined in an infinitely deep potential well.

5. (a) Discuss the phenomenon of interference of light due to parallel thin films. Show that the interference patterns of reflected and transmitted monochromatic source of light are complementary.

(b) Discuss the phenomenon of diffraction at a single slit and show that the relative intensities of a successive maximum are nearly

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

6. (a) What are circularly and elliptically polarized lights? Discuss how the circularly polarized lights are produced and detected.

(b) Describe the working principle of three level and four level lasers.

7. (a) Discuss single mode and multimode optical fibers and also compare their properties.

(b) Describe the construction process of a hologram with necessary diagrams. Also give some applications of hologram.