-94-

Total No. of Pages: 02 *Roll No.....*

FIRST SEMESTER **B.Tech. [All Groups]**

END SEMESTER EXAMINATION **(November *2018*)**

AP-101: PHYSICS-I

Time: 3 Hours ***Max. Marks: 40***

Note: Attempt any ***FIVE*** questions. Question No. 1 is compulsory.
Assume suitable missing data, if any.

1. Answer all the following questions. (2x6)
   (a). Distinguish between inertial and non-inertial frame of references.
   (b). What are essential conditions for sustainable interference?
   (c). Explain Malus law of polarization.
   (d). How fast must an electron move in order that its mass equals the rest mass of the proton?
   (e). Calculate the population ratio of two states in He-Ne laser that produces light of wavelength 6000 Å at 300 K (k_b=1.38×10^{-23} J/K).
   (f). A communication system uses 10 km fibre having a loss of 2.3 dB/Km. Compute the output power if the input power is 400 μW.

2(a). Derive Lorentz velocity transformation equations and prove that the velocity of light is the maximum attainable velocity. A spaceship moving away from earth with the velocity 0.6c fires a rocket whose velocity relative to the space ship is 0.7c away from the earth. What will be the velocity of the rocket as observed from the earth? (4)

(b) A meson of mass π comes to rest and disintegrates into a meson of mass μ and a neutrino of zero mass. Show that the kinetic energy of motion of the μ meson (i.e. without the rest mass energy) is $\frac{(\pi-\mu)^2}{2\pi}c^2$. (3)

3(a). Describe the construction and working of Nicol prism. Explain how it can be used as polarizer and analyser. (4)

(b). What do you understand by missing order in double slit diffraction? Graphically explain the missing orders for d=2e, where 'e' and 'd' are slit width and opaque distance between two slits, respectively. (3)

P.T.O

4(a). What is the general expression for the displacement x for a simple damped mechanical oscillator driven by a force $F_0\cos(\omega t)$? Derive the expressions for the (i) Frequency of maximum displacement and (ii) Maximum displacement. Also plot the variation of the amplitude of displacement versus driving force frequency for different values of damping constant. (4)

(b). The frequency of a damped simple harmonic oscillator is given by

$$\omega' = \frac{s}{m} - \frac{r^2}{4m^2} = \omega_o^2 - \frac{r^2}{4m^2}$$

If $\omega_o^2 - \omega'^2 = 10^{-6}\,\omega_o^2$, find Quality factor (Q) and logarithmic decrement (δ), where symbols have their usual meanings. (3)

5(a). What is LASER? Explain the principle and working of He-Ne laser with the help of suitable energy level diagram. (4)

(b). Distinguish between spontaneous and stimulated emission and derive the relations between Einstein's coefficients. (3)

6(a). Describe different types of optical fibres on the basis of refractive index profile. What is dispersion in optical fibre? Derive an expression for the intermodal dispersion in multimode optical fibres. (4)

(b). A step Index fibre with a large core diameter compared with the wavelength of the transmitted light has an acceptance angle in air of 22^0 and a relative index difference of 3%. Determine: (i) numerical aperture of the fibre, (ii) the critical angle at the core-cladding interface. (3)

7(a). Discuss the reflection and transmission of waves on a string at a boundary and derive the expressions for reflection and transmission coefficients. (4)

(b). Show that in the steady state the amplitude and phase of a driven oscillator adjust themselves so that the "average power supplied by the driving force just equals that being dissipated by the frictional force". (3)