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FIRST SEMESTER

Roll No.....
B.Tech. [All Groups]

SUPPLEMENTARY EXAMINATION

February (2019)

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). What do you mean by inertial frame of reference? Is earth an inertial frame of reference?
 - (b). Why quartz is a doubly refracting substance but not glass? Explain.
 - (c). Distinguish between plane polarized and circular polarized light.
 - (d). Find the velocity with which a body should travel so that its length becomes half of the rest length.
 - (e). Define 'attenuation' in optical fibre. Write the relation for signal attenuation per unit length in decibel for optical fibre.
 - (f). Explain "metastable state" and 'stimulated emission' in LASER.

- 2(a). Explain the objective of Michelson- Morley experiment and also derive the expression for the fringe shift. Discuss the merits and demerits of this experiment. (4)
- (b). Prove that $E^2 - p^2c^2 = m_0^2c^2$ is invariant under Lorentz transformation. (3)

- 3(a). State and explain Brewster law. Show that when light is incident on a transparent substance at polarizing angle, the reflected and refracted rays are at right angle to each other. (4)
- (b). Discuss Fresnel's diffraction at a straight edge and obtain the expressions for the locations of the bright and dark bands. (3)

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4(a). Write the equation of motion for a forced mechanical oscillator. Derive the expression for the displacement of a particle in a forced harmonic oscillator and discuss the variation of velocity amplitude and displacement amplitude with the driving force frequency (ω) for different value of damping constant. (4)

(b). Quality factor (Q) of a sonometer wire is 2×10^4 . On plucking, it executes 240 vibrations per second. Calculate the time in which the amplitude decreases to $\frac{1}{e^2}$. (3)

5(a). Explain the term 'population inversion' in laser. Discuss the principle and working of Ruby laser with the help of suitable energy level diagram. (4)

(b). A laser source of wavelength 6000 \AA , coherence width 4 mm and power 10 mW shines on a surface 100 m away. Deduce the (i): angular spread and (ii): areal spread. (3)

6(a). What is material dispersion? Prove that in case of material dispersion

$$\Delta\tau = -\frac{\lambda_0 l}{c} \frac{d^2 n}{d\lambda_0^2} \Delta\lambda_0, \text{ where the symbols have their usual meaning.} \quad (4)$$

(b). Find the diameter of the core for single mode transmission at 8500 \AA whose refractive indices for core and cladding are 1.48 and 1.47, respectively. (3)

7(a). Explain 'impedance matching; and its significance. Mention the conditions for energy reflection between two strings with an intervening string. (4)

(b). Define quality factor Q of a damped harmonic oscillator and obtain expression in terms of relaxation time. (3)