

B.E., First Semester  
ASP-X01: Applied Physics  
(Common with CSE, Bio-Tech, IT, ECE, Civil, EEE)

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Section.

x-x-x

Question I Attempt any five parts (2 x 5=10)

- (a) List the essential characteristics of damped oscillations which differentiates it from free oscillations.
- (b) How do you interpret the oscillatory behavior of an over-damped LCR circuit.
- (c) What do you understand by terms population inversion and light amplification.
- (d) The four-level laser is easiest to sustain. Justify this statement.
- (e) What is the role of Canada balsam layer in the Nicol prism.
- (f) How do you experimental differentiate between unpolarized and circularly polarized light.
- (g) What are various kinds of dispersions of light signal propagating in optical fiber.

SECTION A

Question II

- (a) Derive the expression of power of a forced oscillator and interpret the meaning of various terms contained in it. Further show that the bandwidth of such a forced oscillator is governed by the condition  $-1 \leq \tan\phi \leq +1$ . (6)
- (b) A body of mass  $m$  is attached at the midpoint of a stretched, light and elastic string of length  $l$  under tension ( $T$ ). The body, displaced through a small displacement and released, executes simple harmonic motion. Find the time period of the motion. (4)

Question III

- (a) Derive the expression for wave equations for propagation of EM waves in a dielectric medium and bring out the essential features out of it. Why do we consider only the electric field oscillations of EM waves to understand the optical phenomenon. (6)
- (b) What is a Poynting vector and state its physical significance. Further show that average value of Poynting vector can be expressed as  $\vec{S}_{av} = \vec{E}_{rms} \times \vec{H}_{rms}$ . (4)

P.T.O.

(2)

**Question IV**

- (a) Derive the expression for the SHM resulting from the superposition of two SHMs expressed as  $y_1 = A\sin 25t$  and  $y_2 = A\sin 28t$ . What shall be the frequency and amplitude of resultant SHM. Draw the displacement versus time graph for the resultant SHM. (5)
- (b) Write down four Maxwell's equations and qualitatively justify that they form the basis for interpreting all the electric and magnetic phenomenon. (5)

**SECTION B****Question V**

- (a) What is a Babinet compensator. Discuss its construction and working while clearly revealing out its role in polarization of light. (4)
- (b) How do you understand the phenomenon of optical activity through wave theory of light. (3)
- (c) A beam of light has intensity of 180 SI units after emerging out of a Nicol prism. It is allowed to pass through another similar Nicol prism with its optics axis inclined to that of previous one at an angle of  $45^\circ$ . What is the intensity of the final emergent beam of light. (3)

**Question VI**

- (a) Discuss the construction and working of a ruby laser. List its operational drawbacks while justifying them under the framework of three level lasers. (6)
- (b) Using Einstein's theory, show that the lasing action is non-equilibrium phenomenon possible at negative absolute temperatures. (4)

**Question VII**

- (a) Discuss various dispersions and attenuations suffered by the light signal propagating through an optical fibre. (4)
- (b) Discuss the applications of the optical fibre in the field of sensors. (6)