Exam.Code:0906
Sub. Code: 6242

2014

B.E. , Second Semester

ASP-X01: Applied Physics

(Common with EEE, BIO, ECE, CIVIL, MECH)

Time allowed: 3 Hours **Max. Marks: 50**

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

x-x-x

Question 1 : Attempt any 5 questions 2x5 = 10

(a) Explain, graphically, the variation of potential energy with time and displacement.

(b) A mass of 2 kg is attached to a spring with constant 18 N/m. It is then displaced to the point x= 2. How much time does it take for the block to travel to the point x= 1?

(c) What will be the effect of increasing resistive component on the variation of displacement amplitude with angular frequency? Discuss it graphically.

(d) What do you understand by curl of a vector? Give its physical significance as well.

(e) Explain the importance of resonator in the construction of a laser.

(f) In the Nicol Prism construction, one of the parallelogram angles is reduced 68 degrees. Explain its importance!

(g) What is the relation between dispersion and the maximum bit rate? Explain their dependence!

Part A

Question 2

(a) Derive differential and linear equation of motion for a damped mass-spring system. Discuss, qualitatively, conditions for under-, over-and critical dampings. 6

(b) Write down differential equation of motion, explaing various terms involved. Given that a mass of 1 kg is suspended from a spring of stiffness constant 25 N/m. If the frequency of natural oscillations is 1.2 times of the frequency of damped oscillations, find the damping constant. 4

Question 3

(a) Discuss the variation of phase difference, between displacement and external force, with the angular frequency of the external force in the case of mechanical forced oscillator. Also, explain the effect on resistive component on this variation. 6

(b) What do you understand by bandwidth for series LCR circuit? Derive its formulation in terms of circuit components. 4

Question 4

(a) Derive formulation for reflection and transmission amplitude for the oblique incidence of an electromagnetic wave having E-field oscillations in the plane of incidence. Discuss phase relation between incident and the reflected components. 6

(b) A plane monochromatic electromagnetic wave travels from one medium (refractive index = 1.1) to another (refractive index = 2.2) with electric field oscillating within the plane of incidence. What will be the reflection and transmission coefficients for the system if incident wave makes an angle 60 degrees with the normal to the interface? 4

Part B

Question 5

(a) Discuss the active medium, pumping and resonator in the He-Ne laser. Explain the various transitions using appropriately labelled energy-level diagram. 4

(b) Explain the concept of light amplification and attenuation, while passing through a medium. Discuss the factors controlling light amplification. 3

(c) How does laser differ from the normal optical light source? Describe various components involved in designing a laser. 3

Question 6

(a) What do you understand by polarization of light? Explain the usage of Nicol prism in obtaining plane polarized light. How did polarization confirm the transverse nature of light? 4

(b) A lab is equipped with a light source (wavelength = 500 nm) of circularly polarized light but an experimental work required to have linearly polarized light. One of the students decided to make use of phase retardation plate (refractive index of E-rays = 1.533 and refractive index of O-rays = 1.544). What should be thickness of the phase retardation plate? 3

(c) What is Brewster's law? Derive relation between Brewster's angle and refractive index. How does Brewster's law is used to produce a plane polarized light? 3

Question 7

(a) Define acceptance angle and derive its formulation in terms of the refractive indices of core and cladding. Give its physical significance as well. 4

(b) For a step-indexed fiber, refractive indices of core and cladding are 1.5 and 1.477 respectively. Calculate acceptance angle and numerical aperture. 3

(c) Define and formulate the attenuation limit? Discuss its dependence on the refractive index of the core/cladding, wavelength and the spectral width of the incident wave. 3

x-x-x