Exam.Code:0905
Sub. Code: 33244

2125
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. I which is compulsory and selecting two questions from each Part.

x-x-x

Question 1 : Attempt any 5 questions $2\times5 = 10$

(a) Assume that a narrow tunnel is dug between two diametrically opposite points of the earth. Treat the earth as a solid sphere of uniform density. Show that if a particle is released in this tunnel, it will execute a simple harmonic motion. Calculate the time period of the motion.

(b) Two 1-D SHM along x-axis superpose with each other. What will be the equation of motion for the resultant wave if two waves have different frequencies but same amplitude and phase?

(c) What do you understand by transient and steady state behaviour of a forced oscillator?

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

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

(f) Two Nicol prisms are aligned to have maximum intensity for the transmitted light. Through what angle should one of the prims to be rotated to reduce the intensity to one third of its maximum value?

(g) The presence of moisture in the core material of an optical fiber attenuates the transmission in the telecommunication range. Explain!

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) Discuss, qualitatively, the conditions for heavy and under damping. Examine whether the discharge of a capacitor of 1 micro-farad through a resistor of 400 ohms and inductor of 0.1 H is oscillatory or not. 4

Question 3

(a) Derive the formulation for average power dissipated in a series LCR forced oscillator. Discuss, using an appropriate diagram, its variation with an angular frequency of the driving force. 6

(b) Show that the bandwidth of the resonance absorption curve defines the phase angle range (-45, 45) degrees. 4

Question 4

(a) Derive Maxwell's equations using basic laws of the electromagnetism and discuss their signficance. 6

(b) Show that electric field, produced by a static charge, is irrotational whereas electric filed produced by a varying magnetic flux is rotational. 4

Part B

Question 5

(a) What are the various methods to achieve pumping in a laser? Describe pumping method, with energy level diagram, used in He-Ne laser. 4

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

(c) Draw an energy level diagram for the Ruby laser and explain the transitions responsible for the laser output. Why output of the Ruby laser is pulsed? 3

P.T.O.

Question 6

(a) You are provided with a piece of calcite crystal. How will you finish, mechanically, this crystal to obtain a plane-polarized light? Also, explain the polarization process using an appropriate diagram. What will be the change in your strategy, if provided with a quartz crystal? 4

(b) Explain the working principle of polaroid in obtaining a polarized light! 3

(c) How should the polarizer and analyzer be adjusted so that the intensity of light is reduced to 25% of its original intensity before polarization? 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) What do you understand by modes for communication through an optical fiber? Discuss its dependence on the wavelength of incident, radius of the core and the refractive indices of the core and the cladding. 3

(c) A 5 mW laser beam passes through a 26 km long fiber of attenuation coefficient 0.2 dB/km. Calculate the power at the output end. 3

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