Exam.Code:0905
Sub. Code: 33208

2125

B.E., First Semester

APH-101: Oscillation and Optics

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) The energy of a note of frequency of 100 Hz decreases to one half of its original value. Calculate the Q-factor of the system.

(b) What do you understand by resonance? Discuss its importance in designing bridges and buildings.

(c) What will be the effect on interference pattern if two coherent sources do not have same amplitude?

(d) For a N-slit diffraction setup, how many secondary minima will be present between two consecutive principal maxima?

(e) Why stimulated emission lead to coherence in the output radiation?

(f) Calculate the thickness of a quarter wave plate for light of wavelength 500 nm and no = 1.544 and ne = 1.533.

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

Part A

Question 2

(a) Derive differential and linear equation of motion for LC oscillator with zero resistance. Graphically explain variation of charge and current with time. 3

(b) A simple pendulum has a time period of 1 second and an amplitude 500 mm. After 100 complete oscillations, its amplitude reduces to 50 mm. Calculate the quality factor and the relaxation time. 4

(c) Prove that in case of forced mechanical oscillator, Quality factor is equal to the amplification factor. 3

Question 3

(a) A man stands on a platform which vibrates simple harmonically in a vertical direction at a frequency of 5 Hz. After which value of displacement, man will lose contact with platform? 3

(b) 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. 2

(c) Derive formula for the average power dissipated in a forced mass-spring system and discuss its variation with the frequency of driving force. 5

Question 4

(a) What are the ultrasonic waves? Describe a method to measure wavelength of ultrasonic waves in a given liquid. 3

(b) What do you understand by reflection and transmission amplitude coefficients? Derive formulation for the reflection and transmission coefficient in terms of medium impedances for string wave. 4

(c) A wave of frequency 400 Hz is travelling with a speed of 800 m/s. How far two points are situated whose displacement differ in phase by 45^o? 3

P.T.O.

Part B

Question 5

(a) Give theory, experimental setup and method to determine the small difference of nearby wavelengths with Michelson's Interferometer. 5

(b) What is the role of interference in holography? Explain the formation of hologram with the appropriate ray-digram. 3

(c) Differentiate between attenuation and dispersion of the signal transmission. Explain the phenomena of waveguide dispersion. 2

Question 6

(a) Derive formulation for the resultant intensity for a single-slit diffraction. Extend it to derive conditions for maxima and minima for double-slit diffraction. 4

(b) What are the various methods to achieve pumping in a laser? Describe pumping method used in semiconductor laser. 4

(c) What are differences between step-indexed and graded-indexed fiber? 2

Question 7

(a) In a biprism arrangement, the eye-piece is located at a distance of 1.5 m from the source. The distance between two virtual sources is found to be 0.7 nm. Calculate wavelength of light, if the eye-piece has to be moved 9.44 mm for counting 10 fringes. 3

(b) Show that in a diffraction grating with 400 lines per centimeter and light of wavelength 550 nm, third and higher order principal maxima are not visible. 3

(c) Explain the phenomena of double refraction. How is it used in the construction of phase retardation plates? 4

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