Exam.Code:0906
Sub. Code: 6667

2010
B.E. (Mechanical Engineering) Second Semester
APH-201: Oscillation and Optics
(Common with ECE, IT and 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 Unit. Calculators are allowed.

x-x-x

I. Answer the following briefly:-

a) Why do excessively thin films seen by reflected light appear dark?

b) Mention differences between temporal and spatial coherence.

c) Compare the diffraction patterns by a single slit of width L, two slits of spacing L and a diffraction grating of N lines and total width L.

d) Calculate the average acceleration in one time period in a simple harmonic motion.

e) Give examples from daily life where the phenomenon of the resonance is used. (5x2)

UNIT – I

II. a) A particle is executing SHM. Show that, average K.E. over a cycle is equal to average P.E. over a cycle and both of them are equal to half of the total energy.

b) What do you mean by characteristic impedance of a string? Prove that when a wave travelling on the string is completely reflected it undergoes a phase change of Π. (2x5)

III. a) For a damped harmonic oscillator show that the work done against the damping force in an infinitesimal time dt is equal to the loss of energy of the mass m during the same time interval dt.

b) What are ultrasonic waves? Discuss the Magnetostriction method of generation of ultrasonic waves. (2x5)

IV. a) What is meant by sharpness of resonance? Derive an expression for the band-width of the sharpness of resonance of an LCR circuit and obtain its relation with the quality factor.

b) Discuss the critically damped harmonic oscillator. Prove that $x = (A+Bt)\, e^{-rt/2m}$ is the solution of critically damped oscillator, where r is the damping constant, m is the mass and A & B are the constants. Explain the behaviour of the oscillator in such a case when it receives an impulse which gives the initial velocity V. (2x5)

P.T.O.

UNIT – II

V. a) Derive an expression for the resolving power of a plane transmission grating.

b) Define specific rotation. Describe construction and working of a Laurant's half shade polarimeter. (2x5)

VI. a) A typical relative refractive index difference for an optical fiber designed for long distance transmission is 1%. Estimate the numerical aperture for the fiber when the core index is 1.46. Further, calculate the critical angle at the core cladding interface within the fiber.

b) Discuss the process of reconstruction of image in Holography.

c) Mention the similarities and differences between interference and diffraction of light. (4,3,3)

VII. a) Explain the construction and working of the He-Ne laser.

b) A lens is coated with a thin film of transparent substance magnesium fluoride (MgF_2) with n = 1.38 to reduce the reflection from the glass surface (n = 1.50). How thick a coating is needed to produce a minimum reflection at the centre of the visible spectrum (λ = 550 nm)? (2x5)

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