Term End External Examination 4th Semester (Session- July 2024)

Subject: Physics

Course No and Title: PHYC1422M/Waves and Optics

Time: 2.15 hours   Max Marks:100   Min. Marks:40

Section A: Objective Type Questions

Q1. Choose the appropriate Answer: (8x1.5=12)

i. SHM can be regarded as a projection of
 A   Linear Motion   B   Uniform Circular Motion
 C   Uniform Linear Motion   D   None of the above

ii. The Superposition Principle holds for
 A   Linear systems only   B   Non-Linear systems only
 C   Both A &B   D   None of the above

iii. For a non dispersive medium, phase velocity v_p is related to group velocity v_g as

 A $v_p > v_g$ B $v_p < v_g$
 C $v_p = v_g$ D   None

iv. What is the range of frequencies that humans are capable of hearing?
 A   20Hz to 20kHz   B   2Hz to 50kHz
 C   All frequencies below 20Hz   D   All frequencies above 20Hz

v. Which of the following light phenomena confirms the transverse nature of light?
 A   Refraction of light   B   Diffraction of light
 C   Dispersion of light   D   Polarization of light

vi. Interference and Diffractions suggest that the nature of light is
 A   Electromagnetic in nature   B   Quantum in nature
 C   Wave in nature   D   All of the above

vii. The life time of electron in meta stable state is of the order of
 A 10^{-9}s   B 10^{-3} s.
 C 10^{-8} s.   D 10^{-7} s.

viii. The condition for achieving laser action is…
 A   The system must be in a state of population inversion
 B   The excited state of the system should be in metastable state
 C   The atom should be in lower energy state
 D   All of the above

Section-B: Descriptive Type Questions (Short Type)

Q2: Answer all the Questions   (8 x 4 =32)

i. What kind of equivalent motion will have for two superimposing harmonic oscillations, at right angle to each other, of equal amplitude and frequencies having phase difference of $\frac{\pi}{2}$.

ii. If two SHMs having frequencies 450 rad/sec and 406 rad/sec are superimposed, calculate the no. of beats produced.

iii. Can stationary waves be produced in a string of infinite length? Comment?

iv. Discuss the limits of Audibility. What is Decibel and Phon?

v. What are coherent sources? What are the conditions for two sources to be coherent?

vi. Why do radio waves diffract around buildings while visible light waves do not?

vii. What is LASER? Write its two applications?

viii. Write short notes on Spontaneous and induced Emission in LASER.

Section – C: Descriptive Type Questions (Medium Type)

Answer all the questions: (4 x 7=28)

Q 3. Discuss Analytically Superposition of two Collinear SHOs of different frequencies.

OR

Discuss analytically superposition of two perpendicular Harmonic oscillators having frequency in the ratio 1:2.

Q 4. Define Phase velocity and Group velocity. Derive relation between them.

OR

Define reverberation, reverberation time and what are the causes of reverberation?

Q 5. Describe Fresnel's biprism. How wavelength of a monochromatic source of light can be determined with its help.

OR

Explain the difference in interference by division of wave front and by division of amplitudes. Give examples.

Q6. How is zone plate constructed? What are positive and negative zone plates?

OR

Explain the terms; coherence length and coherence time

Section – D: Descriptive Type Questions (Long Type)

Answer any two of the following: **(2 x 14=28)**

Q 7. Discuss both analytically and graphically the superposition of two perpendicular harmonic oscillators having same frequency.

Q8. State and Prove Sabine Formula for reverberation time.

Q 9. Discuss in detail the formation of Newton's rings by reflected light. Why Newton's rings are circular.

Q 10. Discuss Fraunhofer diffraction at a single slit. Derive expression for intensity distribution and find the maxima and minima and state their positions.