U.G. 2nd Semester Examination - 2022

PHYSICS

[HONOURS]

Course Code: BPHSCCHC 202

Course Title: Waves and Optics

Full Marks : 30 Time : 2 Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer any **ten** questions from the following: 1×10=10

a) The wavelength of certain light in air is 600nm. Find its wavelength in a medium of refractive index 1.5.

b) Sketch graphically the shapes of the first three modes in a pipe open at both ends.

c) Explain plane wavefront.

d) What do you mean by spatial coherence?

e) What is the radius of the first zone in a plate of principal focal length 20cm for light of wavelength 6000 Å ?

f) In what respects does a zone plate differ from a convex lens?

g) Derive the differential equation of motion of a simple harmonic oscillator.

h) What is the difference between 'phase' and 'epoch'?

i) What is the significance of linearity used in the principle of superposition?

j) Write down the expression of spherical wave with proper meaning of the symbols used.

k) What is the role of the compensator in Michelson interferometer?

l) What is ripple waves?

m) Explain phase and group velocities.

n) A string of length 50cm and mass 0.5kg is stretched by 9kg weight. Calculate the velocity of tranverse vibrations of the string.

o) Give one example each of plucked and struck stringed musical instruments.

2. Answer any **five** questions: 2×5=10

a) Why is it necessary to use narrow source for Fresnel's biprism and extended source for Newton's rings experiments?

b) What are Lissajous figures? Write down one practical application of Lissajous figures. 1+1

c) Explain the existence of multiple foci of a zone plate.

d) Write the Newton's formula for velocity of sound and explain it. Give Laplace's correction. 1+1

e) A 10m long wire is stretched between two fixed supports such that two adjacent glass plate. Calculate the refractive index of the liquid.

f) Calculate the coherence time and spectral width $(\Delta\lambda)$ for a source of mean wavelength 5893 Å and coherence length 1cm.

g) Using adiabatic gas law show that the velocity of sound wave througth gases is given by $v = \sqrt{\frac{\gamma RT}{M}}$, Here, the symbols used in the expression are of usual meaning.

h) Newton's rings are formed by light reflected normally from a plano-convex lens and a plane glass plate with a liquid between them. The diameters of *n*th and (n+10)th bright rings are 2.18mm and 4.51mm respectively. Calculate the refractive index of the liquid. Radius of curvature of the lens is 90cm and wavelength of light employed is 589.3nm.

3. Answer any **two** questions: 5×2=10

a) Explain the principle of recording and reconstruction of hologram with proper ray-diagram. In what respect does holography differ from ordinary photography? Mention some important applications of holography. $2+1\frac{1}{2}+1\frac{1}{2}$

b) A string of length 'l' is fixed at the two ends and plucked at a distance 'a' from one end through a distance 'h'. Find the expression for the displacement at any point 'x' on the string at time 't'. State the Young's law for a plucked string. 4+1

c) Distinguish between Fresnel and Fraunhofer class of diffractions. What is Fresnel's half-period zone? Fraunhofer diffraction pattern is observed by a double slit having slit width a=0.16mm and separation between the slits b=0.8mm. Find the missing orders. 2+1+2

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