



WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 2nd Semester Examination, 2021

PHSACOR04T-PHYSICS (CC4)

Time Allotted: 2 Hours

Full Marks: 40

*The figures in the margin indicate full marks.
Candidates should answer in their own words and adhere to the word limit as practicable.
All symbols are of usual significance.*

Question No. 1 is compulsory and answer any *two* from the rest

1. Answer any **ten** questions from the following: 2×10 = 20
- (a) Show that $\psi(x, t) = f(ct - x)$ represents a wave propagating along positive x -axis with a velocity c .
 - (b) State the conditions for production of sustained interference fringes.
 - (c) Compare a zone plate with a convex lens.
 - (d) Calculate the fringe width of interference pattern produced in Young's double slit experiment with slits 10^{-3} meter apart on a screen 90 cm away. Wavelength of light is 6000 \AA .
 - (e) How can stationary waves be formed from progressive waves?
 - (f) Two closed pipes of lengths 1.1 m and 1.046 m are sounded together at the fundamental modes. If the speed of sound in air is 340 m/sec, calculate the number of beats generated per second.
 - (g) Distinguish between Fresnel and Fraunhofer diffraction.
 - (h) Construct the Lissajous figure along with the direction of the trajectory for the following motions: $x = \cos 2\omega t$, $y = \sin 2\omega t$.
 - (i) What do you mean by absent spectra in a diffraction grating pattern?
 - (j) What are the corrections introduced by Laplace in the Newton's formula for velocity of sound in a gaseous medium?
 - (k) Explain in brief how does straight fringes are produced in Michelson Interferometer.
 - (l) A He-Ne laser has a coherence length of 10 m. Determine the value of the corresponding coherence time.
 - (m) What do you mean by fringes of equal thickness? Give an example.
 - (n) Define plane and spherical waves.
2. (a) For a plane progressive wave, show that the instantaneous energy density is not constant, but its average value over a complete period is constant. 4

- (b) A particle moves in xy plane such that its position at any instant of time t is given by $x = a \cos \omega t$ and $y = b \cos 2\omega t$. Show that the particle describes an arc of a parabola. 3
- (c) Two strings A and B of the same material, cross-sectional area and length are fixed at their ends and subjected to tension in the ratio of 2.89:1 respectively when the strings are vibrated, 8 beats per second are heard between the third harmonic of string A and the fifth harmonic of string B. Calculate fundamental frequencies of each string. 3
3. (a) What do you mean by 'string'? Find the expression for kinetic energy for transverse vibration of a string. 1+4
- (b) A string vibrates with a frequency n under a certain tension. When the tension is increased by 2 kg-wt, the frequency becomes $(3/2)n$? What was the original tension? 2
- (c) Show that in vibration of air column in an open pipe all harmonics can be generated. 3
4. (a) What are Newton's rings? Explain how the Newton's ring experiment can be used to determine the refractive index of an unknown liquid. 2+3
- (b) Why is it necessary to use narrow source for Biprism and extended source for Newton's ring? 2
- (c) In a biprism experiment, the fringe-width is 0.3 mm at a distance 150 cm from the biprism for light of wavelength $\lambda = 6 \times 10^{-5}$ cm. The biprism is made of glass of refractive index 1.5 and is placed 25 cm away from the illuminated slit. Calculate the vertex angle of the biprism. 3
5. (a) What are Fresnel's half period zones? Show that areas of all these zones are same. 1+2
- (b) Find the expression of intensity of Fraunhofer diffraction pattern due to a single slit. Discuss the conditions for maxima and minima. 3+2
- (c) A grating of width 2 cm has 500 lines per cm. Can it resolve D_1 and D_2 line of sodium in 1st order? 2

N.B. : Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.

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