



WEST BENGAL STATE UNIVERSITY
B.Sc. Honours 2nd Semester Examination, 2020

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
- Show that in a non-dispersive medium the phase velocity and the group velocity of a progressive wave are equal.
 - If the equation $y = a \sin^2(kx - \omega t)$ represents a progressive wave, then find out the amplitude and frequency of the wave.
 - Explain how Laplace corrected the Newton's formula for the velocity of sound.
 - In Melde's experiment the number of loops on the string decreases from 5 to 4 when the tension is increased by 45 gm-wt. What was the initial value of the tension?
 - Two SHMs produce Lissajous' figures. It is found that the trajectory looks like the "figure of eight". If the frequency of one fork is 250 Hz, then find the probable frequencies of the other.
 - Define 'decibel' and 'phon'.
 - State the 'principle of superposition' of waves.
 - Write Huygens' principle of propagation of light wave.
 - A plane diffraction grating has 104 lines per mm. Monochromatic light of wavelength 589 nm is incident normally on the grating. What is the highest order of the principal maximum visible in the spectra?
 - What will happen to the fringe pattern if the acute angles of the biprism are increased?
 - Write the basic differences between Fresnel and Fraunhofer diffraction.
 - Find the missing orders of a double slit Fraunhofer diffraction pattern if the slit widths are 0.1 mm and they are 0.8 mm apart.
 - What is the relation between the resolving power and the dispersive power of a plane transmission grating?
 - State any two differences between the fringes produced by Michelson interferometer and Newton's ring?

2. (a) Derive the resultant motion when two SHMs with same frequency, but with different amplitudes, at right angles to each other are superposed. Draw the resultant trajectory when the phase difference between them is π . 4+1
- (b) Two wires of the same material are stretched with the same load. Their lengths are 40 cm and 60 cm and their diameters are 1.2 mm and 1.5 mm respectively. The first string resonates with a fork of frequency 384 Hz. Find the frequency of the other. 3
- (c) Write the conditions of formation of stationary waves. 2
3. (a) Derive an expression for velocity of a plane longitudinal wave in a fluid medium. 4
- (b) 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
- (c) Two open pipes, blown together, produce 5 beats per second (due to the fundamentals). If the shorter pipe is 1 m long, calculate the length of the longer pipe. Given, speed of sound in air is 340 m/s. 2
4. (a) What do you mean by interference of light? 2
- (b) Show that in Young's double slit experiment, the locus of the point, corresponding to the maxima or minima is a hyperbola. 4
- (c) Show that the diameter D_n of the n -th (dark) Newton's ring, when the surfaces of radii R_1 and R_2 are placed in contact, is given by, $\frac{1}{R_1} \pm \frac{1}{R_2} = \frac{4n\lambda}{D_n^2}$. 4
5. (a) What is a zone plate? Prove that a zone plate has multiple foci. Compare the actions of a zone plate and those of a converging lens. 1+2+2
- (b) State Rayleigh's criterion for the resolution of spectral lines. 2
- (c) A diffraction grating of 2 cm width is just able to resolve sodium D-lines in the second order. Find the number of rulings per mm. 3

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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