



WEST BENGAL STATE UNIVERSITY
B.Sc. Honours 2nd Semester Examination, 2019

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.*

Answer Question No. 1 and any two questions from the rest

1. Answer any **ten** questions from the following:

2×10 = 20

- ✓ (a) State Huygen's Principle.
- (b) In a Lloyd's mirror experiment, calculate the ratio of the intensities at the interference maxima and minima if the mirror reflects only 75% of the light incident on it.
- ✓ (c) Distinguish between grating spectra and prism spectra.
- ✓ (d) Why is it necessary to use narrow source for biprism and extended source for Newton's rings?
- ✓ (e) What are the basic characteristics of a LASER source?
- ✓ (f) State Rayleigh's criterion of resolution.
- ✓ (g) In Michelson's interferometer, 100 fringes cross the field of view when the movable mirror is displaced through 0.02948 mm. Calculate the wavelength of the monochromatic light used.
- (h) Explain why the quality of sound is richer in an open organ pipe than a closed organ pipe.
- ✓ (i) Give one example of each of struck string and plucked string instrument.
- ✓ (j) Give the main difference between the fringes produced by a biprism and those produced by a Lloyd's mirror.
- ✓ (k) Deduce the expression for frequency of the fundamental tone in case of pipe open at both ends.
- (l) Show that the first order and second order spectra will never overlap when a grating is used for studying a light beam containing wavelength components from 400 nm to 700 nm.
- ✓ (m) Discuss about the requirements of holography.
- (n) Show that the velocity of longitudinal wave in a solid is larger than the velocity of transverse wave.

$$c = n\lambda$$

$$n = \frac{c}{\lambda}$$

$$v = \frac{c}{\lambda}$$

2. (a) Write the expression for Fraunhofer diffraction pattern of a double slit. 2
- (b) Deduce the expression for maxima and minima for intensity distribution of double slit. 2
- (c) A parallel beam of light of wavelength $5460 \text{ \AA}$ is incident at an angle 30° on a plane transmission grating which has 6000 lines/cm . Find the highest order of spectrum that can be observed. 3
- (d) Explain absent spectra. 3
3. (a) 'n' number of simple harmonic motions along the x-axis having the same amplitude 'a' and the same angular frequency ' ω ' but equal successive phase advancement δ , are superposed. Find the resultant motion. 4
- (b) Define group velocity and phase velocity. Deduce the relation $v = c - \lambda \frac{dc}{d\lambda}$, 2+3+1
where v is the group velocity and c is the phase velocity. In which type of medium will the two velocities be equal?
4. (a) What are stationary waves? Give the theory of formation of stationary waves. 1+3
- (b) An object placed in air is vibrating with a frequency 250 Hz and releasing sound energy uniformly in all directions at a rate 10 J/s . Calculate the intensity and amplitude of the wave at a distance of 100 m from the source. Given density of air $= 1.3 \text{ kg/m}^3$ and the speed of waves in air $= 340 \text{ m/s}$. Assume no loss of energy in air during propagation. 2
- (c) Consider the formation of a hologram with a point object and a plane reference wave. Choose the z axis to be along the normal from the point source to the plane of the photograph assumed to be coincident with the plane $z = 0$. Obtain the interference pattern recorded by the hologram. (Assume the reference wave to fall normally on the photographic plate). 4
5. (a) State the conditions for the production of sustained interference fringes. 2
- (b) Show that the diameters of Newton's dark rings are proportional to square root of natural number. 3
- (c) What is the difference between the fringes produced by Michelson interferometer and Newton's ring instrument? 2
- (d) When a narrow monochromatic source of light of wavelength $5893 \text{ \AA}$ is placed at a distance 50 cm from the biprism, width of the fringes obtained on a screen placed 1 m from the biprism is found to be 0.12 mm . Find the obtuse angle of the biprism. (R.I. of material of biprism is 1.5) 3

—x—

(180 - 2\alpha)