

TDC Odd Semester Exam., 2020
held in July, 2021

PHYSICS

(Honours)

(1st Semester)

Course No. : PSHH-103

(Geometrical Optics, Waves and Oscillations)

Full Marks : 35

Pass Marks : 12

Time : 2 hours

*The figures in the margin indicate full marks
for the questions*

Answer **five** questions, taking **one** from each Unit

UNIT—I

1. (a) State Fermat's principle and apply it for the derivation of laws of reflection at a curved surface. 1+3=4
- (b) Two thin convex lenses each of focal length 20 cm are placed coaxially 5 cm apart. Calculate the position of principal and focal planes. 3

2. (a) Derive Lens Maker's formula for a thin convex lens. 3
- (b) What are the uses of Lens Maker's formula? 2
- (c) Find focal length of a double concave lens bounded by spherical surfaces of radii of curvature 20 cm each and having refractive index $5/3$. The surrounding medium is air. 2

UNIT—II

3. (a) What do you understand by spherical aberration? 1
- (b) Discuss three methods of minimising spherical aberration. 6
4. (a) Explain how transparent sphere acts as an aplanatic surface. 4
- (b) Discuss how the idea of a transparent sphere acting as an aplanatic surface can be utilized in the construction of Abbe's high power oil immersion objective. 3

(3)

UNIT—III

5. (a) Define transverse and angular magnifications. 2
(b) Deduce Helmholtz-Lagrange equation. 5
6. (a) Explain the construction and principle of working of Huygen's eyepiece. 4
(b) State the advantages and disadvantages of Huygen's eyepiece. 3

UNIT—IV

7. (a) Find the resultant of two simple harmonic motions of equal periods when they act at right angles to one another. 4
(b) What are Lissajous figures? How will you trace Lissajous figures, when—
(i) the periods are equal and (ii) the phase difference is $\frac{\pi}{4}$? 3
8. (a) A system exerting damped simple harmonic motion is subjected to an external periodic force having a frequency without damping. Investigate the forced vibrations and obtain the condition for resonance. Illustrate it by an example. 5+1=6

(4)

- (b) What is the expression of amplitude at resonance? 1

UNIT—V

9. (a) What do you mean by progressive wave? Deduce the equation of a progressive wave in one dimension. 1+3=4
(b) Deduce the relation for energy of a progressive wave. 3
10. (a) Deduce the differential equation of a plane progressive wave. 3
(b) Differentiate between wave velocity and group velocity. 2
(c) For carbon disulphide, $v_D = 1635$. Deduce the group velocity, if
$$v = 5893 \times 10^8 \text{ cm}$$
$$d = 1000 \text{ \AA}$$
$$d = 0.0189$$
 2
