

1/EH-24 (i) (Syllabus-2015)

2016

(October)

PHYSICS

(Elective/Honours)

(Mechanics, Optics, Acoustics)

[Phy-01 (T)]

Marks : 75

Time : 3 hours

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

Answer Question No. 1 which is compulsory
and **any four** from the rest

1. (a) Find the value of the deviation from vertical direction suffered by a body due to Coriolis force when it is dropped from a height of 200 m at (i) equator and (ii) latitude 45°N . 3+1=4
- (b) The Young modulus of a material is $7 \times 10^{10} \text{ N/m}^2$ and the rigidity modulus is $3 \times 10^{10} \text{ N/m}^2$. Calculate the bulk modulus of the material. 4

(2)

- (c) Two thin converging lenses of focal lengths 0.3 m and 0.4 m are placed coaxially 0.2 m apart. An object is placed at a distance of 0.5 m from the first lens. Calculate the focal length of the combination, the positions of the principal points and the image. $2+2+3=7$
2. (a) Find the expressions for velocity and acceleration of a particle moving in a plane in polar coordinate system. $3+3=6$
- (b) What is central force? Write down three characteristics of central force motion. $1+3=4$
- (c) Calculate the gravitational potential and field at a point outside the thin spherical shell of mass M and radius R . $4+1=5$
3. (a) Define elastic and inelastic collisions. During the direct impact two bodies stick together to form a single entity. Show that the collision is inelastic. $1+1+4=6$
- (b) State the postulates of special theory of relativity. 2
- (c) What are the drawbacks of Galilean transformation equations? Derive Lorentz transformation equations. $2+5=7$

D7/22

(Continued)

(3)

4. (a) What is the physical significance of moment of inertia? 2
- (b) State and prove parallel axes theorem of moment of inertia. $1+3=4$
- (c) Derive Poiseuille's equation. 6
- (d) A soap bubble of surface tension $25 \times 10^{-3} \text{ N/m}$ is slowly enlarged from a radius of 0.03 m to a radius of 0.05 m. Calculate the work done in the process. 3
5. (a) Define cardinal points of a system of coaxial lenses. Name the different cardinal points and represent them in a ray diagram. $1+3=4$
- (b) What is monochromatic aberration? Name the different kinds of monochromatic aberration and define them. $1+2\frac{1}{2}+5=8\frac{1}{2}$
- (c) Which of the two eyepieces, Ramsden or Huygens, one should prefer for observing biological specimens? Explain. $2\frac{1}{2}$
6. (a) Describe the construction and working principle of Michelson interferometer. What are the conditions to observe circular and straight fringes? $2+4+2=8$

D7/22

(Turn Over)

- (b) In Newton's rings experiment, if the diameters of the 3rd and 23rd rings are 1.81×10^{-3} m and 5.1×10^{-3} m respectively and the radius of curvature of the curved surface of the lens is 1 m, calculate the wavelength of the light used. 4
- (c) Define normal and anomalous dispersion. 3
7. (a) Define resolving power of an optical instrument. Obtain an expression for the resolving power of a plane diffraction grating. $1+4=5$
- (b) What is double refraction? How is this phenomenon used to produce plane polarized light? $2+3=5$
- (c) What is grating element? Discuss how you can use a plane diffraction grating to determine the wavelength of an unknown monochromatic light. $1+4=5$
8. (a) What are reverberation and reverberation time? Derive Sabine's formula for reverberation time. $2+6=8$
- (b) Find an expression for the velocity of sound in a thin long rod. 4
- (c) Explain the terms 'intensity' and 'loudness'. What are their units (SI system)? $2+1=3$
