

**B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MAY 2014****Second Semester**

Core Course—MECHANICS AND PROPERTIES OF MATTER

(Common for the Programmes B.Sc. Physics (Model I),

B.Sc. Physics (Model II), B.Sc. Physics - E.E.M., B.Sc. Physics - Instrumentation)

[Prior to 2013 admissions]

Time : Three Hours

Maximum Weight : 25

*Candidates can use non-programmable scientific calculator.***Part A (Objective Type)***Answer all questions.**Weight 1 for each bunch.***Bunch I**

1. Dimensional formula for force is :

(a)  $MLT^{-2}$ .

(b)  $MLT^{-1}$ .

(c)  $ML^2T^{-1}$ .

(d)  $ML^{-2}T^{-1}$ .

2. Linear momentum in translation motion is equivalent to angular momentum  $L = \text{—————}$  in rotatory motion :

(a)  $vI$

(b)  $I\omega$ .

(c)  $v^2I$ .

(d) None of these.

3. A progressive wave is given by  $y = 10 \sin (100x + 400 t)$ . The wave velocity is :

(a) 10.

(b) 40.

(c) 4.

(d) 400.

4. Which material is more elastic ?

(a) Steel.

(b) Wood.

(c) Lead.

(d) Rubber.

**Bunch II**

5. When temperature increases, the surface tension of a liquid ?

(a) Increases.

(b) Decreases.

(c) Remains the same.

(d) None of these.

**Turn over**

6. Pressure exerted by a liquid depends upon :
- (a) Density. (b) Viscosity.  
(c) Critical velocity. (d) Terminal velocity.
7. An electron is revolving around the nucleus. The centripetal force is :
- (a) Gravitational. (b) Electrostatic.  
(c) Gravitational and Electrostatic. (d) Neither gravitational nor electrostatic.
8. The moment of inertia of a body does not depends upon :
- (a) The angular velocity of the body.  
(b) The mass of the body.  
(c) The distribution of mass 'm' in the body.  
(d) The axis of rotation of this body.

## Bunch III

9. Viscosity is \_\_\_\_\_.
- (a) Adhesive force. (b) Cohesive force.  
(c) Long range force. (d) None of these.
10. Soap helps in cleaning of cloths because of :
- (a) It reduces the surface tension. (b) It increases the surface tension.  
(c) It absorbs the dirt. (d) If some other reasons.
11. The energy density of a plane progressive wave is directly proportional to :
- (a) Square of the amplitude. (b) Square of the frequency.  
(c) Density of the medium. (d) All are correct.
12. Shearing strain is expressed by :
- (a) Angle of shear. (b) Angle of twist.  
(c) Decrease in volume. (d) Increase in area.

## Bunch IV

13. The quantity that varies in uniform circular motion is :
- (a) Linear velocity. (b) Linear momentum.  
(c) Centripetal acceleration. (d) Centripetal force.  
(e) All of the above.

14. Radius of gyration of a disc about its central axis is given by :

(a)  $\frac{R}{\sqrt{2}}$ .

(b)  $R\sqrt{2}$ .

(c)  $\frac{R}{2}$ .

(d)  $2R$ .

15. The equations of two progressive waves are given by  $y_1 = a \sin(\omega t - kx)$  and  $y_2 = a \cos(\omega t - kx)$ .  
What is the phase difference between two waves ?

(a)  $\frac{\pi}{4}$ .

(b)  $\pi$ .

(c)  $\frac{\pi}{2}$ .

(d)  $\frac{\pi}{6}$ .

16. The substance which shows no elastic after effect is :

(a) Copper.

(b) Silver.

(c) Quartz.

(d) Rubber.

(4 × 1 = 4)

### Part B (Short Answer questions)

Answer any **five** questions.

Weight 1 each.

17. What is meant by radius of gyration ?
18. State parallel axis theorem.
19. State Doppler effect in sound.
20. Explain, why steel girders are made in the form of I-section.
21. What is surface energy ?
22. Distinguish between streamline and turbulent motion.
23. What is Poisson's ratio ?
24. Distinguish between progressive wave and stationary wave.

(5 × 1 = 5)

### Part C (Short Essay/Problems)

Answer any **four** questions.

Weight 2 each.

25. Calculate the excess of pressure between inside and outside of a soap bubble of radius 0.5 cm. Surface tension of soap solution is  $3.2 \times 10^{-2}$  N/m.

Turn over

26. A flywheel has a moment of inertia of  $5 \text{ kg-m}^2$ . It is rotating at a speed of 5 revolutions per second. Calculate the constant torque required to stop the flywheel in 10 rotations. Calculate also the work done by the braking torque.
27. Calculate the work done in stretching a wire of cross-section  $1 \text{ mm}^2$  and length 2 m through 0.1 mm. Young's modulus of the material of the wire is  $2 \times 10^{11} \text{ N/mm}^2$ .
28. Calculate the mass of water flowing in 10 seconds through a horizontal capillary tube of circular cross section of radius  $10^{-3} \text{ m}$ . The tube is fitted at the bottom of a constant level tank at a depth of 1 m. Length of the tube is 0.3142 m.
29. A progressive harmonic wave travelling in a string is given by  $y = a \sin 2\pi \left( \frac{x}{100} - \frac{t}{0.02} \right)$  with length expressed in cm. and time in seconds. Find the wavelength amplitude, frequency and velocity of wave.
30. Obtain an expression for the centripetal force for a body in uniform circular motion.

 $(4 \times 2 = 8)$ **Part D (Essay)***Answer any two questions.**Weight 4 each.*

31. Setup the differential equation for a damped harmonic oscillator and solve it. Discuss the three different cases of damping.
32. Derive an expression for the depression at the free end of a Cantilever loaded at free end.
33. Derive an expression for acceleration due to gravity for an unsymmetric compound pendulum.

 $(2 \times 4 = 8)$