

**B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, NOVEMBER 2015****First Semester**

Complementary Course—Physics

**PROPERTIES OF MATTER, MECHANICS AND PARTICLE PHYSICS**

(For the Subjects Chemistry and Geology)

[2013 Admission onwards]

Time : Three Hours

Maximum : 60 Marks

*Candidates can use Clark's tables and scientific non-programmable calculators.***Part A (Very Short Answer Questions)***Answer all questions briefly.**Each carries 1 mark.*

1. Define Yield point and Breaking stress.
2. Diamond is said to be a hard material. What does it mean in terms of its modulus of elasticity.
3. Give a practical application of non-uniform bending.
4. Which terms in the moment of inertia tensor vanish when principal axes are referred ?
5. Define SHM and give one example.
6. Why rails are made in the form of I section ?
7. Two circular discs have their masses in the ratio 1 : 2 and their diameters in the ratio 2 : 1. What is the ratio of their moment of inertia ?
8. Distinguish between Bosons and Mesons.

(8 × 1 = 8)

**Part B (Brief Answer Questions)***Answer any six questions.**Each carries 2 marks.*

9. Define and distinguish between angle of shear and angle of twist.
10. Explain elastic fatigue ? Differentiate it from elastic limit.
11. Distinguish between free and forced vibrations.
12. State and explain parallel axis theorem.
13. Define moment of inertia ? What is its physical significance ?
14. Explain, why a loaded bus is more comfortable than an empty bus ?
15. Give two physical examples of resonance.

**Turn over**

16. Define : (i) amplitude ; (ii) frequency ; (iii) time period ; and (iv) phase of a body executing SHM.
17. What is meant by gauge particles ? Explain.
18. Why does a cyclist lean when negotiating a turn ?

(6 × 2 = 12)

### Part C (Problems/Deviations/Short Essays)

Answer any **four** questions.

Each carries 4 marks.

19. A rubber cord of a catapult has a cross-sectional area of  $2 \text{ mm}^2$  and an initial length of 0.2 m and is stretched to 0.25 m to fire a small object of mass 15g. If the Young's modulus is  $Y = 6 \times 10^8 \text{ N/m}^2$ , what is the initial velocity of the object that is released ?
20. A wire of diameter 0.36 mm elongates by 1.2 mm when stretched by a force of 0.32 kg. wt. It twists through one radian when equal and opposite torques of  $1.6 \times 10^{-5} \text{ N/m}$  are applied at its ends. Find the Poisson's ratio of the material of the wire.
21. A bicycle wheel has a radius of 30 cm and mass 2 kg and the bicycle is moving at 6 m/s :
  - (a) Calculate the angular velocity of the wheel.
  - (b) Find the angular momentum of the wheel under the assumption that the mass of the wheel is entirely at its edge.
22. A flywheel of radius of gyration 2 m and mass 8 kg rotates at an angular speed of 4 radians/sec about an axis perpendicular to it through its centre. Find the kinetic energy of rotation.
23. The velocity of the particle executing SHM is 1 m/s and 0.7 m/s when its distance from its mean position is 30 cm and 60 cm respectively. Find its time period and amplitude.
24. A mass of 100 kg is supported on a spring of stiffness constant 980 N/m. Find its compression and time period of vibration.

(4 × 4 = 16)

### Part D (Essay/Problems)

Answer any **two** questions.

Each question carries 12 marks.

25. Describe torsion pendulum. Explain how it can be used to measure the moment of inertia of an irregular body and torsional rigidity ?
26. Derive the moment of inertia of a thin uniform rod about an axis perpendicular to its length and passing through : (i) its centre of mass, and (ii) one end.
27. What do you mean by simple harmonic oscillator ? Derive the equation of motion for SHM. Find the expression for angular frequency and energy of a simple harmonic oscillator ?
28. Differentiate between angle of twist and angle of shear. Derive an expression for the couple per unit twist of a uniform solid cylinder.

(2 × 12 = 24)