

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, NOVEMBER 2016**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 Marks : 60

*Candidates can use Clark's tables and
Scientific non-programmable calculators.*

Part A (Very Short Answer Questions)*Answer all questions briefly.**Each question carries 1 mark.*

1. What do you mean by Elastic fatigue ?
2. Explain, why the mass of a flywheel is generally concentrated at its rim.
3. Point out *two* effects produced by damping.
4. Why steel girders and rails are made in the form of I section ?
5. What are the theoretical limits of Poisson's ratio ?
6. What is meant by bending moment ?
7. What is the practical significance of resonance ?
8. What are Leptons ?

(8 × 1 = 8)

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

9. Define Torsion rigidity of a wire. How is it related to modulus of elasticity ?
10. Explain conservation of angular momentum. What is its importance ?
11. Show that for a harmonic oscillator, total energy is proportional to the square of the amplitude.
12. Distinguish between hadrons and mesons.

Turn over

13. Show that the moment of inertia of a thin uniform rod about an axis passing through the centre of mass and perpendicular to its length is $\frac{ML^2}{12}$.
14. Why does a cyclist lean while negotiating a turn?
15. With usual notations, prove $\frac{1}{K} = \frac{9}{Y} - \frac{3}{n}$.
16. What is a Cantilever? Why a Cantilever of uniform cross-section is more likely to break near its fixed end?
17. A body executes SHM such that its velocity at mean position is 1 m/s, and acceleration at one extremity is 1.5 m/s^2 . Calculate the time period of oscillation.
18. State and explain perpendicular axes theorems.

(6 × 2 = 12)

Part C (Derivations/Problems/Short Essays)

Answer any four questions.

Each question carries 4 marks.

19. A material has Poisson's ratio 0.25. If a uniform rod of it suffers longitudinal strain 4.0×10^{-3} , calculate the change in volume.
20. A body of mass 6 kg acquires an acceleration of 10 rad/s^2 by an applied torque of 2 Nm. Calculate its moment of inertia and radius of gyration.
21. A bar of length 1 m, breadth 3 cm and thickness 4 mm is used as a Cantilever. Calculate the depression at the free end when a load of 250 gm is attached to the free end. Young's modulus of the material of the bar is $0.9 \times 10^{10} \text{ N/m}^2$.
22. The total energy of a particle executing SHM is E. Calculate its kinetic and potential energies when the displacement is one-half the amplitude.
23. The flywheel of an engine is rotating so that a point on its rim has a linear speed of 50 km per hour. The radius of the wheel is 0.5 m. What average torque must be applied to the rim of the wheel so that the wheel is brought to rest in 15 sec? The mass of the flywheel is 40 kg. The flywheel may be considered as a ring.
24. A gold wire, 0.3 mm in diameter, elongates by 1 mm when stretched by a force of 320 gm-wt and twists through 1 radian, when equal and opposite torques of $145 \times 10^{-7} \text{ Nm}$ are applied at its ends. Calculate the value of Poisson's ratio for the metal.

(4 × 4 = 16)

Part D (Essay Questions)*Answer any two questions.**Each question carries 12 marks.*

25. With necessary theory describe how will you determine the rigidity modulus of a rod is determined by static torsion method.
26. Explain the significance of bending moment. Derive an expression for the depression of a point distant x from the fixed end of the Cantilever.
27. Derive expression for the moment of inertia of a solid sphere about (i) a diameter ; and (ii) a tangent.
28. What do you mean by a simple harmonic oscillator ? Derive its differential equation and find the expressions for its velocity, displacement and period.

 $(2 \times 12 = 24)$