

**B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, NOVEMBER 2014****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 question carries 1 mark.*

1. Define Young's modulus ? What is its dimension and units ?
2. State and explain the three elastic moduli ?
3. Define and explain Poisson's ratio.
4. Can the mass of a body be considered as concentrated at its centre of mass for the purpose of calculation of moment of inertia.
5. Where are the principal axes located ? Explain.
6. A spring is executing SHM with an amplitude  $A$ . What is its displacement at which potential energy is half its maximum value.
7. What is the moment of Inertia of a disc of radius  $r$  and mass  $m$  about a diameter as axis ?
8. What is Antiparticle ? Explain.

 $(8 \times 1 = 8)$ **Part B (Brief Answer Questions)***Answer any six questions.  
Each question carries 2 marks.*

9. What is centripetal and centrifugal forces ? Write down expressions and explain.
10. What is flywheel ? Explain why the mass of a flywheel is generally concentrated at its rim ?
11. Define and explain : strain, bulk modulus, modulus of rigidity, yield point.
12. Explain neutral surface, plane of bending and bending moment.
13. What is resonance ? State and explain the conditions for resonance ?

**Turn over**

14. State and explain perpendicular axes theorem.
15. Does the hammer of an elastic bell make free or forced vibrations when the bell is ringing ? Explain.
16. A spring carrying the mass  $m$  is forced horizontally on a smooth table. The mass is slightly pulled and let off. Discuss its motion.
17. What is meant by radius of gyration ? What is its physical significance ?
18. Explain the particle quantum numbers and their significance.

(6 × 2 = 12)

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

*Answer any four questions.*

*Each carries 4 marks.*

19. A rubber tube 40 cm long whose external and internal diameters are 1.0 cm and 0.4 cm respectively extends 0.6 mm when stretched by a force of 5 kg-wt. Calculate the Young's modulus of rubber.
20. A steel wire of length 100 cm and cross-sectional area  $0.005 \text{ cm}^2$  is stretched horizontally between two pillars. A mass of 100 g is suspended from the mid point  $p$  of the wire. Calculate the depression of the point  $p$ . Young's modulus of steel :  $2 \times 10^{11} \text{ N/m}^2$ .
21. A flywheel of diameter 1.2 m weighs 10 kg. What will be its angular acceleration if it is acted upon by a net torque of 18 N-m.
22. Show that the moment of inertia of a right circular cylinder radius  $R$  and length  $l$  about a line at right angles to its axis and passing through the middle points is  $\frac{M(3R^2 + l^2)}{12}$ .
23. Calculate the time period of a body executing SHM if it has an acceleration of  $2\text{m/s}^2$  when its displacement is 10 cm.
24. A spring of spring constant 980 N/m is attached to a mass of 10 kg and is placed on a smooth table. It is pulled through 10 cm and let go. Find the restoring force of the system and the time period of vibrations.

(4 × 4 = 16)

### Part D (Essays/Problems)

*Answer any two questions.*

*Each carries 12 marks.*

25. With necessary theory, describe how would you determine the rigidity modulus of a rod by the static torsion method ?
26. What is a flywheel ? Derive an expression for the moment of Inertia of the flywheel.
27. A rectangular bar of iron is supported at its two ends on knife edges and a load is applied at the middle point. Calculate the depression at the middle point. How can this be utilised to determine Young's modulus of iron ?
28. Explain the Quark model of elementary particle and its applications.

(2 × 12 = 24)