

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, NOVEMBER 2013**First Semester****Complementary Course—Physics—PROPERTIES OF MATTER, MECHANICS AND PARTICLE PHYSICS**

(For the subjects Chemistry and Geology)

[Prior to 2013 admissions]

Time : Three Hours

Maximum Weight : 25

*Candidates can use Clark's tables and Scientific non-programmable calculators.***Part A (Objective Type)***Answer all questions.**Each bunch of four questions carries a weight of 1.***Bunch I**

1. If the density of a material increases, the value of the Young's modulus :
(a) Increases. (b) Decreases.
(c) First increases and then decreases. (d) First decreases and then increases.
2. Young's modulus for a plastic body is :
(a) Zero. (b) Infinite.
(c) 1. (d) Finite.
3. Poisson's ratio is the ratio of lateral strain to ———.
(a) Volume strain. (b) Shearing strain.
(c) Longitudinal strain. (d) None of these.
4. The substance which shows no elastic after effect is :
(a) Copper. (b) Silver.
(c) Quartz. (d) Rubber.

Bunch II

5. The potential energy of a particle executing SHM with amplitude A is maximum when the displacement is :
(a) Zero. (b) $A/2$.
(c) A. (d) $A/$.

Turn over

6. A spring of force constant k is cut into two pieces whose lengths are in the ratio 1 : 2. What is the force constant of the longer piece :
- (a) $2/3k$. (b) $1/3k$.
(c) $3/2k$. (d) $3k$.
7. A particle executing SHM with a frequency γ . The frequency with which the kinetic energy oscillates is :
- (a) γ . (b) $\gamma/2$.
(c) 2γ . (d) Zero.
8. For an undamped oscillator quality factor $Q = \text{—————}$.

Bunch III

9. In SHM, the acceleration of a particle is zero when the velocity is :
- (a) Maximum. (b) Half of its maximum value.
(c) Zero. (d) None of the above.
10. Force in linear motion has as its analogue in rotational motion :
- (a) Torque. (b) Moment of inertia.
(c) Angular momentum. (d) Weight.
11. The MI of a sphere of radius R and mass M about a tangent to the sphere is :
- (a) MR^2 . (b) $2/5 MR^2$.
(c) $21/5 MR^2$. (d) $7/5 MR^2$.
12. MI of a disc of radius R and mass M about a diameter as axis is :
- (a) MR^2 . (b) $MR^2/2$.
(c) $MR^2/4$. (d) $5/4 MR^2$.

Bunch IV

13. The MI of a body comes into play only in :
- (a) Motion along a curved path. (b) Linear motion.
(c) In rotational motion. (d) None of these.
14. When the torque acting upon a system is zero, which of the following will be constant :
- (a) Force. (b) Linear Momentum.
(c) Angular momentum. (d) Impulse.
15. In weak interactions, the exchange particles are :
- (a) Photons. (b) Gluons.
(c) Mesons. (d) Intermediate bosons.
16. In gravitational interactions, the exchange particles are :
- (a) Electrons. (b) Gravitons.
(c) Mesons. (d) Positrons.

Part B (Short Answer Type)

Answer any five questions.

Each question carries a weight of 1.

17. What is bending moment ?
18. What is a flywheel ?
19. Distinguish between Angle of twist and Angle of shear.
20. State and explain the theorem of perpendicular axes.
21. Obtain the differential equation of a particle executing SHM.
22. What are forced oscillations ?
23. What are gauge particles ?
24. Name the conservation laws in particle physics.

(5 × 1 = 5)

Part C (Short Essay/Problems)

Answer any four questions.

Each question carries a weight of 2.

25. Prove the theorem of perpendicular axes.
26. The mass of a flywheel is usually concentrated at the rim. Why ?
27. The amplitude of a damped harmonic oscillator is reduced to half its undamped value in 200 seconds. If $\omega_0 = \pi$ rad/sec., what is the relaxation time and quality factor.
28. Derive the condition under which amplitude resonance occurs.
29. A wire of length 8 m. and diameter 1.5 mm. is stretched through 4 mm. by a load. Calculate the work done. Given $y = 2 \times 10^{11}$ N/m.²
30. A cylindrical rod of length 1 m. and radius 1 cm. is uniformly bent into a circular arc of radius 10 m. Calculate the bending moment. Given $y = 9 \times 10^{10}$ N/m.²

(4 × 2 = 8)

Part D (Essay Type Questions)

Answer any two questions.

Each question carries a weight of 4.

31. Derive the relation for the expression at the middle of a uniform beam supported between two knife edges and loaded at the middle.
32. What are the fundamental interactions in nature ? Give examples. Explain the quark model.
33. Define SHM. Derive expressions for velocity, acceleration and total energy of a particle executing SHM.

(2 × 4 = 8)