K22U 3267

Reg. No. : .....

Name : .....

I Semester B.Sc. Degree (CBCSS – Supplementary) Examination, November 2022
(2016-2018 Admissions)
CORE COURSE IN PHYSICS
1B01 PHY : Physics Primers

Time : 3 Hours Max. Marks : 40

***Instruction** : Write answers only in **English**.*

SECTION – A

(Answer **all** – Very short answer type – **Each** question carries **one** mark.)

1. Particles with integer spin are called _____
2. _____ is the weakest fundamental force.
3. The Laplacian operator ∇^2 in Cartesian coordinates is _____
4. The velocity of longitudinal waves in gases depends on the elasticity and _____ of gases. **(4×1=4)**

SECTION – B

(Answer **any seven** – Short answer type – **Each** question carries **two** marks.)

5. Explain Hubble's law.
6. What are Higgs Bosons ?
7. Define gradient of a scalar. What is its geometrical meaning ?

P.T.O.

8. Show the spherical coordinates (r, θ, ϕ) of a point in a diagram.

9. State the fundamental theorem for divergence of a vector function.

10. What is meant by a conservative force ?

11. State Fourier's theorem.

12. What is a compound pendulum ? Give the equation for its angular frequency.

13. What is meant by simple harmonic motion ? Give its differential equation.

14. For small amplitude vibrations, what is the shape of the potential energy curve of a diatomic molecule ? Write down the expression for the frequency of such oscillations. **(7×2=14)**

SECTION – C

(Answer **any four** – Short essay/problem type – **Each** question carries **three** marks.)

15. Give any three characteristics for each of the following basic forces :
    a) Gravitational force and
    b) Weak force.

16. Prove the fundamental theorem for gradients using the function $T = x^3y$ by integrating ∇T along a straight line between (1, 3) and (3, 3).

17. Calculate the divergence of the vector function $A = 3x^2y\hat{i} + x^3\hat{j} + xz\hat{k}$ at (1, – 1, 3).

18. Write down the expression for elementary volume in cylindrical coordinates and integrate it to obtain the volume of a cylinder of length L and radius R.

19. A 2 kg mass hangs from a spring. A 0.3 kg body hung below the mass stretches the spring 2 cm farther. If 0.3 kg body is removed and the mass is set into oscillation, find the period of motion.

20. If in air a plane wave of frequency 256 Hz and amplitude 0.001 mm is produced. Calculate the radiated energy per unit volume and the energy current. (Velocity of sound is 332 m/s and density of air is 1.29 kg/m^3) **(4×3=12)**

SECTION – D

(Answer **any two** – Long essay type – **Each** question carries **five** marks.)

21. a) Explain Planck's hypothesis of quantum.

    b) Give the contributions of the following Indian scientist to the Physics – SN Bose, MN Saha and CV Raman.

22. What are cylindrical polar coordinates ? Discuss the unit vectors, elementary lengths, elementary area and elementary volume.

23. Discuss the propagation of longitudinal waves in rods and derive at an expression for its velocity.

24. Derive an expression for the kinetic energy, potential energy and total energy of a harmonic oscillator and represent these variations with displacement in a plot. **(2×5=10)**

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K22U 3428

Reg. No. : .....

Name : .....

I Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/ Improvement) Examination, November 2022
(2019 Admission Onwards)
CORE COURSE IN PHYSICS
1B01 PHY : Mechanics – I

Time : 3 Hours Max. Marks : 40

PART – A

All questions are **compulsory**, **each** question carries **1** mark.

1. What is moment of inertia ? What is its unit ?
2. State parallel axis theorem.
3. What is impact parameter in scattering problems ?
4. Express velocity and acceleration in plane polar coordinates.
5. What do you mean by a central force ?
6. Give the relation between torque and angular momentum. **(6×1=6)**

PART – B

Answer **any 6**, **each** question carries **2** marks.

7. Starting from Hooke's law, obtain the differential equation for simple harmonic motion for a block of mass M attached to one end of the horizontal spring with the other end of spring is fixed.
8. Define centre of mass. Give the expression for the centre of mass of a non-uniform mass distribution of density ρ.

P.T.O.

9. If weight is defined as the true gravitational force acting on a body, what happens to the weight of a turtle when it is inside an elevator which moves with a downward acceleration equals g ? What happens to the reaction by the elevator in this case ?

10. When do we call certain forces as conservative forces ? What is being conserved when work is done by a conservative force ?

11. Finite angular rotation is not a vector whereas angular velocity is a vector. Justify this statement.

12. What is meant by constraints ? What is the constraint in the Atwood's machine ?

13. What is the law of conservation of angular momentum ? A rolling cycle tyre remain vertical for some time whereas a cycle tyre placed vertically at rest falls immediately when released. Why ?

14. Describe stability using potential energy curve. **(6×2=12)**

PART – C

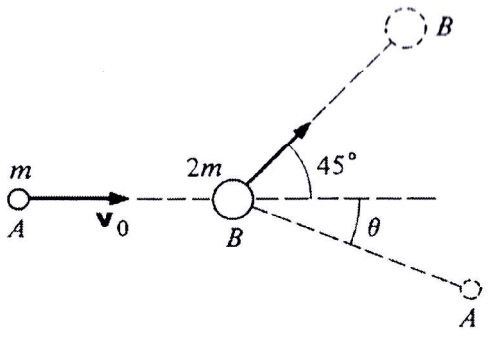
Answer **any 4**, **each** question carries **3** marks.

15. The potential energy function of an interaction is given as $U = x^3 - 3x^2$. Find the points of equilibria. Find the point of stable equilibrium.

16. A mass m is attached to the end of a string of length R and whirled round in a vertical plane in the gravitational field of earth. Find the tension on the string and the tangential acceleration produced.

17. How do we apply Newtons laws of motion for a system of particles ? Derive the relation between the rate of change of the momentum of the system and the net external force acting on the system.

18. Particle A of mass m has initial velocity v_0. After colliding with particle B of mass 2 m initially at rest, the particle follows the path as shown in Figure. Find θ.



19. Derive the accelerations of the masses M_a and M_b connected in an Atwood's machine with a massive pulley of mass M.

20. Describe how the Kater's pendulum allows to measure the value of g with great accuracy. **(4×3=12)**

PART – D

Answer **any 2**, **each** question carries **5** marks.

21. Determine the position vector of the centre of mass of a right triangular sheet of mass M and base 'a' and height 'b'.

22. State the work energy theorem. Show that the mechanical energy is conserved when a particle moves under a central force.

23. Derive an expression for the angular momentum of a body that is undergoing both translation and rotation in the x-y plane. (The rotation axis remains parallel to the z axis throughout the motion.)

24. What is centre of percussion ? Show that the place of a doorstop fixed on a wall to stop the door from banging the wall while opening should be at a distance $\frac{2}{3}$w from the hinges. (where 'w' is the width of the door). **(2×5=10)**

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