C 6161

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Name.....

Reg. No.....

SECOND SEMESTER B.Sc. DEGREE (SUPPLEMENTARY) EXAMINATION, MAY 2016

(UG-CCSS)

Complementary Course

PH 2C 03—MECHANICS, RELATIVITY WAVES AND OSCILLATIONS

Time : Three Hours

Maximum : 30 Weightage

Section I (Objective Type Questions)

Answer **all** *questions.*
Each question carries a weightage of ¼.

1. Write the Schrödinger's time-independent wave equation.
2. If a particle could move with the velocity of light, how much kinetic energy would it possess ?
3. Write the expression for relativistic length of a body interms of its proper length.
4. "Under Galilean transformation, velocity remains invariant." Is this true ?
5. Force, which does not really act on the particle but appears due to the acceleration of the frame is called ———.
6. The energy equivalent to 1 amu = ——— eV.
7. Freely falling bodies deviate from their true vertical path. This is due to the effect of ———.
8. The angular momentum of a particle is conserved, if torque acting on th particle is ———.
9. The working principle of Rocket is based on the law of conservation of :
   (a) Linear momentum.
   (b) Energy.
   (c) Angular momentum.
   (d) Electric charge.
10. Which of the following is not an example for linear simle harmonic motion :
    (a) Vibrations of atoms and molecules.
    (b) Vibrations of a tuning fork.
    (c) Oscillations of a simple pendulum.
    (d) Oscillations of a freely suspended magnet in a uniform magnetic field.
11. The pressure variation in the case of a longitudinal progressive wave travelling through a gas is given by, $\left(\frac{dy}{dx}\right.$ is the volume strain$\left.\right)$:
    (a) $P = -E\frac{dy}{dx}$.
    (b) $P = \frac{-1}{E}\frac{dy}{dx}$.
    (c) $P = +E\cdot\frac{dy}{dx}$.
    (d) $P = \sqrt{E}\frac{dy}{dx}$

Turn over

12. The acceleration of a particle executing simple harmonic motion at any instant is :

(a) $-\omega x$.

(b) $-\omega^2 x$.

(c) $\omega\sqrt{A^2 - x^2}$.

(d) $\omega\sqrt{A^2 + x^2}$.

(12 × ¼ = 3 weightage)

Section II (Short Answer Type Questions)

Answer **all** *the questions.*
Each question carries 1 *weightage.*

13. Distinguish between an inertial frame and non-inertial frame of references.
14. Define proper time interval.
15. Write the Galilean transformation equations.
16. What is quality factor associated with a damped harmonic oscillator ?
17. Obtain the differential equation representing a simple harmonic motion.
18. What is meant by centre of mass frame of reference ?
19. State Fourier's theorem.
20. Define eigen values and eigen functions.
21. "Simultaneity is relative." Explain.

(9 × 1 = 9 weightage)

Section III (Short Essay/Paragraph Questions)

Answer any **five** *questions.*
Each question carries 2 *weightage.*

22. Show that in a central force field, the angular momentum of a particle is conserved.
23. Explain the working principle of an electron microscope.
24. If in air a planewave of frequency 256 Hz and amplitude $\frac{1}{1000}$ mm. is produced, calculate the radiated energy per unit volume and the energy current velocity of sound = 332 m/s, density of air is 1.29 kg/m.^{3}
25. Obtain the equation representing the oscillations of a loaded spring.
26. Check whether the following are eigen functions of the operator $\frac{d^2}{dx^2}$:

(a) $\sin x$; (b) e^x ; (c) $\sin^2 x$; (d) $\cos x$.

27. A particle of mass 1 kg. executes simple harmonic motion of amplitude 25 cm. and time period 2 s. Calculate its total energy and kinetic energy when x = 12.5 cm.
28. Calculate the rest energy of an electron in joules.

(5 × 2 = 10 weightage)

Section IV (Essay Questions)

Answer any **two** *questions.*
Each question carries 4 weightage.

29. Define angular momentum of a particle about a point. Derive a relation between the torque applied on a rotating body and its angular momentum. Hence state the law of conservation of angular momentum.

30. Derive Einstein's mass-energy equivalence. Illustrate any *two* examples for mass-energy equivalence.

31. Arrive at the differential equation for a damped harmonic oscillator. Give its solution.

(2 × 4 = 8 weightage)