

15753

(Pages : 3)

Name.....

Reg. No.....

**SECOND SEMESTER B.Sc. DEGREE EXAMINATION
MAY 2011**

(CCSS)

Complementary Course

PH 2C 03 – MECHANICS, RELATIVITY, WAVES AND OSCILLATIONS

Time : Three Hours

Maximum : 30 Weightage

Section I – Answer all twelve questions. (¼ weightage each)

Section II – Answer all nine questions. (1 weightage each)

Section III – Answer any five questions. (2 weightage each)

Section IV – Answer any two questions. (4 weightage each)

Section I (Objective Type Questions)

I. Answer all questions :

1. Force, which does not really act on the particle but appears due to the acceleration of the frame is called _____.
2. If the angular momentum of a particle is conserved, then the torque acting on the particle is _____.
3. For a photon, the expression for relativistic momentum $P =$ _____.
4. Write the expression for relativistic length of a body in terms of its proper length.
5. At what displacement the energy of a harmonic oscillator becomes half kinetic and half potential?
6. What is the frequency of second overtone, if the fundamental frequency of vibration for a transverse wave is n .
7. If a particle could move with the velocity of light, how much kinetic energy would it possess?
8. Which of the following is not invariant under Galilean transformation?
 - (a) length.
 - (b) velocity.
 - (c) acceleration.
 - (d) none of these.
9. The maximum possible acceleration for a simple harmonic oscillator is
 - (a) $\omega^2 a$
 - (b) $\omega \sqrt{a^2 - x^2}$
 - (c) ωa
 - (d) ωa^2

Turn over

10. The pressure variation in the case of a longitudinal progressive wave travelling through gas is given by :

(a) $P = -E \frac{dy}{dx}$

(b) $P = \frac{1}{E} \frac{dy}{dx}$

(c) $P = E \frac{dy}{dx}$

(d) $P = -\sqrt{E} \frac{dy}{dx}$

11. The working principle of rocket is based on the law of conservation of :

- (a) angular momentum. (b) energy.
 (c) linear momentum. (d) none of these.

12. Which of the following statement is true?

- (a) $|\psi^2|$ represents the probability density of the particle.
 (b) If ψ is normalised, then $\int \psi^* \psi dt = 1$
 (c) If ψ_i and ψ_j are orthogonal, then $\int \psi_i^* \psi_j dt = 0$
 (d) All the above statements are true.

(12 × ¼ = 3 weights)

Section II (Short Answer Type Questions)

Answer all questions.

13. Define centre of mass frame of reference.
14. State the law of conservation of angular momentum.
15. Write the differential equation for a system of loaded spring.
16. Define quality factor associated with a damped harmonic oscillator.
17. Write the expression for a plane progressive wave.
18. What do you mean by relativistic time dilation?
19. Give the postulates of special theory of relativity.
20. Define eigen values and eigen functions.
21. State Fourier's theorem.

(9 × 1 = 9 weights)

Section III (Short Essay / Paragraph Question)

Answer any five questions.

22. Obtain the Galilean transformation equations.
23. How fast would a rocket have to go relative to an observer for its length to be contracted to 99% of its length at rest?
24. Explain the working principle of an electron microscope.

25. If in air a plane wave of frequency 256 Hz and amplitude $\frac{1}{1000}$ mm is produced, calculate the radiated energy per unit volume and the energy current. Density of air = 1.29 kg/m^3 and velocity of sound in air = 332 m/s.
26. Find the period of oscillation and maximum acceleration of a simple harmonic motion represented by the equation $x = 2 \sin(\pi t + \pi/2)$.
27. What are the basic postulates of quantum mechanics? Explain the physical significance of wave function.
28. Explain Einstein's mass - energy equivalence. Give any two examples.

(5 × 2 = 10 weightage)

Section IV (Essay Questions)

Answer any two questions.

29. Derive the Lorentz transformation equations.
30. Arrive at the differential equation for a damped harmonic oscillator. Give its solution.
31. (a) What are conservative and non-conservative forces?
- (b) What do you understand by the potential energy curve? Explain the positions of equilibrium? What is the significance of a parabolic potential well?

(2 × 4 = 8 weightage)