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Name.....

Reg. No.....

# SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2015

(CUCBCSS–UG)

Complementary Course

Physics

PH2 C02—MECHANICS, RELATIVITY, WAVES AND OSCILLATIONS

ne : Three Hours

Maximum : 80 Marks

## Section A

*Answer* **all** *questions.*
*Each question carries* 1 *mark.*

1. Any frame of reference moving relative to an identical frame with constant velocity will be ————.
2. Two colliding particle in CM frame approaches as well as separate with ————.
3. Multistage rockets are used in practice to ————.
4. Give the expression for the relativistic equivalence of mass and energy.
5. What happens to amplitude as time increases during damping ?
6. By which theorem can you explain the different quality of sound produced by different musical instruments ?
7. According to Schrödinger a particle is equivalent to a ————.

te whether the following statements are True / False :—

8. The speed of a comet is highest at its Aphelion.
9. An electron microscope can magnify objects by 10X.
10. A collision is said to be elastic if the kinetic energy is conserved.

(10 × 1 = 10 marks)

## Section B

*Answer* **all** *questions.*
*Each question carries* 2 *marks.*

11. Does a flying projectile experience deviations due to Coriolis force ? Explain.
12. Distinguish between internal and external forces.
13. How does a rocket work ?
14. Give two important kinematical features which are derived from the special theory of relativity.

**Turn over**

15. Explain profer time interval.
16. What is logarithmic decrement ?
17. Distinguish between elastic and inelastic collisions.
18. What is intensity of a wave. Give the inverse square law.
19. Explain probability density.
20. What is an operator ? Give example.

(7 × 2 = 14 ma

## Section C

*Answer any* **five** *questions. Each question carries* 4 *marks.*

21. Explain non inertial frames and factious forces.
22. What is a central force ? Show that the central forces are conservative.
23. State the law of conservation of angular momentum. Explain one application.
24. How does mass change with velocity ? Show that 'c' is the ultimate speed of the particles.
25. Prove that for a harmonic oscillator the average PE and average KE are equal.
26. State Fourier's theorem. What are its conditions of applicability ? Analyze a saw tooth curve
27. What are eigen values and eigen functions ? Illustrate with examples.

(5 × 4 = 20 ma

## Section D

*Answer any* **four** *questions. Each question carries* 4 *marks.*

28. Prove that the total angular momentum of an isolated system of particles is conserved.
29. Prove that in a perfectly elastic collision the total final KEn of the colliding particles is equa their inertial KE.
30. What will be the apparent length of a meter stick measured by an observer at rest, when the s is moving with a velocity of 0.851C.
31. The average lifetime of a neutron as a free particle at rest is 15 minutes. It disintegra spontaneously into an electron, proton and neutrino. What is the average minimum velocity w which – a neutron must leave the sun to reach the earth before breaking 1.29 ? Distance betw earth sun = $11 \times 10^7$ km.
32. A plane wave of frequency 256 Hz and amplitude 0.001 mm is produced in air. Calculate t energy density and energy current, given velocity of sound in air = 332 m/s and density air = 1.29 kg/m$^3$.
33. A mass of 1.6 kg extends a spring by 8 cm from its unstretched position. The mass is replaced a body of mass 50 gm. Find the period of oscillation if the mass is pulled and released ?
34. Obtain the time dependent Schrödinger equation in three dimensions.

(4 × 4 = 16 ma

## Section E

*Answer any* **two** *questions.*
*Each question carries* 10 *marks.*

35. Prove that the linear momentum of a system of particles in centre of mass frame is zero.

36. State the postulates of the special theory of relativity and hence derive the Lorentz transformation equations.

37. Write notes on :

    (a) Electron microscope ;

    (b) Scanning tunneling microscope.

38. Prove that the pressure variations in a medium due to a sound wave is $P = -E\, dy/dx$. Hence show that the velocity of longitudinal waves in a gas depends on elasticity and density of the medium.

(2 × 10 = 20 marks)