D 31899　　　　　　　　　　　(Pages : 4)　　　　　　Name...................................

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SECOND SEMESTER B.Sc. DEGREE (SUPPLEMENTARY) EXAMINATION DECEMBER 2012

Physics—(Complementary Course)

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

Time : Three Hours　　　　　　　　　　　　　　　　　　　Maximum : 30 Weightage

Section A

Answer **all** *the questions.*

1. A body is projected at an angle to the horizontal. Then path of the body in a frame of reference which is moving with velocity equal to horizontal component of velocity of body :

   (a) Vertical straight line.　　　　　　(b) Horizontal straight line.

   (c) Parabola.　　　　　　　　　　　　(d) Hyperbola.

2. A plumb line is suspended from the roof of a rail road car. When car is moving on a circular track, the plumb line inclines ?

   (a) Forward.　　　　　　　　　　　　(b) Rearward.

   (c) Towards centre of path.　　　　　　(d) Away from centre of path.

3. Two trains A and B are running in same direction on parallel roads such that A is faster than B, Packets of equal weight are transferred between them. What do you think will happen due to this ?

   (a) A will be accelerated B will be retarded.

   (b) B will be accelerated A will be retarded.

   (c) No change in A but B will be accelerated.

   (d) No change in B but A will be accelerated.

4. A satellite is revolving round earth, which of the following is not conserved :

   (a) Linear momentum.　　　　　　　　(b) Angular momentum.

   (c) Areal velocity.　　　　　　　　　(d) Total energy.

5. An object of mass '*m*' moving with a velocity υ is approaching a second object of same mass at rest. Total kinetic energy as viewed from the centre of mass is :

   (a) $m\upsilon^2$.　　　　　　　　　　(b) $\frac{1}{2}m\upsilon^2$.

   (c) $\frac{1}{4}m\upsilon^2$.　　　　　　(d) None of these.

6. Eigenvalue of the operator $\dfrac{d}{dx}$ is 5 then corresponding eigenfunction is :

(a) $5x$.

(b) $\sin 5x$.

(c) e^{5x}.

(d) 5.

7. If frequency in S.H.M. is f then frequency of its kinetic energy is :

(a) $\dfrac{f}{2}$.

(b) f.

(c) $2f$.

(d) $4f$.

8. The equation for progressive wave is $Y = 10\sin 2\pi (5t - 20x)$. Then wavelength of wave is :

(a) 50.

(b) 20.

(c) 0.5.

(d) 0.05.

9. Which of the following frames of reference is non-inertial ?

(a) A car in circular motion.

(b) A car in uniform motion.

(c) A car at rest.

(d) A car is moving along straight line with same velocity.

10. If speed of a body of rest mass m and length L in the direction of motion is L, is equal to speed to light, Then its relativistic mass and length are :

(a) m, L.

(b) 0, 0.

(c) 0, Infinity.

(d) Infinity, 0.

11. Amplitude of damped oscillations :

(a) Increases linearly with time.

(b) Decreases linearly with time.

(c) Increases exponentially with time.

(d) Decreases exponentially with time.

12. Energy radiated per unit volume through progressive waves is :

(a) Directly proportional to amplitude.

(b) Directly proportional to square of the amplitude.

(c) Inversely proportional to amplitude.

(d) Inversely proportional to square of amplitude.

$(12 \times \frac{1}{4} = 3 \text{ weightage})$

Section B

Answer **all** *nine questions.*

13. What is meant by Galeelian Transformation ?

14. What are the conclusions do you draw from Michelson-Morley experiment ?

15. Distinguish between free oscillations and Damped oscillations.

16. 'In the abscence of external forces, velocity of Centre of mass is a constant' Prove it.

17. What is potential energy curve ? Draw P.E. Curve and mark the points of unstable and stable equilibria ?

18. Explain Fourier Theorem.

19. What is a second pendulum ? Find out its length.

20. List out the postulates of Quantum Mechanics.

21. Explain about centrifugal force.

(9 × 1 = 9 weightage)

Section C

Answer any **five** *questions.*

22. A body at rest explods, braking into three pieces, two pieces having equal masses, Fly-off perpendicular to one another with same speed of 30 m/s. The third piece has three times mass of each other pieces. Find out velocity of third piece.

23. Three masses 1 kg, 2 kg, 1 kg are at the vertices of a right-angled triangle at A, B, C with $\angle B = 90°$, AB = 3 m, BC = 4 m. Find out the position of centre of mass of this system.

24. Prove that oscillations of simple pendulum are simple harmonic.

25. Calculate the Coriolis acceleration of a rocket moving with a velocity of 2 kms^{-1} at 60° South latitude.

26. A plane wave of frequency 512 Hz and amplitude 0.001 mm are produced in air. Calculate energy radiated per unit volume of medium. (ρ_{air} = .0013 g/cc

$$V_{sound} = 338 \text{ m/s}).$$

27. How fast would a rocket have to go relative to an observer for its length to be contracted t 99% of its length at rest ?

28. A particle is limited to X-axis has the wave function $\psi = e^{ikx}$ between $x = 0$ and $x = 1$. Fin out the probability that the particle can found between $x = 0.5$ to 0.6.

(5 × 2 = 10 weightag

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Section D

*Answer any **two** questions.*

29. Derive relativistic formula for variation of mass.

30. Derive one dimensional time dependent Schrödinger equation. Convert it into three dimensional form.

31. What is the basic principles of Rocket Propulsion ? Derive expression for final velocity of Rocket.

(2 × 4 = 8 weightage)