Reg. No. : ....

Name : ....

Third Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/Improvement) Examination, November 2022
(2019 Admission Onwards)
CORE COURSE IN PHYSICS
3B03PHY : Mechanics – II

Time : 3 Hours

Max. Marks : 40

PART – A

Short answer questions, answer **all** questions, **each** question carries 1 mark. **(6×1=6)**

1. State the principle of equivalence.

2. State law of equal areas.

3. Write down the equation of a forced damped harmonic oscillator and describe the terms involved.

4. Write down general expression for a plane progressive wave traveling in positive x direction and negative x direction.

5. Explain length contraction.

6. Describe the relativistic Doppler Effect.

PART – B

Short essay questions, answer **any 6** questions, **each** question carries 2 marks.
(6×2=12)

7. Show that any coordinate system moving uniformly with respect to an inertial system is also inertial.

8. What is a central force ? Show that the motion of particle under central force is always confined to a single plane.

9. What are stationary satellites ? Calculate the height at which such a satellite must revolve in its orbit around the earth.

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10. Show that Energy Dissipation in the Damped Oscillator is exponentially in time.

11. State Fourier theorem. What are the conditions to apply Fourier theorem ?

12. Write down Lorentz coordinate transformation equation. Show that Lorentz coordinate transformation reduce to Galilean transformation when u << c.

13. Show that two events that are simultaneous in one reference frame are not simultaneous in another reference frame moving with first.

14. Explain the twin paradox.

PART – C

Problems, answer **any 4** questions, **each** question carries **3** marks. **(4×3=12)**

15. A small weight of mass m hangs from a string in a car which accelerates at a rate A. What is the static angle of the string from the vertical and what is its tension ? Analyze the problem both in an inertial frame and in a frame accelerating with car.

16. A particle is in a circular orbit under the action of an attractive central force given by $f(r) = k/r^3$, where k is constant. Obtain an expression for the angular momentum and show that it is constant.

17. If the quality factor Q in a damped harmonic oscillator is defined as Q = (2π × average energy stored per cycle)/ (Average energy dissipated per cycle). Then show that $Q = \omega/2b$.

18. If the velocity of sound in hydrogen at a certain temperature is 1300 m/s. Calculate velocity at the same temperature in a diatomic gas of molecular weight 32.

19. In the laboratory one particle A moves with velocity $v_x = + 2 \times 10^8$ m/sec and another particle B moves with velocity $v_x = -2 \times 10^8$ m/sec. Calculate the velocity of A relative to B.

20. Find the velocity and momentum of electron ($E_0 = .511$ MeV) with kinetic energy of 10 MeV.

PART – D

Long essay questions, answer **any 2** questions, **each** question carries **5** marks. **(2×5=10)**

21. State and explain Kepler's laws of planetary motion. Prove second and third law.

22. Establish differential equation of motion for a damped harmonic oscillator and write down the general solution for displacement for oscillatory motion and sketch it. Show that Energy falls exponentially with time.

23. Describe the Michelson-Morley experiment. How does it invalidate the concept of ether ?

24. Obtain the Lorentz transformation equations.

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