



K22U 3642

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 $u \ll c$.
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 $Q = (2\pi \times \text{average energy stored per cycle}) / (\text{Average energy dissipated per cycle})$. 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.

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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.