



M 7579

Reg. No. :

Name :

III Semester B.Sc. Degree (CCSS-Reg./Supple./Imp.) Examination,
November 2014

CORE COURSE IN PHYSICS
3B03 PHY : Classical Mechanics

Time : 3 Hours

Max. Weightage : 30

SECTION - A

Choose the correct answer. **Each** bunch of question carries a weightage of 1.

1. i) The real law of motion is
 - a) Newton's I law
 - b) Newton's II law
 - c) Newton's III law
 - d) None
 - ii) The trajectory of a particle in a central force field where $E = 0$ is
 - a) Parabola
 - b) Hyperbola
 - c) Circle
 - d) Ellipse
 - iii) The homogeneity of flow of time leads to law of conservation of
 - a) Angular momentum
 - b) Linear momentum
 - c) Energy
 - d) None of the above
 - iv) For a harmonic oscillator, the condition for over damped motion is
 - a) $k > w_0$
 - b) $k = w_0$
 - c) $k < w_0$
 - d) $k > w_0^2$
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2. i) Frame of reference in which Newton's law is valid is known as
 - a) Inertial frame
 - b) Non-inertial frame
 - c) Uniformly rotating frames
 - d) None
 - ii) The rest mass of a photon is
 - a) 1
 - b) ∞
 - c) 0
 - d) Cannot be determined



- iii) Gravitational force is an example of
- a) Conservative force b) Non-conservative force
c) Storage force d) Both b) and c)
- iv) A particle oscillating under a force $\vec{F} = -k\vec{x} - b\vec{v}$ is a (k and b are constants)
- a) simple harmonic oscillator b) nonlinear oscillator
c) damped oscillator d) forced oscillator
- (2×1=2)

SECTION – B

Answer **any six** questions. **Each** carries a weightage of 1.

3. Define torque and angular momentum. How are they related ?
 4. State Kepler's laws of planetary motion.
 5. Define Q-factor of a harmonic oscillator.
 6. Distinguish between inertial and non-inertial frame of references.
 7. State the postulates of special theory of relativity.
 8. Distinguish between escape velocity and orbital velocity. How are they related ?
 9. What is Lorentz Fitzgerald contraction ?
 10. What is time dilation ?
- (6×1=6)

SECTION – C

Answer **any nine** questions. **Each** carries a weightage of 2.

11. Show that the velocity of light is the same for all inertial frames, whatever their relative speeds may be.
12. Explain length contraction.
13. Derive the differential equation of a harmonic oscillator.
14. Prove Newton's I law from Newton's second law of motion.
15. Define gravitational potential. Obtain an expression for it.



16. The rest mass of an electron is 9.1×10^{-31} kg. What will be its mass if it were moving with $(4/5)^{\text{th}}$ of the speed of light ?
17. What is half width ? Obtain an expression for half width of resonance curve.
18. The frequency of a tuning fork is 300 Hz. If its Q-factor is 5×10^4 , find the time after which its energy becomes $\frac{1}{10}$ of its initial value.
19. Prove that the angular momentum is a constant for motion under a central force.
20. Briefly explain the fundamental forces in nature.
21. Calculate the reduced mass of CO. Given atomic number of C and O atoms are 12 and 16 respectively. (1 a.m.v. = 1.67×10^{-27} kg).
22. With what velocity should a space ship fly so that every day spent on it may correspond to 3 days on the earth's surface. (9×2=18)

SECTION – D

Answer **any one** question. **Each** carries a weightage of 4.

23. Derive an expression for gravitational potential and field due to a thin spherical shell at a point (i) outside the shell and (ii) inside the shell.
24. Derive the Lorentz transformation equations. (1×4=4)
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