12390

Name..

Reg. No..................................

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2016

(CUCBCSS-UG)

Physics/Applied Physics

PHY 3B 03/APY 3B 03—MECHANICS

e : Three Hours

Maximum : 80 Marks

Section A

Answer **all** *questions.*
Each question carries 1 mark.
Answer in a word **or** *phrase.*

1. The force that does not really act on the particle but appears due to the acceleration of the frame is ————.

2. Freely falling body deviates from their vertical path. This is due to the effect of ————.

3. The geometrical restrictions on the motion of a particle are known as ————.

4. For conservative forces, the sum of potential and kinetic energies is ————.

5. The essential requirement of a frame of reference is that it should be ————.

6. Frictional and viscous forces are examples of ———— force.

7. The work done in moving a unit mass from one point to another on an equipotential surface is ————.

ite *True or False* :

8. Newton's law or motion are also known as laws of mechanics.

9. Torque is the rate of change in linear momentum.

10. In an inelastic collision the momentum is not conserved.

(10 × 1 = 10 marks)

Section B

Answer **all** *questions.*
Each question carries 2 marks.
Answer in two **or** *three sentences.*

11. What are inertial frames of references ?

12. Give the postulates of special theory of relativity.

13. Explain conservative and non-conservative forces with examples.

14. What is the difference between the pseudo force and the real force appearing in inertial frames ?

15. State the principle of virtual work.

Turn over

6. What is time dilation hence explain twin paradox ?

7. What does the term "rotational invariance" imply ?   (7 × 2 = 14 m

Section C

8. Use Galilean transformation to show that the distance between two p (x_1, y_1, z_1) and (x_2, y_2, z_2) is invariant in two inertial frames.

9. State the postulates of special theory of relativity, and deduce from them the Lorentz transforma

10. Prove work energy theorem.

11. Define angular momentum of a particle. Show that the time rate of change of angular mome of a particle is equal to the torque acting on it.

22. Show that the intensity of the field can be expressed as $E = -\text{grad } V$, where V is the poten

23. Establish the relations (i) $m = m_0\sqrt{1 - \dfrac{v^2}{c^2}}$ and (ii) $E = mc^2$.

24. Derive an expression for the potential energy of a system of masses.

                                                                         (5 × 4 = 20 m

Section D

25. Prove that the plane of oscillation of Foucault's pendulum rotates $15°\sin\phi$ per hour, where ϕ latitude of the place.

26. Calculate the fictitious force and the total force acting on a freely falling body of mass 20 kg reference to a frame moving with a downward acceleration of 6 m/s.

27. If $F = (2xy + z^2)\hat{i} + x^2\hat{j} + 2xz\hat{k}$, then show that it is conservative. Calculate the amount of done by this force in moving a particle from (0, 1, 2) to (5, 2, 7).

28. Two particles, having the positions $r_1 = (3\hat{i} + 5\hat{j})$ m and $r_2 = -(5\hat{i} + 3\hat{j})$ m move with velo $v_1 = (4\hat{i} + 3\hat{j})$ m/s and $v_2 = (a\hat{i} + 7\hat{j})$ m/s. Find (i) the value of a, they collide, (ii) when and w the collision will take place ?

29. Period of Saturn is 29.5 years. Calculate the average distance of the Saturn from the sun radius of the earth's orbit is 1.5×10^8 km.).

30. Calculate the length and acceleration of a rod of length 5 m. in a frame of reference wh moving with 0.6 c velocity in a direction making 30° angle with the rod.

31. Calculate the energy in electron volts released when a neutron decays into a proton and ele $(m_n = 1.6747 \times 10^{-27}$ kg, $m_p = 1.6725 \times 10^{-27}$ kg, $m_e = 0.9 \times 10^{-31}$ kg.).

Section E

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

32. Explain inertial frame of reference, frame of reference 'r' rotates about its origin fixed in an inertial frame of reference 'I'. Find how velocities and accelerations in the two reference frames are related to each other.

33. State Kepler's laws of planetary motion. Show how the universal law of gravitation of Newton has been derived from these laws.

34. State the postulates of special theory of relativity, and deduce from them the Lorentz transformations.

35. What is relativistic energy ? Prove the relation $E^2 - P^2 C^2 = m_0^2 C^4$. Derive an expression for the velocity of a particle in terms of the relativistic momentum and energy.

$(2 \times 10 = 20 \text{ marks})$