THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2014

(U.G.—CCSS)

Core Course—Physics

PH 3B 05—MECHANICS

(2013 Admissions)

Time : Three Hours   Maximum : 30 Weightage

Part A

Answer all questions.
Each question carries ¼ weightage.

1. (i) Foucault's Pendulum have freedom of oscillation in : (a) only one direction ; (b) only in two direction ; (c) only in three direction ; and (d) in any direction.

    (ii) Earth is rotating uniformly about its axis from : (a) East to West ; (b) West to East ; (c) North to south ; and (d) South to North.

    (iii) ——————— Frame is also called zero —momentum frame .

    (iv) The escape velocity from the earth is 11 kms^{-1}. The escape velocity from a planet having twice the radius and the same mean density as that of the earth is ? (a) 5.5 kms^{-1} ; (b) 11 km/s ; (c) 22 km/s ; and (d) None of these.

2. (i) An earth satellite is moved from one circular orbit to another higher circular orbit. Which of the following quantities will increase for the satellite : (a) potential energy ; (b) Kinetic energy ; (c) angular velocity ; and (d) acceleration.

    (ii) An object entering the earth atmosphere at high velocity catches fire due to : (a) Viscosity of air ; (b) due to pressure of the air ; (c) Due to temperature of the air ; and (d) none of the above.

    (iii) For the Lagrangian $L = \frac{1}{2} q^2 - qq + q^2$, Find p conjugate to q (a) $p \times q$; (b) $p + q$; (c) $p - q$; (d) $p'q$.

    (iv) A wire is bent in the form of a parabola $z = ar^2$ and a bead slides of the wire without friction. The wire is rotated by means of a shaft with a constant angular acceleration. The Hamiltonian is (a) a constant of motion ; (b) increasing with time ; (c) decreasing with time linearly ; and (d) decreasing with time quadratically.

Turn over

3. (i) At what velocity along its length will a rod contract 50 % ? (a) c/2 ;(b) $\sqrt{3c}/2$. (c).
   (d) 5c/9

   (ii) ——— is the relativistic mass formula.

   (iii) Energy equivalent to one a.m.u is——— MeV (a) 937.5 ; (b) 827.5 ; (c) 746 ; and (d)

   (iv) Einstein got Nobel Prize for ———.

   (12 × ¼ = 3 weigh

Section B

Answer all nine questions.
Each question carries a weightage of 1.

4 What is a fictitious force ?

5 What is the potential energy curve of a particle ?

6 Explain the law of conservation of mechanical energy.

7 What is Galilean Invariance ?

8 A light and heavy body have equal KE, which one will have greater momentum ? Expl

9 State Keplers laws.

10 What are generalized co-ordinate system ?

11 What are constraints ? Distinguish between holonomic and non-holonomic constraints.

12 What do you meant by Hamiltonian of a system ?

(9 × 1 = 9 weigh

Section C

Answer any five questions.
Each question carries a weightage of 2.

13 What is meant by a non — inertial frame of reference ?

14 Assuming the law of gravitation, find an expression for the period of revolution of a sate

15 Show that the following force is conservative. $F = (y^2 - x^2) I + 2xyj$

16 Explain the basic postulates of special theory of relativity.

17 State and explain D' Alembert's principle.

18 A rod of 1 metre length is moving along its length with a velocity 0.6 c. Calculate its lengt
   it appears to an observer on the earth.

19 Calculate the speed of electron which has kinetic energy 1.02 MeV.

(5 × 2 = 10 weight

Section D

*Answer any **two** questions.*
Each question carries a weightage of 4.

20 What is a Foucault pendulum ? How does it enable us to demonstrate the rotation of the earth about its own axis ?

21 Obtain the Lagrange's equation for a conservative system. Show that if a coordinate q, is absent in the Lagrangian of a conservative system then $\dfrac{dl}{dq}$ is conserved.

22 Describe the Michelson-Morley experiment and explain the physical significance of the negative results.

$(2 \times 4 = 8 \text{ weightage})$