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

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2015

(CUCBCSS—UG)

Core Course—Physics/Applied Physics

PH 3B 03/AP 3B 03—MECHANICS

Time : Three Hours Maximum : 80 Marks

I. Answer *all* questions, each question carries 1 marks (in a word or phrase) :

1 Give an example of inertial frame of reference.

2 What is Coriolis force ?

3 Give an example of conservative force.

4 Why frictional force is non-conservative ?

5 What is the significance of principle of virtual work ?

6 What is generalized co-ordinates ?

7 What is generalized momentum ?

8 What is frame of reference ?

9 What is proper time ?

10 Do we have one absolute reference system ?

(10 × 1 = 10 marks)

II. Answer *all* questions, each question carries 2 marks (Answer in two or three sentence) :

11 State and explain the law of conservation of momentum.

12 What is potential energy curve ?

13 State work energy principle.

14 Explain whether a body have kinetic energy without momentum.

15 Explain Lorentz transformation.

16 What was the aim of Michelson - Morley experiment ?

17 What is twin paradox ?

(7 × 2 = 14 marks)

III. Answer any *five* questions, each question carries 4 marks (Answer in a paragraph) :

18 Show that Lorentz force is a conservative force.

19 Write a short note on the law of conservation of momentum and its importance in Physics. Does the law also hold good in nuclear and relativistic physics ?

Turn over

20 Briefly explain conservation laws and symmetry properties.

21 Using Lagrange's equation, derive Newton's second law.

22 Describe an experiment in support of time dilation.

23 Explain the principle of Michelson - Morley experiment and discuss its importance.

24 Derive the equation $E = mc^2$.

(5 × 4 = 20 marks)

Answer any *four* questions, each question carries 4 marks :

25 Calculate the fictitious force and the observed force on a body of mass 5 kg in a frame of reference moving vertically upwards with an acceleration of 4 m/s².

26 The position of a moving particle is at any instant given by $r = A \cos \theta\ I + A \sin\ \theta j$. Show that the force acting on it is a conservative one.

27 A hunter has a rifle that can fire 0.06 kg bullets with a muzzle velocity of 900 m/sec. A 40 kg leopard springs at him at a speed of 10 m/s. How many bullets must the hunter fire into the leopard in order to stop it in its tracks ?

28 Derive Lagrange's equation from Hamilton's principle.

29 In the Michelson-Morley experiment, the wavelength of the monochromatic light used is 5000 Angstrom unit. What will be the expected fringe shift on the basis of stationary ether hypothesis if the effective length of each path be 5 meters? Given velocity of earth is 3×10^4 m/s.

30 A rod of 1 meter long is moving along its length with a velocity 0.6 c. Calculate its length as it appears to an observer on the earth.

31 Deduce the minimum energy of a gamma ray photon which can cause electron-positron pair productions.

(4 × 4 = 16 marks)

Answer any *two* questions, each question carries 10 marks.

32 What is collision ? Briefly explain different types of collision. Derive an expression for the final velocities of colliding particles in elastic one dimensional collision. Discuss the different cases.

33 Show that the conservation of the angular momentum of a system is a consequence of the rotational invariance of its potential energy. Derive the expression for the distance of closest approach of a proton projected into the Coulomb field of a heavy nucleus.

34 Derive Galilean transformation equations. Show that acceleration is invariant under the transformation.

35 Explain Hamilton's principle and hence deduce Lagrange's equations of motion.

(2 × 10 = 20 marks)