C 31127

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Name......................................

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THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2017

(CUCBCSS—UG)

Physics/Applied Physics

PHY 3B 03/APY 3B 03—MECHANICS

Time : Three Hours   Maximum : 80 Marks

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

  1 What is rotating frame of reference ?

  2 Give an example of fictitious force.

  3 A light and heavy body has equal kinetic energies of translation. Which one has the larger momentum ?

  4 What do you meant by areal velocity ? Name the law behind it.

  5 Give any *one* example of conservation of angular momentum.

  6 What is proper length ?

  7 Write down the expression for Kinetic energy in generalized coordinates.

  8 What is ether hypothesis ?

  9 What is holonomic constraints ?

 10 Give the significance of space – time diagram.

                  (10 × 1 = 10 marks)

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

 11 What is Keplers laws of periods ?

 12 What is the principle of the law of conservation of angular momentum ?

 13 What is collision ?

 14 What is proper mass ?

 15 What is meant by simultaneity ?

 16 What is Hamilton's principle ?

 17 What do you mean by cyclic co-ordinates ?

                  (7 × 2 = 14 marks)

Turn over

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

18 What is potential energy curve of a particle ? What significant information does it give about the behavior of the particle ?

19 The distance between the centers of the carbon and oxygen atoms in the carbon monoxide gas molecule is 1.130×10^{-10} meters. Locate the centre of mass of the molecule relative to the carbon atom.

20 A particle of mass m moves under the action of a central force whose potential is $V(r) = Kmr^3$. For what Kinetic energy and angular momentum will the orbit be a circle of radius R about the origin.

21 Show that the shortest distance between two points in a plane is a straight line.

22 Using Lagrange's equation derive time period of oscillation of a simple pendulum.

23 Show that a particle with zero rest mass travels with the speed of light.

24 Derive the relativistic expression for the kinetic energy of a particle. Show that it reduces to the classical expression when $v \ll c$.

$(5 \times 4 = 20 \text{ marks})$

IV. Answer any *four* questions. Each question carries 4 marks :

25 Considering the earth to be a homogeneous sphere of mass density. Show that the period of revolution of a satellite in an orbit lying just outside the equator depends only upon the density.

26 Show that the force $F = (2xy + z^2)l + x^2j + 2xz\,k$ is conservative.

27 A rocket, set for vertical firing weighs 50 kg and contains 450 kg of fuel. It can have a maximum exhaust velocity of 2 km/s. What should be its minimum rate of fuel consumption to lift if off the launching pad ?

28 A red hot sphere of iron has a mass of 1 kg. If the temperature of the sphere is reduced by 1200 K, what is the loss of mass ? Given specific heat capacity of iron is 462 J/Kg/K.

29 In the laboratory two particles are observed to travel in opposite directions with speed 2.8×10^{10} cm/s. Deduce the relative speed of the particles.

30 A paricle in a stationary frame S lies in the X - Y plane and has a velocity 0.8c inclined at $60°$ to the axis of x. What will be the velocity of the particle as observed by a person in a frame S' moving relative to S with a velocity 0.4 c metres/sec.

31 A muon is travelling through the laboratory at 3/5 th the speed of light. How long does it last if its life time is 2×10^{-4} s.

$(4 \times 4 = 16 \text{ marks})$

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

32 What is Faucaults pendulum ? How does it enable us to demonstrate the rotation of the Earth about its own axis ?

33 (a) State the law of conservation of angular momentum. Give *one* example of its application.

   (b) Show that for a central force, the angular momentum is conserved.

34 Explain the principle of Michelson-Morley experiment and describe it to prove that there is no absolute frame of reference. How was the negative result explained ?

35 (a) What are constraints ? Distinguish between holonomic and non-holonomic constraints.

   (b) State the principle of virtual work and hence derive D'Alembert's principle. List some of its applications in Physics.

(2 × 10 = 20 marks)