M-104-300 **2nd Terminal Examination,December 2014**

Paper- Physics

Class—XI

Time : 3hrs. **M.M. 70**

General Instructions :

i) All questions are compulsory.

ii) There are 26 questions in total. Questions Nos. 1 to 5 are very short answer type questions and carry one mark each.

iii) Question Nos. 6 to 10 carry two marks each, Question Nos. 11 to 22 carry three marks each and question Nos. 24 to 26 carry five marks each.

iv) The question no. 23 carrying 4 marks weightage is value based question.

v) Use of calculators is not permitted. However, you may log tables if necessary.

vi) You may use the following values of physical constants wherever necessary:

Boltzmann's constant K=1.381 × 10-23 JK^{-1}; Avogadro's number $N_A = 6.022 \times 10^{23}$/mol

Radius of Earth = 6400 km; 1 atmospheric pressure = 1.013 × 10^5 Pa; g = 9.8 m/s^2 R = 8.3 J mol^{-1} K^{-1}

1. A body has mass 5kg on earth's surface. Find its mass at centre of earth.

2. A ball is thrown vertically upwards. Draw its acceleration time curve.

3. What is the relation between torque and power?

4. The position coordinate of a moving particle is given by $x = 6 + 18t + 9t^2$ (x is in metre and t in second). What is its velocity at t= 2s.

5. What is the amount of work done by the Earth's gravitational force in keeping the Moon in its circular orbit around the Earth.

6. Find the dimensions of constant 'a' and 'b' occurring in van der Waal's equation :

$$\left[P + \frac{a}{V^2}\right].[V - b] = TR$$

7. A ball is projected vertically upwards from ground with a velocity v.

   (i) How high will it rise before falling back?

   (ii) What is the time taken by ball to reach the highest point? and

   (iii) After how much time the ball comes back to the starting point?

8. Define the term orbital speed. Establish a relation for orbital speed of a satellite orbiting very close the surface of the Earth. Find the ratio of this orbital speed and escape speed.

Or

Derive an expression for the tune period of a satellite revolving around the Earth.

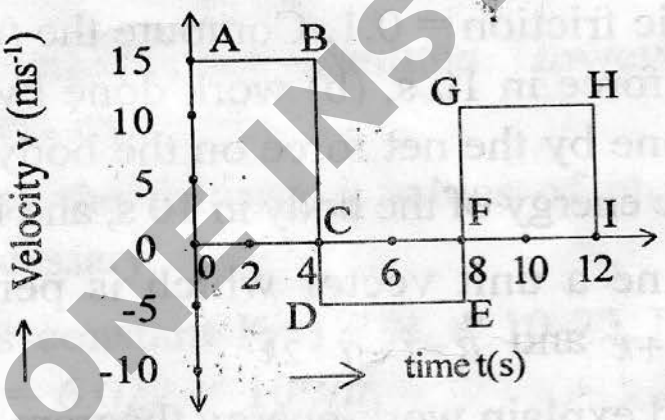
9. A person of mass 50kg stands on a weighing scale on a lift. If the lift is descending with a downward acceleration of 9 ms^{-2}, what would be the reading of the weighing scale? ($g=10\ ms^{-2}$)

10. A body starting from rest accelerates unformly along a straight line at the rate of 10 ms^{-2} for 5s. IT moves for 2s with uniform

velocity of 50 ms^{-1}. Then it retards uniformly and comes to rest in 3s. Draw velocity-time graph of the body and find the total distance traveled by the body.

11. The resistance of a metallic wire is given by R = V/I, where V i the potential difference and I is the current. In a circuit the potential difference across resistance is $V = (8 \pm 0.5)\,V$ and current in circuit $I = (4 \pm 0.2)\,A$. What is the value of resistance with its percentage error?

12. Velocity-time graph of a moving particle has been shown in Fig. Find thc displacement covered by the particle in time intervals (i) 0 s -4 s, (ii) 0 s - 8 s, and (iii) 0 s -12 s from the graph.



13. Two masses m_1 and m_2 (where $m_1 > m_2$) are connected together by a light, inextensible string passing over a smooth, light pulley. Find the magnitude of acceleration of the system. Also find the tension in the string.

14. A block of mass 0.4 kg is suspended from the ceiling by a light string. A second block of 0.3 kg is suspended from the first block through another light string. Find the tension in the two strings. (Take g = 10 ms^{-2})

15. (a) Derive an expression for the acceleration of a body sliding down a rough inclined plane. (b) A block of mass M is pulled along a horizontal frictionless surface by a rope of mass *m* by applying a force P at the free end of the rope. Find the force exerted by the rope on the block.

16. A projectile is projected with a certain velocity u at an angle o with horizontal from the ground. Final expression for its trajectory.

Or

Show that the path of a projectile projected at an angle θ from horizontal is parabolic in shape.

17. A body of mass 2 kg initially at rest moves under the action of an applied horizontal force of 7N on a table with coefficient of kinetic friction = 0.1. Compute the (a) work done by the applied force in 10 s, (b) work done by friction in 10 s, (c) work done by the net force on the body in 10 s, (d) change in kinetic energy of the body in 10 s, and interpret your results.

18. Determine a unit vector which is perpendicular to both $\vec{A} = 2\hat{i} + \hat{j} + \hat{k}$ and $\vec{B} = \hat{i} - \hat{j} + 2\hat{k}$

19. State and explain work-energy theorem.

Or

Draw a graph showing variation of potential energy, kinetic energy and the total energy of a body freely falling on Earth (from a height h) under gravitational force.

20. State the theorem of parallel axes & perpendicular axes.

21. The maximum and minimum values of the resultant of two forces acting at a point are 29 N and 5 N, respectively. If each force be increased by 3 N, find the resultant of these two new forces when acting at right angle to each other.

22. Four particles of mass 1kg, 2kg, 3kg and 4kg are placed at the four vertices A, B, C and D of a square of side 1m. Find the position of centre of mass of the particle.

23. Ram went to a circus show alongwith his parents. There he saw an item, names "globe of death". A big size hollow sphere of steel rods with gaps in between was placed at the centre part of arena. The spherical shell had a door. Then suddenly a person riding a motor cycle rushed up towards the globe, entered into it through the door, completed vertical circles inside the globe and then escaped from the door. Ram was amazed because the motorcyclist did not fall even when he was upside down at the upper part of his vertical loop inside the globe of death. After viewing the circus show, when he returned to his home, he asked his father about this item. His father explained him the basic principle of successful looping the vertical loop by the motorcyclist.

(a) In your opinion how does motorcyclist maintain his equilibrium in the globe of death?

(b) If a globe of death has a radius of 5m, what should be the minimum speed of a motorcyclist at the top point of vertical circle executed by him so that he can maintain his equilibrium?

24. Derive an expression for maximum speed a vehicle should have to take a deduce expression for angle of banking at which there is minimum wear and tear turn on a banked road. Hence to the tyres of the vehicle.

Or

A body is projected with velocity u at angle θ upward from horizontal. Prove that the trajectory is parabolic. Deduce expression for (i) horizontal range, (ii) maximum height attained.

25. Show that the law of conservation of angular momentum can be used to deduce Kepler's second law of planetary motion and write 1st & 3rd law also.

Or

(a) Show that the velocity with which an object is to be projected from the surface of the Earth so that it may just overcome the gravitational pull of the Earth is $\sqrt{\frac{2GM}{R}}$

(b) Find the expression of total energy of a satellite revolving around the surface of Earth. What is the significance of negative sign in the expression?

26. Discuss elastic collision in one dimension. Obtain expression for velocities of two bodies after such a collision?

Or

A simple pendulum of length $1m$ has a wooden bob of mass 1kg. It is struck by a bullet of mass 10^{-2} kg moving with a speed of 2×10^{2} ms^{-1}. The bullet gets embedded into the bob. Obtain the height to which the bob rises before swinging back.

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