Time : 02:30:00 Hrs

Total Marks : 70

Section - I

15 x 1 = 15

Note : i) All Questions are compulsory

ii) Choose the most suitable answer from the given four alternatives and write the option code and the corresponding answer

1) If the length and time period of an oscillating pendulum have errors of 1% and 3% respectively then the error in measurement of acceleration due to gravity is

   (a) 4%   (b) 5%   (c) 6%   (d) 7%

2) Which of the following physical quantities have same dimensional formula?

   (a) Torque and Workdone   (b) Energy and Angular momentum   (c) Force and Torque

   (d) Angular momentum and Linear momentum

3) If a particle has negative velocity and negative acceleration, its speed

   (a) increase   (b) decrease   (c) remains the same   (d) is zero

4) An object is dropped in an unknown planet from height 50m. It reaches the ground in 2s. The acceleration due to gravity in this unknown planet is

   (a) g=20ms^{-2} (b) g=25ms^{-2} (c) g=15ms^{-2} (d) g=30ms^{-2}

5) A force vector applied on a mass is represented as $\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}$ and accelerates with $\sqrt{2}$ ms^{-2} What will be the mass of the body?

   (a) 10kg   (b) 20kg   (c) $10\sqrt{2}$kg   (d) $2\sqrt{10}$ kg

6) Two masses m_1 and m_2 are experiencing the same force where $m_1 < m_2$ The ratio of their acceleration a_1/a_1 is

   (a) 1   (b) less than 1   (c) greater than 1   (d) all the three cases

7) When an object is at rest on the inclined rough surface

   (a) Static and kinetic frictions acting on the object is zero   (b) Static friction is not zero but kinetic friction is not zero

   (c) Static friction is not zero and kinetic friction is zero   (d) Static and kinetic friction are not zero

8) What is the minimum velocity with which a body of mass m must enter a vertical loop of radius R so that it can complete the loop?

   (a) $\sqrt{2gR}$ (b) $\sqrt{3gR}$ (c) $\sqrt{5gR}$ (d) $\sqrt{gR}$

9) The coefficient of restitution (e) for a material is as follows

   (a) e=0   (b) e=1   (c) 0<e<1   (d) 0>e>-1

10) A rope is wound around a hallow cylinder of mass 3 kg and radius 40cm/ What is the angular acceleration of the cylinder if the rope is pulled with a force 30N?

   (a) 0.25rad s^{-2} (b) 25rad s^{-2} (c) 5ms^{-2} (d) 25s^{-2}

11) The magnitude of the Sun's gravitational field as experienced by Earth is

   (a) Same over the year   (b) decreases in the month of January and increase in the month of July

   (c) decrease s in the month of July and increase in the month of January

   (d) increase during day time and decreases during night time

12) For a given material, the rigidity modulus is $\left(\frac{1}{3}\right)^{rd}$ of young's modulus. Its Poisson's ratio is

   (a) 0   (b) 0.25   (c) 0.3   (d) 0.5

13) A hot cup of coffee is kept on the table. After sometime it attains a thermal equilibrium with the surroundings. By considering the air molecule in the room as a thermodynamic system, which of the following is true?

   (a) $\Delta U > 0, Q = 0$ (b) $\Delta U > 0, W = 0$ (c) $\Delta U > 0, Q > 0$ (d) $\Delta U = 0, Q > 0$

14) The efficiency of a heat engine working between the freezing point and boiling point of water is

(a) 6.25% (b) 20% (c) 26.8% (d) 12.5%

15) The dimension of sphere of influence molecule is

(a) 1Å (b) 10Å (c) 100Å (d) 0.1Å

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Section - II   9 x 2 = 18
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II. Answer any six questions: (Question No.20 is compulsory)

16) What are the limitation of the dimensional analysis?

17) Compare scalars and vectors

18) Give the various types of friction. Suggest a few methods to reduce friction.

19) Differentiate elastic and inelastic collisions.

20) Calculative the work done by force of 30N in lifting a load of 2kg to a height of 10m (g = 10ms^{-2})

21) How do you distinguish between stable an unstable equilibrium?

22) Why is the energy of a satellite or any other planet negative?

23) Stae Hook's law of elasticity

24) In an adiabatic process with an equation PT$^{r/1-r}$ the pressure of a gas is found to be proportional to the cube of the temperature. What is the ratio o C_p/C_v of the gas?

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Section - III   9 x 3 = 27
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III. Answer any six questions: (Question No.29 is compulsory)

25) How is the diameter of the Moon measured using parallax method?

26) Write a short note on vector product between two vectors

27) Explain the concept of inertia. Give examples for inertia of motion, inertia of rest and inertia of direction.

28) Compare conservative and non-consevative forces

29) The position vectors of two points 10kg and 5kg are $(3\hat{i} + 2\hat{j} + 4\hat{k})m$ and $(3\hat{i} + 6\hat{j} + 5\hat{k})m$ respectively. Locate the position centre of mass

30) State Kepler's three laws

31) Distinguish between Streamlined flow and turbulent flow

32) Obtain an ideal gas equation from Boyle's and Charles' law

33) A car moving with a speed of 40km/hr comes to rest at a distance of 2m after applying brakes. If the same car is moving with a speed of 80km/hr, what is the minimum stopping distance?

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Section - IV   10 x 5 = 50
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IV. Answer All Questiuons:

34) Explain the principle of homogeneity of dimensions. What are its uses? Give example.

35) State Newton's three laws and discuss their significance

36) Discuss the properties of scalar and vector products

37) Derive the equation of motion for range and maximum height reached by the particle thrown at an oblique angle θ with respect to the horizontal direction.

38) Explain the motion in a vertical circle

39) State and prove parallel axes theorem

40) What is escape speed? Derive an expression for it

41) State and prove Bernoulli's theorem.

42) Discuss the various modes of heat transfer

43) Derive Mayer's relation for an ideal gas

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