M2021

No. of Printed Pages : 4

Register Number

A

PART – III

, awgpay; / **PHYSICS**

(English Version)

Time Allowed : 3.00 Hours]   [Maximum Marks : 70

Instructions :   (1)   Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.

(2)   Use **Blue** or **Black** ink to write and underline and pencil to draw diagrams.

PART – I

Note :   (i)   Answer **all** the questions.   15x1=15

(ii)   Choose the most appropriate answer from the given **four** alternatives and write the option code and the corresponding answer.

1.   Two equal masses m_1 and m_2 are moving along the same straight line with velocities 5 ms⁻¹ and -9 ms⁻¹ respectively. If the collision is elastic, then calculate the velocities after the collision of m_1 and m_2, respectively.
(a) -9 ms⁻¹ and 5 ms⁻¹   (b) -4 ms⁻¹ and 10 ms⁻¹
(c) 5 ms⁻¹ and 1 ms⁻¹   (d) 10 ms⁻¹ and 0 ms⁻¹

2.   If a particle executes uniform circular motion in the xy plane in clockwise direction, then the angular velocity is in:
(a) $-z$ direction   (b) $+y$ direction
(c) $-x$ direction   (d) $+z$ direction

3.   A hollow sphere is filled with water. It is hung by a long thread. As the water flows out of a hole at the bottom, the period of oscillation will:
(a) increase continuously   (b) first increase and then decrease
(c) decrease continuously   (d) first decrease and then increase

4.   Which of the following is not a Scalar?
(a) Pressure   (b) Viscosity   (c) Stress   (d) Surface tension

5.   If an object is thrown vertically up with the initial speed u from the ground, then the time taken by the object to return back to ground is:
(a) $\dfrac{u}{2g}$ (b) $\dfrac{u^2}{2g}$ (c) $\dfrac{2u}{g}$ (d) $\dfrac{u^2}{g}$

6.   The efficiency of a heat engine working between the freezing point and boiling point of water is:
(a) 26.8%   (b) 6.25%   (c) 12.5%   (d) 20%

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7. When an object is at rest on the inclined rough surface:
    (a) Static friction is not zero and kinetic friction is zero
    (b) Static and kinetic frictions acting on the object is zero
    (c) Static and kinetic frictions are not zero
    (d) Static friction is zero but kinetic friction is not zero

8. A couple produces:
    (a) rotation and translation   (b) pure rotation
    (c) no motion   (d) pure translation

9. A transverse wave moves from a medium A to a medium B. In medium A, the velocity of the transverse wave is 500 ms⁻¹ and the wavelength is 5 m. The frequency and the wavelength of the wave in medium B when its velocity is 600 ms⁻¹, respectively are:
    (a) 120 Hz and 6 m   (b) 120 Hz and 5 m
    (c) 100 Hz and 6 m   (d) 100 Hz and 5 m

10. The dimensional formula of Planck's constant h is:
    (a) $[MLT^{-1}]$ (b) $[ML^2T^{-1}]$ (c) $[ML^3T^{-3}]$ (d) $[ML^2T^{-3}]$

11. The unit of surface energy is:
    (a) Nm^3 (b) Nm^{-2} (c) Nm (d) Nm^{-1}

12. The gravitational potential energy of the Moon with respect to Earth is:
    (a) can be positive or negative   (b) always positive
    (c) always zero   (d) always negative

13. A spring is connected to a mass 'm' suspended from it and its time period for vertical oscillation is 'T'. The spring is now cut into two equal halves and the same mass is suspended from one of the halves. The period of vertical oscillation is:

    (a) $T' = \sqrt{2T}$ (b) $T' = \sqrt{2}\,T$ (c) $T' = \sqrt{\dfrac{T}{2}}$ (d) $T' = \dfrac{T}{\sqrt{2}}$

14. If the internal energy of an ideal gas U and Volume V are doubled then, the Pressure:
    (a) halves   (b) doubles   (c) quadruples   (d) remains same

15. Consider a circular leveled road of radius 10 m having coefficient of static friction 0.81. With what speed a car has to move on the turn so that it will have safe turn? (g=10 ms⁻²)
    (a) 12 ms⁻¹   (b) 8 ms⁻¹   (c) 14 ms⁻¹   (d) 10 ms⁻¹

PART – II

Note : Answer **any six** questions. Question No. **24** is **compulsory.** 6x2=12

16. Define angular velocity.

17. State Wien's law.

18. Check the correctness of the equation v=u+at using dimensional analysis method.

19. Give any two examples of torque in day-to-day life.

20. Define frequency of simple harmonic motion.

21. A book of mass m is at rest on the table. Draw the free body diagram for the book.

22. Compute the distance between anti-node and neighbouring node.

23. Why the energy of a satellite or any other planet is negative?

24. Calculate the energy consumed in electrical units when a 75 W fan is used for 8 hours daily for one month (30 days).

PART – III

Note : Answer **any six** questions. Question No. **33** is **compulsory.** 6x3=18

25. Derive the relation between Momentum and Kinetic energy.

26. State the law of transverse vibrations in stretched strings.

27. Show that in horizontal projection, the path of a projectile is a Parabola.

28. Define centre of gravity.

29. State Stefan-Boltzmann Law.

30. What are the salient features of Static and Kinetic friction?

31. What are the applications of Dimensional Analysis?

32. Define the degrees of freedom. Give an example.

33. If excess pressure is balanced by a column of oil with specific gravity 0.8, 4 mm high, where R=2.0 cm, find the surface tension of the soap bubble.

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PART – IV

Note :   Answer **all** the questions.   5x5=25

34.   (a)   Explain the oscillations of liquid column in U-tube.
(OR)
(b)   Derive the kinematics equations of motion for constant acceleration.

35.   (a)   State and explain work energy principle.
(OR)
(b)   Explain how overtones are produced in a closed organ pipe.

36.   (a)   Convert 76 cm of mercury pressure into Nm^{-2} using the method of dimensions.
(OR)
(b)   Explain in detail Newton's law of cooling.

37.   (a)   State and Prove Bernoulli's theorem.
(OR)
(b)   Derive an expression for Kinetic Energy in Rotation.

38.   (a)   Explain the need for banking of tracks.
(OR)
(b)   Explain the variation of g with depth from the Earth's surface.

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