

Roll No _____ (To be filled in by the candidate) (Academic Sessions 2020 – 2022 to 2023 – 2025)
PHYSICS 224-1st Annual-(INTER PART – I) Time Allowed : 20 Minutes
 Q.PAPER – I (Objective Type) GROUP – I Maximum Marks : 17

PAPER CODE = 6475

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	Two S.H.M having displacements are $x_1 = a \sin \omega t$ and $x_2 = b \cos \omega t$. The path difference between them will be : (A) Zero (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{2}$ (D) π
2	A particle of 1 Kg moving with initial velocity 5 ms^{-1} is acting upon by a constant force 10N. After 5 seconds its velocity becomes : (A) 50 ms^{-1} (B) 55 ms^{-1} (C) 5 ms^{-1} (D) 10 ms^{-1}
3	Dolphins detect small differences in the shape, size and thickness of objects through : (A) Beats (B) Radio waves (C) Echolocation (D) Both A and B
4	The ratio of dimensions of torque to angular momentum is : (A) I : T (B) M : T (C) T : I (D) L : T
5	Potential energy associated to the molecules of an ideal gas is considered to be : (A) 100 J (B) Low (C) Zero (D) High
6	A particle moves in a circle of radius r . In half the period of revolution, its displacement and distance covered are : (A) $2r, \pi r$ (B) $2r, 2\pi r$ (C) $\sqrt{2}r, \pi r$ (D) $r, \pi r$
7	The magnitude of $-\hat{i} \cdot (\hat{k} \times \hat{j})$ is equal to : (A) 0 (B) $-2\hat{i}$ (C) 1 (D) $2\hat{i}$
8	The percentage uncertainty in mass and radius of earth is 2% and 5% respectively. The total percentage uncertainty in the volume of earth is : (A) 7% (B) 15% (C) 9% (D) 3%
9	The frequency of heart of normal human being is : (A) 1.2 Hz (B) 0.83 Hz (C) 72 Hz (D) 2 Hz
10	The magnifying power of a magnifying glass is 3. Its focal length will be : (A) 15 cm (B) 20 cm (C) 8.3 cm (D) 12.5 cm
11	A flywheel gains an angular speed of 540 rev / min in 9 second. Its angular acceleration is : (A) $9 \pi \text{ rad s}^{-2}$ (B) $6 \pi \text{ rad s}^{-2}$ (C) $12 \pi \text{ rad s}^{-2}$ (D) $2 \pi \text{ rad s}^{-2}$
12	The horizontal range of a projectile is : (A) Equal to height at 30° (B) Double of height at 45° (C) One fourth of the height at 90° (D) Four times of height at 45°
13	The efficiency of diesel engine is : (A) 25% to 35% (B) 35% to 40% (C) 45% to 50% (D) 20% to 25%
14	A mass is lifted to a height in 10 seconds. Now if the same mass is lifted to the same height in 20 seconds then work done in two cases are in the ratio : (A) 1 : 2 (B) 2 : 1 (C) 1 : 1 (D) 4 : 1
15	Which of the vector can not be represented on graph : (A) Unit vector (B) Position vector (C) Negative vector (D) Null vector
16	Energy cannot flow away in the : (A) Transverse waves (B) Stationary waves (C) Longitudinal waves (D) Sound waves
17	The direction in which light energy is carried called a : (A) Ray (B) Wave front (C) Locus (D) Spherical wave

SECTION – I

LHR-1-24

2. Write short answers to any EIGHT (8) questions :

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- (i) Write down dimensions of : (a) Pressure. (b) Density.
- (ii) Does a dimensional analysis give any information on constant of proportionality that may appear in an algebraic expression?
- (iii) Name two major types of errors.
- (iv) Write down factors of prefixes atto and tera.
- (v) Can magnitude of a vector have a negative value?
- (vi) If $\vec{A} - \vec{B} = \vec{O}$, what can you say about the components of the two vectors?
- (vii) Can you add zero to a null vector?
- (viii) Motion with constant velocity is a special case of motion with constant acceleration. Is this statement true? Discuss.
- (ix) An object is thrown vertically upward. Discuss sign of acceleration due to gravity relative to velocity, while the object is in air.
- (x) How impulse is equal to change in momentum?
- (xi) An object has 1J of potential energy. Explain what does it mean?
- (xii) Prove that $P = \vec{F} \cdot \vec{v}$ where P, \vec{F} and \vec{v} are power, force and velocity.

3. Write short answers to any EIGHT (8) questions :

16

- (i) A wheel covers 200 m distance between two points. If its radius is 0.2 m, find the number of revolution completed by the wheel.
- (ii) Describe what should be the minimum velocity for a satellite, to orbit close to the earth around it.
- (iii) State the direction of the following vectors in simple situations, angular momentum and angular velocity.
- (iv) When mud flies off the tyre of a moving bicycle, in what direction does it fly? Explain.
- (v) A person is standing near a fast moving train. Is there any danger that he will fall towards it?
- (vi) Explain the working of a carburetor of a motorcar using Bernoulli's principle.
- (vii) Time period of a simple pendulum is 2.0 s and amplitude 20 cm, find its maximum speed.
- (viii) What are the conditions of constructive and destructive interference of two sound waves from coherent sources?
- (ix) Can we realize an ideal simple pendulum?
- (x) What is the total distance travelled by an object moving with SHM in a time equal, to its period, if its amplitude is A?
- (xi) Explain the terms : (i) crest. (ii) antinode.
- (xii) Why does sound travel faster in solids than in gases?

(Turn Over)

(2)

4. Write short answers to any SIX (6) questions :

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- (i) Which principle is helpful to determine the shape and location of new wavefront? Explain briefly.
- (ii) Explain whether the Young's experiment is an experiment for studying interference or diffraction effects of light.
- (iii) What are different methods to get polarized light?
- (iv) What is multimode step index fibre? Explain in short.
- (v) Draw the ray diagram of compound microscope.
- (vi) Describe in short the construction and working of collimator.
- (vii) What will be efficiency of an engine if it performs 100 J of work and rejects 400 J of heat energy to the cold reservoir?
- (viii) Why the efficiency of real heat engine is always less than one?
- (ix) Give an example of a process in which no heat is transferred to or from the system but temperature of system changes.

SECTION – II

Note : Attempt any THREE questions.

5. (a) Find resultant of \vec{A} and \vec{B} using addition of vectors by rectangular components. 5
- (b) A football is thrown upward at an angle of 30° with respect to horizontal. To throw a 40 m pass what must be the initial speed of the ball? 3
6. (a) How would you describe the analytical approach of formula of absolute P.E., also derive the formula with diagrammatic explanation. 5
- (b) The frequency of the note emitted by a stretched string is 300 Hz. What will be the frequency of this note when the tension is increased by one third without changing the length of the wire? 3
7. (a) Define angular momentum and explain orbital and spin angular momentum. 5
- (b) A block of mass 4.0 kg is dropped from height of 0.80 m on to a spring of spring constant $k = 1960 \text{ Nm}^{-1}$. Find the maximum distance through which the spring will be compressed? 3
8. (a) Define pressure of gas. Prove that pressure exerted by the gas is directly proportional to the average translational kinetic energy of the gas molecules. 5
- (b) How large must a heating duct be if air moving along it can replenish the air in a room of 300 m^3 volume every 15 min.? Assume the air's density remains constant. 3
9. (a) Explain Young's Double slit experiment to study the phenomenon of interference of light. 5
- (b) An astronomical telescope having magnifying power of 5 consist of two thin lenses 24 cm apart. Find the focal lengths of the lenses. 3

Note : Four possible answers A, B, C and D to each question are given. The choice which you think is correct, fill that circle in front of that question with Marker or Pen ink in the answer-book. Cutting or filling two or more circles will result in zero mark in that question.

1-1	A body completes five revolutions in a circular path having radius 5 cm, the displacement of the body is : (A) Zero (B) 10 cm (C) 0.157 rad (D) 0.314 rad
2	How many satellites can track your Switch ON mobile phone location globally : (A) 3 (B) 24 (C) 14 (D) 5
3	Longitudinal waves do not exhibit : (A) Refraction (B) Reflection (C) Polarization (D) Diffraction
4	The unit of thermodynamic scale is : (A) Centigrade (B) Fahrenheit (C) Joule (D) Kelvin
5	The dimensions of $\left(\frac{v}{v-u_s}\right)\frac{1}{\lambda}$ are : (A) $[T]^{-1}$ (B) $[L]^{-1}$ (C) $[MT^{-1}]$ (D) $[T^{-1}L]$
6	The speed of sound in air at 373 K is : (A) 332ms^{-1} (B) 300ms^{-1} (C) 291ms^{-1} (D) 393ms^{-1}
7	The resultant force of two forces 30 N and 50 N acting on a body in opposite direction is : (A) 80 N (B) $10\sqrt{34}$ N (C) 50 N (D) 20 N
8	When the bob of simple pendulum is at its extreme position, it has : (A) K.E (B) P.E and K.E (C) P.E (D) P.E or K.E
9	At constant temperature, the graph between v and $\frac{1}{p}$ is : (A) Hyperbola (B) Straight line (C) Parabola (D) Ellipse
10	All the food we eat in one day has about the same energy as (if one litre petrol energy = 5×10^7 J) : (A) 5×10^7 J (B) 0.33 J (C) 10×10^7 J (D) 1.66×10^7 J
11	The diameter of the milky way is of the order of : (A) $10^{20}m$ (B) $10^{10}m$ (C) 10^3m (D) $10^{40}m$
12	The angular speed of hour's hand of mechanical watch at 2 o'clock is : (A) $\frac{\pi}{3}$ rad /hour (B) 2π rad /hour (C) $\frac{\pi}{6}$ rad /hour (D) 4π rad /hour
13	The time of flight of projectile is maximum when it is projected at an angle of : (A) 45° (B) 90° (C) 76° (D) 0°
14	A two meter high tank is full of water. A hole appears at its middle. What is the speed of efflux of water (If $g = 10\text{ms}^{-2}$) : (A) 4.47ms^{-1} (B) 4.32ms^{-1} (C) 10.0ms^{-1} (D) 20.0ms^{-1}
15	Name the quantity which is vector : (A) Density (B) Power (C) Impulse (D) Charge
16	Twenty waves passes through the medium in one second with speed 20ms^{-1} , the frequency of wave is : (A) 400 Hz (B) 20 Hz (C) 50 Hz (D) 2 Hz
17	The magnification of a simple microscope when the final image is formed at infinity : (A) $\frac{d}{f}$ (B) $1 + \frac{d}{f}$ (C) $f_o + f_e$ (D) $\frac{f_o}{f_e}$

SECTION – I

LHR-2-24

2. Write short answers to any EIGHT (8) questions :

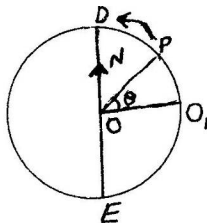
16

- (i) What are two major types of errors, explain them with examples?
- (ii) Give any two rules for significant figures.
- (iii) Find the dimensions of gravitational constant G in the formula $F = G \frac{m_1 m_2}{r^2}$
- (iv) Find the uncertainty in a timing experiment of 30 vibrations completed in 54.6 sec. and the timing device has the least count 0.1 sec.
- (v) Under what circumstances would a vector have components that are equal in magnitude?
- (vi) How would you prove equilibrium of coplanar forces?
- (vii) Analyse the net increase in the value of vector product when angle between two vectors are changed from 0° to 60° .
- (viii) Why do we wear seat belts? Use an equation to support your answer.
- (ix) Mention the points in the path of a projectile for minimum and maximum speed.
- (x) An object is thrown vertically upward, discuss the sign of acceleration due to gravity, relative to velocity, while the object is in air.
- (xi) How pollution can be reduced? Use mass transportation and energy methods to support your answer.
- (xii) A girl drops a cup from a certain height, which breaks into pieces. What energy changes are involved?

3. Write short answers to any EIGHT (8) questions :

16

- (i) Why mud flies off the tyre of a moving bicycle, in what direction does it fly?
- (ii) What are the artificial satellites?
- (iii) Show that orbital angular momentum $L_o = mvr$
- (iv) Differentiate between tangential and angular velocity, how both are related to each other?
- (v) What do you understand about the term viscosity?
- (vi) How do you describe the behaviour of an ideal fluid flow?
- (vii) On what factors does frequency of a simple pendulum depends?
- (viii) If a mass-spring system vibrates, during vibration if potential energy increases what do you conclude about total energy?
- (ix) Locate the position of pointer 'P' along with vibrating point 'N' at different instant of time period.



- (x) Why does sound travel faster in solids than in gases?
- (xi) Describe the phenomenon of sound speed regardless of temperature in air.
- (xii) If stationary waves are set up in an organ pipe with both open ends, how does frequency varies with length of pipe?

(Turn Over)

4. Write short answers to any SIX (6) questions :

12

- (i) Give two applications of Bragg's equation.
- (ii) Under what conditions two or more sources of light behave as coherent sources?
- (iii) Can-visible light produce interference fringes? Explain.
- (iv) Use Snell's law to calculate critical angle for glass air boundary. Make a diagram to support your answer.
- (v) Make the ray diagrams of compound microscope and astronomical telescope.
- (vi) Define resolving power and give its at least two formulae.
- (vii) Give the interpretation of temperature by using pressure of gas equation.
- (viii) How do you describe the all processes of strokes for petrol engine?
- (ix) Give an example of a natural process that involves an increase in entropy.

SECTION - II

Note : Attempt any THREE questions.

5. (a) Define projectile motion. Derive relation for :
 - (i) Time of flight
 - (ii) Range
 - (iii) Maximum height
 5
- (b) Find the angle between two forces of equal magnitude when the magnitude of their resultant is also equal to the magnitude of either of these forces. 3
6. (a) Discuss stationary waves in an air column. Also discuss different modes of vibrations in an open organ pipe. 5
- (b) How large a force is required to accelerate an electron ($m = 9.11 \times 10^{-31} \text{ kg}$) from rest to speed of $2 \times 10^7 \text{ ms}^{-1}$ through a distance of 5 cm? 3
7. (a) What is artificial gravity? Derive an expression for frequency of space-ship to provide the artificial gravity. 5
- (b) A simple pendulum is 50.0 cm long. What will be its frequency of vibration at a place where $g = 9.8 \text{ ms}^{-2}$? 3
8. (a) How does the efficiency of a carnot engine is calculated? 5
- (b) What gauge pressure is required in the city mains for a stream from a fire hose connected to the mains to reach a vertical height of 15.0 m? 3
9. (a) What is meant by diffraction of light? Also discuss the diffraction of light through a narrow slit? 5
- (b) A simple astronomical telescope in normal adjustment has an objective of focal length 100 cm and an eye piece of focal length 5.0 cm. 3
 - (i) Where is the final image formed?
 - (ii) Calculate the angular magnification.