

Roll No _____ (To be filled in by the candidate) (Academic Sessions 2019 – 2021 to 2022 – 2024)

PHYSICS

223-1st Annual-(INTER PART – I)

Time Allowed : 20 Minutes

Q.PAPER – I (Objective Type)

GROUP – I

Maximum Marks : 17

PAPER CODE = 6471

LHR-11-1-23

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 | Which of the following is supplementary unit : (A) Ampere (B) Candela (C) Mole (D) Steradian |
| 2 | In measurement 8,000 kg, if the scale has a least count of 10 kg, then the number of significant figures are : (A) 3 (B) 4 (C) 2 (D) 1 |
| 3 | If the magnitude of resultant of two equal forces is also equal to the magnitude of either forces, then the angle between forces is : (A) 45° (B) 120° (C) 90° (D) 60° |
| 4 | For i, j and k unit vectors $i \times (j \times k)$ is : (A) $\vec{0}$ (B) \hat{i} (C) j (D) k |
| 5 | Slope of velocity-time graph gives : (A) Acceleration (B) Distance (C) Momentum (D) Displacement |
| 6 | The angle between velocity and acceleration at the highest point during the projectile motion is: (A) 45° (B) 30° (C) 90° (D) 0° |
| 7 | As the food we eat in the day has about the same energy as : (A) $\frac{1}{2}$ litre of petrol (B) $\frac{1}{3}$ litre of petrol (C) $\frac{1}{5}$ litre of petrol (D) $\frac{1}{7}$ litre of petrol |
| 8 | The moment of inertia of a cylinder is : (A) $\frac{2}{5}mr^2$ (B) $\frac{1}{2}mr^2$ (C) mr^2 (D) $\frac{1}{12}mr^2$ |
| 9 | 1 torr = ---- Nm^{-2} : (A) 133.3 (B) 143.3 (C) 153.3 (D) 123.3 |
| 10 | The angle $\theta = \omega t$ specifies in SHM : (A) Displacement (B) Direction of motion of the point (C) Both displacement and direction (D) Direction of force |
| 11 | If a wave travelling in denser medium is reflected from the boundary of rarer medium, the phase change in the wave is : (A) 0° (B) 180° (C) 90° (D) 60° |
| 12 | According to Doppler effect, a star moving towards the earth show : (A) Red shift (B) Blue shift (C) Yellow shift (D) Green shift |
| 13 | In Michelson's interferometer, to observe two consecutive dark and bright fringes, the movable mirror is moved through : (A) $\frac{\lambda}{2}$ (B) $\frac{\lambda}{4}$ (C) $\frac{\lambda}{3}$ (D) λ |
| 14 | In collimator the rays coming out of the lens are parallel if the distance between lens and slit is : (A) Equal to the focal length of lens (B) Greater than the focal length of lens (C) Less than the focal length of lens (D) At any distance between lens and slit |
| 15 | If the source and sink are at the same temperature, then net change in entropy is : (A) Minimum (B) Maximum (C) Zero (D) Negative |
| 16 | If the frequency of rotation of a spacecraft is doubled, then gravity produced becomes : (A) Double (B) 3 times (C) 4 times (D) Does not change |
| 17 | An ideal reversible heat engine has efficiency : (A) 100 % (B) Highest (C) Efficiency depends upon the nature of working substance (D) 33.33% |

SECTION – I

LHR-11-1-23

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

16

- (i) Write down dimensions of : (i) Co-efficient of viscosity. (ii) Pressure.
- (ii) A light year is the distance travelled by light in one year. How many meters are there in one light year? (Speed of light = $3 \times 10^8 \text{ m/s}$)
- (iii) What is an error? Write down its types.
- (iv) How the uncertainty is reduced in a timing experiment?
- (v) Two vectors have un-equal magnitudes. Can their sum be zero? Explain.
- (vi) Under what circumstances would a vector have components that are equal in magnitude?
- (vii) \vec{A} and \vec{B} are two non-zero vectors. How can their scalar product be zero? How can their vector product be zero?
- (viii) At what point or points in its path does a projectile have its minimum speed, its maximum speed?
- (ix) As an object is thrown vertically upwards, its velocity decreases. Is this against the law of conservation of linear momentum?
- (x) If 'H' is height attained by a projectile and 'T' is the time of flight, then $H = \frac{gT^2}{8}$
- (xi) What is impulse? How it is related to momentum?
- (xii) A person is standing near a fast moving train. Is there any danger that he will fall towards it?

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

16

- (i) Calculate the work done when a 50 kg bag of books is lifted through 50 cm.
- (ii) When a rocket re-enters the atmosphere, its nose cone becomes very hot? Where does this heat energy come from?
- (iii) Discuss the relation and the importance of -ve sign in the relation $U_g = -\frac{GMm}{r}$.
- (iv) How centripetal force acts and give two forces which can provide centripetal force to the circulating system?
- (v) How would you explain the concept of moment of inertia in orbital and spin angular momentum?
- (vi) Explain how many minimum number of geo-stationary satellites are required for global coverage of T.V. transmission?
- (vii) What should be the length of simple pendulum whose period is 2 sec.?
- (viii) Does the acceleration of a simple harmonic oscillator remain constant during its motion? Is acceleration ever zero? Explain.
- (ix) What is meant by phase angle? Does it define angle between maximum displacement and the driving force?
- (x) Why Newton's formula of speed of sound has 16% error? Support your answer by proper reasoning.
- (xi) How beats are useful in tuning musical instruments?
- (xii) Define the terms crest and trough.

(Turn Over)

(2) LHR-11-1-23

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

12

- (i) Can visible light produce interference fringes? Explain.
- (ii) How would you distinguish between un-polarized and plane-polarized light?
- (iii) Define air film. Write its two examples.
- (iv) Why would it be advantageous to use blue light with a compound microscope?
- (v) What are the uses of spectrometer?
- (vi) Why does the pressure of a gas in a car tyre increases when it is driven through some distance?
- (vii) Is it possible to construct a heat engine that will not expel heat into the atmosphere?
- (viii) Derive Charles' law from kinetic theory of gases.
- (ix) Define triple point of water, also write its value.

SECTION - II

Note : Attempt any THREE questions.

5. (a) Define vector or cross product. Give examples. Give at least four characteristics of vector product. 5
- (b) How large force is required to accelerate an electron ($m=9.1 \times 10^{-31} \text{ kg}$) from rest to a speed of $2 \times 10^7 \text{ ms}^{-1}$ through a distance of 5.0 cm? 3
6. (a) What are geostationary orbits and geostationary satellites? Derive the relation for the radius of a geostationary satellite. 5
- (b) A football is thrown upward with an angle of 30° with respect to the horizontal. To throw a 40 m pass what must be the initial speed of the ball? 3
7. (a) State and prove the Bernoulli's equation in fluid dynamics that relates the pressure to the fluid speed and height. 5
- (b) A heat engine performs 100 J of work and at the same time rejects 400 J of heat energy to the cold reservoirs. What is the efficiency of the engine? 3
8. (a) What is simple pendulum? Show that its motion is SHM. Derive an expression for its time period. 5
- (b) The wavelength of the signal from a radio transmitter is 1500 m and the frequency is 200 KHz. What is the wavelength for a transmitter operating at 1000 KHz and with what speed the radio waves travel? 3
9. (a) What is diffraction of light? Calculate the wavelength of light used by diffraction grating. 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. Calculate the angular magnification. 3

PAPER CODE = 6478 LHR-11-2-23

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 | The first demonstration of wave nature of light was provided in 1801 by the experiment of : (A) Huygen (B) Newton (C) Maxwell (D) Thomas Young |
| 2 | When a body moves in a circle its linear velocity always : (A) Remains constant (B) Becomes zero (C) Changes (D) Increases |
| 3 | The rate of change of momentum of a body falling freely is equal to its : (A) K.E. (B) Weight (C) Power (D) Momentum |
| 4 | A heavily damped system has a fairly flat resonance curve in an : (A) Velocity time graph (B) Distance time graph (C) Amplitude frequency graph (D) Amplitude time graph |
| 5 | The rotational K.E. of Disc is equal to : (A) $\frac{1}{4}mv^2$ (B) $\frac{1}{2}mv^2$ (C) $\frac{1}{2}I\omega$ (D) $I\omega$ |
| 6 | Time interval between normal heart beats is : (A) $1 \times 10^{-5}s$ (B) 8×10^1s (C) $1 \times 10^{-2}s$ (D) $8 \times 10^{-1}s$ |
| 7 | The ratio of $\frac{C_p}{C_v}$ for a diatomic gas is equal to : (A) 1.67 (B) 1.50 (C) 1.40 (D) 1.29 |
| 8 | A typical rocket eject the burn gases at speeds of over : (A) 400 m / sec (B) 4000 m/sec (C) 8000 m/sec (D) 10000 m/sec |
| 9 | Longitudinal waves do not exhibit : (A) Reflection (B) Refraction (C) Polarization (D) Diffraction |
| 10 | The branch of Physics which is concerned with ultimate particles of which matter is composed of is called : (A) Atomic Physics (B) Nuclear Physics (C) Plasma Physics (D) Particle Physics |
| 11 | Viscosity of air at $30^\circ C$ is : (A) $0.019 \times 10^{-3} Nsm^{-2}$ (B) $0.295 \times 10^{-3} Nsm^{-2}$ (C) $0.510 \times 10^{-3} Nsm^{-2}$ (D) $0.564 \times 10^{-3} Nsm^{-2}$ |
| 12 | If $\vec{A} = -4\hat{i}$, $\vec{B} = 6\hat{j}$ then $\vec{A} \cdot \vec{B}$ will be : (A) $24\hat{k}$ (B) 24 (C) Zero (D) $-24\hat{k}$ |
| 13 | The diameter of the core of multimode step index fibre is : (A) 50 mm (B) 50 μm (C) 50 nm (D) 50 Pm |
| 14 | Bats navigate and find food by : (A) Microwaves (B) Echo location (C) Electromagnetic waves (D) Matter waves |
| 15 | If temperature of a sink of a heat engine is absolute zero, the efficiency of heat engine should be : (A) 100 % (B) 50 % (C) 0 % (D) Infinity |
| 16 | Two masses of 1 gm and 4 gm are moving with same K.E. The ratio of their linear momentum are : (A) 1 : 16 (B) 6 : 1 (C) 1 : 2 (D) 4 : 1 |
| 17 | If the magnitude of scalar and vector product of two vectors are $2\sqrt{3}$ and 2 respectively, the angle between vectors is : (A) 30° (B) 45° (C) 120° (D) 180° |

Roll No _____ (To be filled in by the candidate) (Academic Sessions 2019 – 2021 to 2022 – 2024)

PHYSICS 223-1st Annual-(INTER PART – I) Time Allowed : 2.40 hours

PAPER – I (Essay Type) GROUP – II Maximum Marks : 68

SECTION – I LHR-11-2-23

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

16

- (i) Give four conventions for indicating units.
- (ii) What is random error? How it can be eliminated?
- (iii) Why do we find it useful to have two units for the amount of substance, the kilogram and mole?
- (iv) Does a dimensional analysis give any information on constant of proportionality that may appear in an algebraic expression? Explain.
- (v) How would you verify that the dot and cross product become equal in magnitude?
- (vi) If all the components of the vectors \vec{A}_1 and \vec{A}_2 were reversed, how would this alter $\vec{A}_1 \times \vec{A}_2$?
- (vii) Name three different conditions that could make $\vec{A}_1 \times \vec{A}_2 = \vec{0}$
- (viii) Does a moving object has impulse? Explain your reasoning.
- (ix) A 1500 kg car has its velocity reduced from 20 m/s to 15 m /s in 3.0 second. How large was the average retarding force?
- (x) Define impulse and show that how it is related to linear momentum?
- (xi) Why isolated system is important to conserve linear momentum? Also state law of conservation of momentum.
- (xii) Why fog droplets appear to be suspended in air?

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

16

- (i) When a rocket re-enters the atmosphere, its nose cone becomes very hot? Where does this heat energy come from?
- (ii) A boy uses a catapult to throw a stone which accidentally smashes a green house window. List the possible energy changes.
- (iii) State work-energy principle.
- (iv) What is meant by moment of inertia? Explain its significance.
- (v) Explain how many minimum number of geo-stationary satellites are required for global coverage of T.V. transmission?
- (vi) Differentiate between tangential velocity and angular velocity.
- (vii) What happens to the period of simple pendulum, if its length is doubled? What happens if the suspended mass is doubled?
- (viii) What is meant by phase angle? Does it define angle between maximum displacement and the driving force?
- (ix) Differentiate between transverse waves and longitudinal waves.
- (x) What should be the frequency of a simple pendulum whose period is 0.5 seconds at a place where $g = 9.8 \text{ ms}^{-2}$?
- (xi) A wave is produced along a stretched string but some of its particles permanent show zero displacement. What type of wave is it?
- (xii) Explain why sound travels faster in warm air than in cold air?

(Turn Over)

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

- (i) Under what condition two or more sources of light behave as coherent sources?
- (ii) How would you manage to get more orders of spectra using a diffraction grating?
- (iii) Draw an interference pattern formed with white light.
- (iv) Why would it be advantageous to use blue light with a compound microscope?
- (v) Draw ray diagram of compound microscope and write its total magnification.
- (vi) Is it possible to construct a heat engine that will not expel heat into the atmosphere?
- (vii) Can mechanical energy be converted completely into heat energy? If so give an example.
- (viii) Derive the Charles's law from kinetic theory of gases.
- (ix) What is adiabatic process? Write down its two examples.

SECTION – II

Note : Attempt any THREE questions.

5. (a) Define rectangular component. Explain addition of vectors by rectangular components. 5
- (b) Ten bricks, each 6.0 cm thick and mass 1.5 kg lie flat on a table. How much work is required to stack them one on the top of another? 3
6. (a) Define projectile motion. Derive the expression for : 5
 - (i) Time of flight and (ii) Height of a projectile.
- (b) What is the least speed at which an aeroplane can execute a vertical loop of 1.0 km radius so that there will be no tendency for the pilot to fall down at the highest point. 3
7. (a) Show that pressure exerted by the gas is directly proportional to the average translational kinetic energy of gas molecules. 5
- (b) Water flows through a hose, whose internal diameter is 1 cm at a speed of 1ms^{-1} . What should be the diameter of the nozzle if the water is to merge at 21ms^{-1} ? 3
8. (a) Describe Doppler's Effect. Derive apparent frequency and discuss its results if : 5
 - (i) Source is moving towards the stationary observer.
 - (ii) Source is moving away from stationary observer.
- (b) Find the amplitude and frequency of an object vibrating at the end of a spring, if the equation for its position, as a function of time is $X = 0.25 \cos\left(\frac{\pi}{8}\right)t$ 3
9. (a) Describe the principle, construction and working of Michelson's interferometer. How can you find the wavelength of light used? 5
- (b) A compound microscope has lenses of focal length 1.0 cm and 3.0 cm. An object is placed 1.2 cm from the object lens. If a virtual image is formed, 25 cm from the eye, calculate the separation of the lenses and the magnification of the instrument. 3