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 $-\hat{i}.(\hat{k}\times\hat{j})$ 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) 2%
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) $9\,\pi$ rad s^{-2} (B) $6\,\pi$ rad s^{-2} (C) $12\,\pi$ rad s^{-2} (D) $2\,\pi$ 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

No _____ (To be filled in by the candidate) **(Academic Sessions 2020 – 2022 to 2023 – 2025)**

PHYSICS 224-1st Annual-(INTER PART – I) Time Allowed : 2.40 hours

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

SECTION – I

2. Write short answers to any EIGHT (8) questions : 16

(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 $\overline{A} - \overline{B} = \overline{O}$, 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 $P = \overline{F} . \overline{v}$ where P , $\overline{F}$ and $\overline{v}$ 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)

4. Write short answers to any SIX (6) questions : **12**

(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 $\overline{A}$ and $\overline{B}$ 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 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

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.SICS 224-1st Annual-(INTER PART – I) Time Allowed : 20 Minutes

Q.PAPER – I (Objective Type) GROUP – II Maximum Marks : 17

PAPER CODE = 6474

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 = $(\frac{v}{v-u_s})\frac{1}{\lambda}$ 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) $332\,ms^{-1}$	(B) $300\,ms^{-1}$	(C) $291\,ms^{-1}$	(D) $393\,ms^{-1}$
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 ms^{-2}) :			
	(A) $4.47\,ms^{-1}$	(B) $4.32\,ms^{-1}$	(C) $10.0\,ms^{-1}$	(D) $20.0\,ms^{-1}$
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 $20\,ms^{-1}$, 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) $\frac{f_o}{f_e}$

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 : 2.40 hours

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

SECTION – I

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^o to 60^o.

(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?

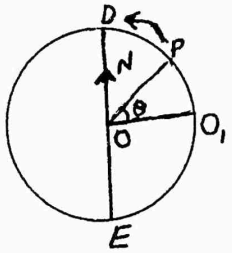
(v) What do you understand about the term viscosity?

(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 ($m = 9.11 \times 10^{-31} kg$) from rest to speed of $2 \times 10^{7} ms^{-1}$ 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 $g = 9.8 ms^{-2}$? 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.

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

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) $\vec{O}$ (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 $\theta = wt$ 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%

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 – I Maximum Marks : 68

SECTION – I

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 = $3\times10^8\, m/s$)

(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)

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 ($m=9.1\times10^{-31}kg$) from rest to a speed of $2\times10^{7}ms^{-1}$ 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

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 – II Maximum Marks : 17

PAPER CODE = 6478

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) $1\times10^{-5}s$	(B) $8\times10^{1}s$	(C) $1\times10^{-2}s$	(D) $8\times10^{-1}s$
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 $30°C$ is :			
	(A) $0.019\times10^{-3}Nsm^{-2}$	(B) $0.295\times10^{-3}Nsm^{-2}$		
	(C) $0.510\times10^{-3}Nsm^{-2}$	(D) $0.564\times10^{-3}Nsm^{-2}$		
12	If $\vec{A}=-4\hat{i}$, $\vec{B}=6\hat{j}$ then $\vec{A}.\vec{B}$ 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

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 $g = 9.8\, ms^{-2}$?

(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 : 12

(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 :
(i) Time of flight and (ii) Height of a projectile. 5

(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

Roll No _____ (To be filled in by the candidate) **(Academic Sessions 2018 – 2020 to 2021 – 2023)**

PHYSICS 222-(INTER PART – I) Time Allowed : 2.40 hours

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

SECTION – I

2. Write short answers to any EIGHT (8) questions : **16**

(i) Find the uncertainty in the time period of a vibrating body, if time of 30 vibrations of a simple pendulum recorded by a stopwatch accurate upto one tenth of a second is 54.6 sec.

(ii) A light year is the distance light travels in one year. How many meters are there in one light year?

(iii) Show that the famous " Einstein's equation" $E = mc^2$ is dimensionally consistent.

(iv) The time period of a simple pendulum is measured by a stopwatch. What types of errors are possible in the time period?

(v) At what point or points in its path does a projectile have its minimum speed, its maximum speed?

(vi) Define impulse and show that how it is related to linear momentum?

(vii) Define instantaneous velocity and instantaneous acceleration and write their mathematical relations.

(viii) Prove that height gained by the projectile is given by $H = \frac{V_i^2 \sin^2 \theta}{2g}$

(ix) Derive Charles' law on the basis of kinetic molecular theory of gases.

(x) Prove that $W = P\Delta V$

(xi) Why does the pressure of a gas in a car tyre increases when it is driven through some distance?

(xii) Specific heat of a gas at constant pressure is greater than specific heat at constant volume, why?

3. Write short answers to any EIGHT (8) questions : **16**

(i) Define the terms : (a) Unit vector. (b) Position vector.

(ii) Can the magnitude of a vector have a negative value?

(iii) Differentiate between both the types of equilibrium with examples.

(iv) When rocket re-enters the atmosphere, its nose cone becomes very hot. Where does this heat energy come from?

(v) What is meant by escape velocity? What is the value of escape velocity for earth?

(vi) State and derive the work energy principle.

(vii) Prove that 1 rad = 57.3°.

(viii) What is the physical significance of moment of inertia?

(ix) Why does a diver change his body positions before and after diving in the pool?

(x) What is meant by coherent sources of light?

(xi) Why the centre of Newton rings is dark? Explain.

(xii) Can visible light produce interference fringes? Explain.

4. Write short answers to any SIX (6) questions : 12

(i) How can the laminar flow be changed into turbulent flow?

(ii) Does frequency depends on the amplitude of harmonic oscillator?

(iii) What are free and damped oscillations?

(iv) How can you compare the masses of two bodies by observing their frequencies of oscillation when suspended by a spring?

(v) Why does sound travel faster in solids than in gases?

(vi) What is the difference between progressive and stationary waves?

(vii) What is the effect of density on the speed of sound?

(viii) Distinguish between magnifying power and resolving power.

(ix) Name three major components of fibre optic communication system.

SECTION – II

Note : Attempt any THREE questions.

5. (a) How can you add two vectors by rectangular components? 5

(b) Ten bricks, each of 6 cm thick and mass 1.5 kg lie flat on table. How much work is done to stack them one on the top of another? 3

6. (a) Derive the expressions for final velocities of two hard smooth balls after their elastic collision in one dimension. 5

(b) What is the least speed at which an aeroplane can execute a vertical loop of 1.0 km so that there will be no tendency for the pilot to fall down at highest point. 3

7. (a) Derive a relation for the frequency of stationary waves set up on a stretched string, if the string is mode to vibrate in n loops. 5

(b) Certain globular protein particle has a density of 1246 kg m^{-3}. It falls through pure water ($\eta = 8.0\times10^{-4} kg\, m^{-1}s^{-1}$) with a terminal speed of $3.0\, cmh^{-1}$. Find the radius of the particle. 3

8. (a) Explain phenomenon of resonance. How would you demonstrate resonance? Give examples where resonance plays an important role. 5

(b) Yellow sodium light of wave length 589 nm emitted by the single source passes through two narrow slits, 1.0 mm apart. The interference pattern observed on a screen 225 cm away. How far apart are two adjacent bright fringes? 3

9. (a) How would you determine the speed of light by using Michelson's experiment? Also, make the diagram of this method. 5

(b) 336 J of energy is required to melt 1 g of ice at 0 °C. What is the change in entropy of 30g of water at 0 °C as it is changed to ice at 0 °C by a refrigerator? 3

Roll No _____ (To be filled in by the candidate) **(Academic Sessions 2018 – 2020 to 2021 – 2023)**

PHYSICS 222-(INTER PART – I) Time Allowed : 20 Minutes

Q.PAPER – I (Objective Type) GROUP – II Maximum Marks : 17

PAPER CODE = 6472

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	SI unit of intensity of light is :			
	(A) Mole	(B) Kelvin	(C) Candela	(D) Ampere
2	SI system is built up by how many kinds of units :			
	(A) Six	(B) Five	(C) Four	(D) Three
3	SI unit of torque is :			
	(A) Nm^{-1}	(B) Nm	(C) Nm^{-2}	(D) $Kgm^{-1}s^{-1}$
4	For a body to be in complete equilibrium :			
	(A) $a = 0$ and $\alpha = 0$	(B) $\Sigma \vec{F} = 0$	(C) $\Sigma \vec{\tau} = 0$	(D) $\Sigma \vec{Fx} = \Sigma \vec{Fy}$
5	The acceleration of $1.5\,ms^{-2}$ is expressed in kmh^{-2} :			
	(A) 324	(B) 19440	(C) 2.25	(D) 5400
6	For what angle of projection projectile has maximum horizontal range :			
	(A) 90°	(B) 0°	(C) 45°	(D) 30°
7	One kilo watt is equal to :			
	(A) 1000 J/S	(B) 10^6 watt	(C) 0.1×10^3 watt	(D) 6.25×10^{25} J
8	Magnitude of centripetal acceleration is :			
	(A) rw^2	(B) r^2w	(C) $\frac{w^2}{r}$	(D) r^2w^2
9	One torr in Nm^{-2} is equal to :			
	(A) 1.333	(B) 133.3	(C) 1333	(D) 13.33
10	Radius of geostationary orbit is :			
	(A) $4.23\times10^4\,m$	(B) $4.23\times10^4\,km$	(C) 6400 km	(D) $423\times10^4\,km$
11	Example of mechanical wave is :			
	(A) Water wave	(B) Radio wave	C) Infrared wave	(D) Ultraviolet wave
12	Distance between node and consecutive antinode is :			
	(A) $\lambda/2$	(B) $3\lambda/2$	(C) $\frac{\lambda}{4}$	(D) λ
13	Open end of an organ pipe act as :			
	(A) Node	(B) Antinode	(C) Crest	(D) Trough
14	In Young's double slit experiment fringe spacing will be maximum if we use :			
	(A) Green light	(B) Red light	(C) Blue light	(D) Yellow light
15	If N is number of ruling on the grating then the resolving power in mth order diffraction is equal to :			
	(A) $R = \frac{N}{m}$	(B) $R = N \times m$	(C) $R = \frac{m}{N}$	(D) $m + \frac{N}{2}$
16	For one mole of an ideal gas , the gas equation becomes :			
	(A) $PV = nRT$	(B) $PV = 3RT$	(C) $PV = \frac{3}{2}RT$	(D) $PV = RT$
17	SI unit of entropy is :			
	(A) $\frac{J}{Kg}$	(B) $\frac{J}{K}$	(C) $Kgms^{-1}$	(D) JK

Roll No _____ (To be filled in by the candidate) **(Academic Sessions 2018 – 2020 to 2021 – 2023)**

PHYSICS 222-(INTER PART – I) Time Allowed : 2.40 hours

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

SECTION – I

2. Write short answers to any EIGHT (8) questions : **16**

(i) Name several repetitive phenomenon occurring in nature which could serve as reasonable time standard.

(ii) The period of simple pendulum is measured by a stopwatch. What type of errors are possible in the time period?

(iii) What choice would have made to take zero as significant figure? Explain your reason.

(iv) What is your opinion to minimize the systematic error? Support your response.

(v) Explain the circumstances in which velocity ' v ' and acceleration ' a ' of a car are :
(a) Parallel. (b) Anti-parallel.

(vi) An object is thrown upward vertically. Discuss the sign of acceleration due to gravity, relative to velocity, while the object is in air.

(vii) What do you think about the acceleration of 3g or more? Is this acceleration safe for us?

(viii) Water flows out from a pipe at 3kg/s and its velocity changes from 5m/s to zero on striking the ball. Calculate the force of water flow.

(ix) Does the entropy of a system increase or decrease due to friction?

(x) What do you understand by adiabatic process?

(xi) What is the condition for an ideal reversible heat engine?

(xii) What are the four successive processes in a petrol engine?

3. Write short answers to any EIGHT (8) questions : **16**

(i) The vector sum of three vectors gives a zero resultant. What can be orientation of the vectors?

(ii) Is it possible to add 6 in $4\hat{i}$? Explain.

(iii) If $\vec{A} = 2\hat{i} - 2\hat{j}$, then what will be the orientation of $\vec{A}$?

(iv) An object has 1 J of potential energy. Explain what does it mean?

(v) Prove that $P = \vec{F} \cdot \vec{V}$

(vi) How energy is obtained from direct combustion and fermentation?

(vii) Show that orbital angular momentum $L_o = mvr$

(viii) What is meant by angular momentum? State law of conservation of angular momentum?

(ix) What are banked track? Explain briefly.

(x) Can visible light produce interference fringes? Explain.

(xi) Why the polaroid sunglasses are better than ordinary sunglasses?

(xii) What is difference between interference and diffraction of light waves?

(Turn Over)

4. Write short answers to any SIX (6) questions : 12

(i) Why fog droplet appears to be suspended in air?

(ii) What happens to the period of a simple pendulum if its length is doubled? What happens if suspended mass is doubled?

(iii) Does the acceleration of a simple harmonic oscillator remains constant during its motion? Is the acceleration ever zero?

(iv) What is driven harmonic oscillator? Give example.

(v) What features do longitudinal waves have in common with transverse waves?

(vi) As a result of a distant explosion, an observer senses a ground tremor and then hear the explosion. Why?

(vii) What is doppler shift?

(viii) Could you obtain Newton's rings with transmitted light? If yes, would the pattern be different from that obtained with reflected light?

(ix) What are the conditions for detectable interference?

SECTION – II

Note : Attempt any THREE questions.

5. (a) Define scalar product of two vectors. Give its any four characteristics. 5

(b) A diver weighing 750 N dives from a board 10 m above surface of a pool of water. Use the conservation of mechanical energy, to find his speed at a point 5.0 m above the water surface (ignoring friction). 3

6. (a) What is meant by centripetal force? Derive its relation. 5

(b) Find the angle of projection of a projectile for which its maximum height and horizontal range are equal. 3

7. (a) State and prove Bernoulli's equation in detail. 5

(b) Two tuning forks exhibit beats at a beat frequency of 3 Hz. The frequency of one fork is 256 Hz. Its frequency is then lowered slightly by adding a bit of wax to one of its prong. The two tuning forks then exhibit a beat frequency of 1 Hz. Determine the frequency of the second tuning fork. 3

8. (a) Explain the Young's double slit experiment by drawing its diagram. How are determine fringe spacing by this method? 5

(b) A simple pendulum is 50 cm long. What will be its frequency of vibration at a place where $g = 9.8 ms^{-2}$? 3

9. (a) What is " Carnot Engine"? Derive formula for its efficiency. 5

(b) An astronomical telescope having magnifying power of 5 consists of two thin lenses 24 cm apart. Find the focal length of the lenses. 3

Roll No _____ (To be filled in by the candidate) **(Academic Sessions 2015 – 2017 to 2018 – 2020)**

PHYSICS 219-(INTER PART – I) Time Allowed : 20 Minutes

Q.PAPER – I (Objective Type) GROUP – I Maximum Marks : 17

PAPER CODE = 6471

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 ratio of 1 femtometer to 1 nanometer is :			
	(A) 10^{-6}	(B) 10^{6}	(C) 10^{-7}	(D) 10^{8}
2	In the relation $F = 6\pi\eta r v$. Dimensions of coefficient of viscosity η is :			
	(A) $[M^{-1}LT^{-1}]$	(B) $[ML^{-1}T]$	(C) $[M^{-1}L^{-1}T]$	(D) $[ML^{-1}T^{-1}]$
3	If $\vec{F} = (2\hat{i} + 4\hat{j})N$; $\vec{d} = (5\hat{i} + 2\hat{j})m$ work done is :			
	(A) 15 J	(B) 18 J	(C) Zero	(D) – 18 J
4	The sum of two perpendicular forces 8 N and 6 N is :			
	(A) 2 N	(B) 14 N	(C) 10 N	(D) – 2 N
5	The distance covered by a freely falling body in first 2 seconds, when its initial velocity was zero :			
	(A) 9.8 m	(B) 39.2 m	(C) 19.6 m	(D) 4.9 m
6	Value of solar constant is :			
	(A) $1.4 Wm^{-2}$	(B) $1400 Wm^{-2}$	(C) $14 kWm^{-2}$	(D) $1.0 kWm^{-2}$
7	Relation between the speed of disc and hoop at the bottom of an incline is :			
	(A) $V_{disc} = \sqrt{\frac{3}{4}} V_{hoop}$	(B) $V_{disc} = \sqrt{\frac{4}{3}} V_{hoop}$	(C) $V_{disc} = \sqrt{\frac{2}{5}} V_{hoop}$	(D) $V_{disc} = 2V_{hoop}$
8	2 revolutions are equal to :			
	(A) π rad	(B) $\frac{3\pi}{2}$ rad	(C) 2π rad	(D) 4π rad
9	Terminal velocity V_t is related with the radius r of a spherical object as :			
	(A) $v_t \propto r^2$	(B) $v_t \propto r$	(C) $v_t \propto \frac{1}{r}$	(D) $v_t \propto \frac{1}{r^2}$
10	The unit of $\frac{1}{2}\rho V^2$ in Bernoulli's equation is same as that of :			
	(A) Energy	(B) Pressure	(C) Work	(D) Power
11	Base units of spring constant is :			
	(A) $kg^{-1}s^{-2}$	(B) $kg^{-1}ms^{-2}$	(C) $kg\,ms^{-2}$	(D) kgs^{-2}
12	Speed of sound at 0 °C, in air is :			
	(A) $332\,ms^{-1}$	(B) $280\,ms^{-1}$	(C) $1400\,ms^{-1}$	(D) $5500\,ms^{-1}$
13	Two identical waves moving in same direction produce :			
	(A) Interference	(B) Beats	(C) Stationary waves	(D) Diffraction
14	Bragg's equation is :			
	(A) $2d\sin\theta = n\frac{\lambda}{2}$	(B) $d\sin\theta = n\lambda$	(C) $d\sin\theta = n\frac{\lambda}{2}$	(D) $d\sin\theta = 2\lambda$
15	If $f_o = 100\,cm$; $f_e = 5\,cm$ length and magnifying power of an astronomical telescope is :			
	(A) 0.05 cm ; 20	(B) 95 cm ; 20	(C) 20 cm ; 500	(D) 105 cm ; 20
16	Root mean square velocity is related to the absolute temperature of an ideal gas as :			
	(A) $V_{rms} \propto T$	(B) $V_{rms} \propto T^2$	(C) $V_{rms} \propto \sqrt{T}$	(D) $V_{rms} \propto \frac{1}{\sqrt{T}}$
17	If P = Pressure ; V = Volume of a gas PΔV represents :			
	(A) Work	(B) Density	(C) Power	(D) Temperature

Roll No _____ (To be filled in by the candidate) (Academic Sessions 2015 – 2017 to 2018 – 2020)

PHYSICS 219-(INTER PART – I) Time Allowed : 2.40 hours

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

SECTION – I

16

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

(i) Write down the two uses of dimensional analysis.

(ii) What are the characteristics of an ideal standard?

(iii) If $\vec{A} = 4\hat{i} - 4\hat{j}$, what is the orientation of $\vec{A}$?

(iv) Define resultant vector and component of a vector.

(v) The magnitude of the sum of two vectors is zero. What are the conditions to get this?

(vi) A car is moving along a circle of radius r. It completes four revolutions and terminates its journey at starting point. How much work is done by the car? Explain.

(vii) How energy is obtained by water waves and what is the source of this energy?

(viii) Explain the term systolic and diastolic pressure.

(ix) Two row boats moving parallel in the water are pulled towards each other. Explain why?

(x) Is any relation existed between damping and resonance? Explain.

(xi) In relation to SHM, explain the equation $y = A\sin(\omega t + \phi)$.

(xii) A mass-spring system is vibrating with amplitude 10 cm. Find its K.E. and P.E at equilibrium position, when spring constant is $20\,Nm^{-1}$.

16

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

(i) What is the difference between uniform velocity and uniform acceleration?

(ii) Show that time rate of change of momentum of a body equals the applied force.

(iii) A 1500 kg car has its velocity reduced from $20\,ms^{-1}$ to $15\,ms^{-1}$ in 3.0 seconds. How large was the average retarding force?

(iv) Can the velocity of an object reverse the direction when acceleration is constant? If so, give an example.

(v) Write down the uses of telecommunication satellites.

(vi) Show that $S = r\theta$ where S = Arc length , r = radius of the circle , θ = angle in radian.

(vii) What do you mean INTELSAT VI? What are the frequencies on which it operates?

(viii) A disc without slipping rolls down a hill of height 10.0 m. If the disc starts from rest at the top of the hill, what is the speed at the bottom?

(ix) How the speed of sound change with the density of the medium?

(x) A pipe has a length of 1 m. Determine the frequencies of the fundamental, if the pipe is open at both ends. Speed of sound = $340\,ms^{-1}$

(xi) State Doppler Effect. Write down its one application.

(xii) How Doppler effect can be used to monitor blood flow?

(Turn Over)

4. Write short answers to any SIX (6) questions : 12

(i) What is Bragg's law? Derive Bragg's equation.

(ii) Explain whether the Young's experiment is an experiment for studying interference or diffraction effects of light.

(iii) How would you manage to get more orders of spectra during a diffraction grating?

(iv) Write two differences between angular magnification and resolving power.

(v) How a single bi-convex lens can be used as a magnifying glass?

(vi) Derive Charles' law from kinetic theory of gases.

(vii) Justify! Work and heat are similar.

(viii) Show that : Change in entropy is always positive.

(ix) What happens to the temperature of the room when an air-conditioner is left running on a table in the middle of the room?

SECTION – II

Note : Attempt any THREE questions.

5. (a) Prove that molar specific heat of a gas at constant pressure C_p is greater than molar specific heat at constant volume C_v by an amount equal to universal gas constant R. 5

(b) Suppose, we are told that the acceleration of a particle moving in a circle of radius r with uniform speed v is proportional to some power of r, say r^n, and some power of v, say v^m. determine the powers of r and v. 3

6. (a) Explain the method of vector addition by rectangular components. 5

(b) A foot ball 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) Define absolute potential energy. Derive relation for absolute P.E. of a body of mass m. 5

(b) A stationary wave is established in a string which is 120 cm long and fixed at both ends. The string vibrates in four segments, at a frequency of 120 Hz. Determine its wavelength and the fundamental frequency. 3

8. (a) Define SHM. Prove that total energy remains conserved in mass-spring system, oscillating with SHM. 5

(b) A gramophone record turntable accelerate from rest to an angular velocity of 45.0 rev min^{-1} in 1.60 s. What is its average angular acceleration? 3

9. (a) What is compound microscope? Describe its construction and working also calculate its magnification. 5

(b) In a double slit experiment the second order maximum occurs at $\theta = 0.25°$. The wavelength is 650 nm. Determine the slit separation. 3

Roll No _____ (To be filled in by the candidate) **(Academic Sessions 2015 – 2017 to 2018 – 2020)**

PHYSICS 219-(INTER PART – I) Time Allowed : 20 Minutes

Q.PAPER – I (Objective Type) GROUP – II Maximum Marks : 17

PAPER CODE = 6478

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	Fringe spacing increases if we use :			
	(A) Red light	(B) Blue light	(C) Yellow light	(D) Green light
2	The expression for centripetal force is given by :			
	(A) $\frac{mv^2}{r^2}$	(B) $\frac{m^2v^2}{r}$	(C) $\frac{m^2v^2}{r^2}$	(D) $mr\omega^2$
3	Rocket ejects the burnt gasses at a speed of over (consuming fuel at rate of 10000 kg / s) :			
	(A) 4000 m/s	(B) 400 m/s	(C) 4000 cm/s	(D) 400 cm/s
4	Distance between adjacent node and antinode is :			
	(A) λ	(B) $\frac{\lambda}{2}$	(C) $\frac{\lambda}{4}$	(D) $\frac{\lambda}{3}$
5	Equation of continuity gives the conservation of the :			
	(A) Mass	(B) Energy	(C) Speed	(D) Volume
6	Which pair has same unit :			
	(A) Work and power	(B) Momentum and impulse		
	(C) Force and torque	(D) Torque and power		
7	Efficiency of diesel engine is :			
	(A) 25% to 30%	(B) 30% to 35%	(C) 35% to 40%	(D) 40% to 50%
8	The ratio between orbital velocity and escape velocity is :			
	(A) 1	(B) $\frac{1}{2}$	(C) $\sqrt{\frac{1}{2}}$	(D) $\sqrt{2}$
9	Types of wave used in sonar are :			
	(A) Sound waves	(B) Light waves	(C) Heat waves	(D) Water waves
10	The quantity 1 $(km)^2$ is equal to :			
	(A) $1\times10^6 m^2$	(B) $1\times10^5 m^2$	(C) $1\times10^7 m^2$	(D) $1\times10^4 m^2$
11	1 torr is equal to :			
	(A) $133.3\,Nm^{-2}$	(B) $133.3\,Nm^2$	(C) $133.3\,Nm$	(D) $133.3\,N^2m$
12	If R_x and R_y both are negative then resultant lies in the quadrant :			
	(A) 1st	(B) 2nd	(C) 3rd	(D) 4th
13	Product of number of rulings " N" and the order of diffraction "m" is equal to :			
	(A) Resolving power	(B) Magnification	(C) Near point	(D) Magnifying power
14	In order to double period of a simple pendulum the length of the pendulum should be increased by :			
	(A) Four times	(B) Three times	(C) Two times	(D) Eight times
15	Difference between C_p and C_v is equal to :			
	(A) Avogadro's number	(B) Planck's constant		
	(C) Universal gas constant	(D) Boltzman's constant		
16	Ratio of disk velocity to hoop velocity (in case of rotational kinetic energy) is :			
	(A) $\sqrt{\frac{4}{3}}$	(B) $\frac{1}{2}$	(C) 2	(D) $\sqrt{\frac{3}{4}}$
17	Cross product of $\hat{j}\times\hat{k}$ is :			
	(A) Zero	(B) 1	(C) $\hat{i}$	(D) $-\hat{i}$

Roll No _____ (To be filled in by the candidate) **(Academic Sessions 2015 – 2017 to 2018 – 2020)**

PHYSICS 219-(INTER PART – I) Time Allowed : 2.40 hours

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

SECTION – I

2. Write short answers to any EIGHT (8) questions : 16

(i) Define light year. Calculate its value. (Speed of light $C = 3\times10^{8} ms^{-1}$)

(ii) Give the definition of unit of solid angle.

(iii) How a vector is subtracted from another vector? Explain using diagram.

(iv) Find unit vector in the direction of the vector $\vec{A} = 12\hat{i} - 5\hat{j}$

(v) Name three different conditions that could make $\vec{A_1} \times \vec{A_2} = \vec{0}$

(vi) Calculate the work done in kilo joules in lifting a mass of 10 kg (at steady velocity) through a vertical height of 10 m.

(vii) Prove that 1 kWh = 3.6 MJ

(viii) How does a chimney work?

(ix) Explain, how the swing is produced in a fast moving cricket ball?

(x) What happens to the period of a simple pendulum if its length is doubled? What happens if the suspended mass is doubled?

(xi) Does frequency depend on amplitude for harmonic oscillator?

(xii) Define angular frequency. Give its formula and unit.

3. Write short answers to any EIGHT (8) questions : 16

(i) A rubber ball and lead ball of same size, are moving with same velocity. Which ball have greater momentum and why?

(ii) A bullet is fired from a rifle. Derive the relation for velocity of rifle.

(iii) Define range of projectile. In which situations its value is maximum and minimum.

(iv) Define impulse of the force and how can it relate with momentum.

(v) Define radian and degree and what is relation between them.

(vi) Define critical velocity and find its value.

(vii) What is difference between Newton's and Einstein's views of gravitation?

(viii) Define geo-synchronous satellite and what is the height of such satellite above the earth?

(ix) What are the conditions for interference of two sound waves?

(x) What is effect of temperature on speed of sound?

(xi) What is effect on frequency of sound waves, when source and observer are moving towards each other?

(xii) How are beats useful in tuning musical instruments?

4. Write short answers to any SIX (6) questions : 12

(i) 5000 lines per centimeter has been ruled on a diffraction grating. Find its grating element.

(ii) What is optically active crystals?

(iii) State Huygen's principle.

4. Write short answers to any SIX (6) questions : 12

(i) What is Bragg's law? Derive Bragg's equation.

(ii) Explain whether the Young's experiment is an experiment for studying interference or diffraction effects of light.

(iii) How would you manage to get more orders of spectra during a diffraction grating?

(iv) Write two differences between angular magnification and resolving power.

(v) How a single bi-convex lens can be used as a magnifying glass?

(vi) Derive Charles' law from kinetic theory of gases.

(vii) Justify! Work and heat are similar.

(viii) Show that : Change in entropy is always positive.

(ix) What happens to the temperature of the room when an air-conditioner is left running on a table in the middle of the room?

SECTION – II

Note : Attempt any THREE questions.

5. (a) Prove that molar specific heat of a gas at constant pressure C_p is greater than molar specific heat at constant volume C_v by an amount equal to universal gas constant R. 5

(b) Suppose, we are told that the acceleration of a particle moving in a circle of radius r with uniform speed v is proportional to some power of r, say r^n, and some power of v, say v^m, determine the powers of r and v. 3

6. (a) Explain the method of vector addition by rectangular components. 5

(b) A foot ball 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) Define absolute potential energy. Derive relation for absolute P.E. of a body of mass m. 5

(b) A stationary wave is established in a string which is 120 cm long and fixed at both ends. The string vibrates in four segments, at a frequency of 120 Hz. Determine its wavelength and the fundamental frequency. 3

8. (a) Define SHM. Prove that total energy remains conserved in mass-spring system, oscillating with SHM. 5

(b) A gramophone record turntable accelerate from rest to an angular velocity of 45.0 rev min^{-1} in 1.60 s. What is its average angular acceleration? 3

9. (a) What is compound microscope? Describe its construction and working also calculate its magnification. 5

(b) In a double slit experiment the second order maximum occurs at $\theta = 0.25°$. The wavelength is 650 nm. Determine the slit separation. 3

Roll No _____ (To be filled in by the candidate) **(Academic Sessions 2015 – 2017 to 2017 – 2019)**

PHYSICS 218-(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	The component of the weight which balances the tension in pendulum is :			
	(A) $mg\cos\theta$	(B) $mg\sin\theta$	(C) $mg\tan\theta$	(D) $-mg\sin\theta$
2	Work has the dimensions as that of :			
	(A) Momentum	(B) Power	(C) Torque	(D) Force
3	If red light is used as compared to blue light, then fringe spacing :			
	(A) Increases	(B) Decreases	(C) Remains same	(D) Becomes zero
4	A precise measurement is the one which has :			
	(A) Greater precision	(B) Less precision	(C) Medium precision	(D) More % error
5	The work done in isochoric process is :			
	(A) Constant	(B) Variable	(C) Zero	(D) Depend on condition
6	As we go from pole to equator of earth, the value of 'g' :			
	(A) Increases	(B) Decreases	(C) Remains constant	(D) Zero
7	Maximum number of components of a vector may be :			
	(A) One	(B) Two	(C) Three	(D) Infinite
8	Physical quantity " pressure" in term of base unit is :			
	(A) $Kg^{-1}mS^{-2}$	(B) $Kg^{2}mS^{-3}$	(C) $Kg^{2}m^{-2}Sec$	(D) $Kg\,m^{-1}S^{-2}$
9	When one end of organ pipe is closed, then the frequency of stationary waves of any harmonic in it is given by :			
	(A) $f_n = \frac{nv}{2\ell}$	(B) $f_n = \frac{n\ell}{4v}$	(C) $f_n = \frac{4v}{n\ell}$	(D) $f_n = \frac{nv}{4\ell}$
10	Repeaters are placed in new system at distance of :			
	(A) 30 km	(B) 50 km	(C) 80 km	(D) 100 km
11	The fluid is said to be incompressible, if its density is :			
	(A) Zero	(B) Very high	(C) Very small	(D) Constant
12	The distance covered by a body in time 't' starting from rest is :			
	(A) at^2	(B) $2at^2$	(C) $\frac{1}{2}at^2$	(D) $\frac{1}{2}a^2t$
13	When hot and cold water are mixed, the entropy :			
	(A) Decreases	(B) Increases	(C) Remains constant	(D) Zero
14	The relation between the speed of disc and hoop can be written as :			
	(A) $V_{disc} = \sqrt{\frac{3}{4}}V_{hoop}$	(B) $V_{disc} = \sqrt{\frac{4}{3}}V_{hoop}$	(C) $V_{disc} = V_{hoop}$	(D) $V_{disc} = \frac{1}{2}V_{hoop}$
15	The magnitude of a vector $\vec{r} = 3\hat{i} + 6\hat{j} + 2\hat{k}$ is :			
	(A) – 1	(B) – 7	(C) 7	(D) 8
16	If a stretched string is 4 m and it has 4 loops of stationary waves, then wavelength is :			
	(A) 1 m	(B) 2 m	(C) 3 m	(D) 4 m
17	The blue colour of sky is due to :			
	(A) Diffraction of light	(B) Reflection of light		
	(C) Polarization of light	(D) Scattering of light		

Roll No _____ (To be filled in by the candidate) **(Academic Sessions 2015 – 2017 to 2017 – 2019)**

PHYSICS 218-(INTER PART – I) Time Allowed : 2.40 hours

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

SECTION – I

2. Write short answers to any EIGHT (8) questions : **16**

(i) Define and explain scientific notation, also give example.

(ii) Show that the expression $v_f = v_i + at$ is dimensionally correct.

(iii) Write any two uses of dimensional analysis.

(iv) Name several repetitive phenomenon occurring in nature which could serve as reasonable time standards.

(v) Can the magnitude of a vector have a negative value?

(vi) The vector sum of three vectors gives a zero resultant. What can be the orientation of the vectors?

(vii) Define the terms (i) Null vector (ii) Subtraction of vector

(viii) What happens when a very heavy body collides with lighter stationary body? Explain.

(ix) Can the velocity of an object reverse direction when acceleration is constant? If so, give an example.

(x) Define isolated system with example.

(xi) Two boats moving parallel in the same direction are pulled towards each other. Explain why?

(xii) Explain the difference between laminar flow and turbulent flow.

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 comes from?

(ii) What sort of energy is in compressed spring and water in a high dam?

(iii) Write two merits and demerits of solar cells.

(iv) Explain how many minimum number of geo-stationary satellites are required for global coverage of T.V. transmission.

(v) Show that orbital angular momentum $L_o = mvr$

(vi) Find total kinetic energy of rolling sphere of mass 'm' and radius ' r ' on horizontal smooth surface.

(vii) Prove that $\omega = \sqrt{\frac{k}{m}}$ for mass spring system.

(viii) How displacement and amplitude are related for mass spring system?

(ix) What happens to the period of a simple pendulum if its length is doubled? What happens if the suspended mass is doubled?

(x) Explain the term crest, trough, node and antinode.

(xi) As a result of a distant explosion an observer senses a ground tremor and then hears the explosion. Explain the time difference.

(xii) Why does transverse wave reflecting from a denser medium undergo a phase change of 180^o?

(Turn Over)

4. Write short answers to any SIX (6) questions : 12

(i) Differentiate between polarized and unpolarized light.

(ii) What aspect of nature of light is proved by the phenomena of polarization?

(iii) Explain briefly whether the Young's experiment. is an experiment for studying interference or diffraction effects of light.

(iv) Differentiate between linear magnification and angular magnification.

(v) Why would it be advantageous to use blue light with a compound microscope?

(vi) Derive Charles's law from kinetic theory of gases.

(vii) Define internal energy of a substance.

(viii) Give an example of a natural process that involves an increase in entropy.

(ix) Is it possible to construct a heat engine that will not expel heat into the atmosphere?

SECTION – II

Note : Attempt any THREE questions.

5. (a) Define elastic and inelastic collision. Discuss elastic collision in one dimension and show that velocity of approach is equal to the velocity of separation. 5

(b) A load of 10 N is suspended from a clothline. This distorts the line so that it makes an angle of 15° with each end. Find tension in the clothline. 3

6. (a) What is escape velocity? Derive an expression for it and calculate its value on the surface of the earth. 5

(b) A 1000 kg car travelling with a speed of 144 kmh^{-1} round a curve of radius 100 m. Find the necessary centripetal force. 3

7. (a) What is petrol engine? Describe its working by elaborating its four strokes and what is main difference between petrol engines and diesel engines. 5

(b) 336 J of energy is required to melt 1 gm of ice at 0 °C. What is the change in entropy of 30 gm of water at 0 °C as it is changed to ice at 0 °C by a refrigerator? 3

8. (a) What is Doppler Effect? Discus the case when :
(i) observer is moving towards a stationary source,
(ii) observer is moving away from stationary source. 5

(b) A simple pendulum is 50.0 cm long. What will be its frequency of vibration at a place where $g = 9.8ms^{-2}$? 3

9. (a) Explain a simple microscope. Derive formula for its magnification. 5

(b) Sodium light of wavelength $\lambda = 589$ nm, is incident normally on a grating having 3000 lines per centimeter. What is highest order of the spectrum obtained with this grating? 3

Roll No _____ (To be filled in by the candidate) **(Academic Sessions 2015 – 2017 to 2017 – 2019)**

PHYSICS 218-(INTER PART – I) Time Allowed : 20 Minutes

Q.PAPER – I (Objective Type) GROUP – II Maximum Marks : 17

PAPER CODE = 6478

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	Intensity of light depends on :			
	(A) Wavelength	(B) Amplitude	(C) Velocity	(D) Frequency
2	The ratio of angular frequency and linear frequency is :			
	(A) 2π	(B) π	(C) $\frac{1}{2\pi}$	(D) $\frac{\pi}{2}$
3	Which shows correct relation between H and T of projectile :			
	(A) $H=\frac{gT^2}{8}$	(B) $H=\frac{8T^2}{g}$	(C) $H=\frac{8g}{T^2}$	(D) $H=\frac{8}{gT^2}$
4	Velocity of sound is independent of :			
	(A) Temperature	(B) Density	(C) Pressure	(D) Medium
5	If the radius of droplet becomes half, then its terminal velocity will be :			
	(A) Double	(B) Half	(C) One fourth	(D) Four time
6	The percentage uncertainty in measurement of mass and velocity are 2% and 3%, the maximum uncertainty in the measurement of kinetic energy is :			
	(A) 11%	(B) 8%	(C) 6%	(D) 1%
7	SI unit pressure of gas is :			
	(A) Nm^{-2}	(B) Nm	(C) N^2m^{-1}	(D) N^2m
8	Hot igneous rocks usually in molten or partly molten state are found in the depth of :			
	(A) 5 km	(B) 10 km	(C) 15 km	(D) 20 km
9	Angle between ray of light and wave front is :			
	(A) 0^o	(B) 60^o	(C) 120^o	(D) 90^o
10	Solid angle subtended at the center by a sphere is :			
	(A) 2π	(B) 4π	(C) 6π	(D) 8π
11	If 30 waves per second pass through a medium at speed of $30ms^{-1}$, the wavelength is :			
	(A) 30 m	(B) 15 m	(C) 1 m	(D) 900 m
12	$\hat{i}.(\hat{j}\times\hat{k})$ is equal to :			
	(A) $\hat{k}$	(B) 1	(C) Null vector	(D) Zero
13	Information carrying capacity of optical fibre is called :			
	(A) Capacity	(B) Band width	(C) Immunity	(D) Ability
14	Radar system is an application of :			
	(A) Interference	(B) Beats		
	(C) Stationary waves	(D) Doppler's effect		
15	For an ideal gas, the potential energy associated with its molecules is :			
	(A) Maximum	(B) Zero	(C) $\frac{1}{2}KX_o^2$	(D) $\frac{1}{2}KX_o$
16	A wheel of radius 50 cm having an angular speed 5 rad / sec will have linear speed :			
	(A) $1.5ms^{-1}$	(B) $2.5ms^{-1}$	(C) $3.5ms^{-1}$	(D) $4.5ms^{-1}$
17	The resultant of two forces 3N and 4N acting parallel to each other is :			
	(A) 7N	(B) 1N	(C) 5N	(D) 4N

Roll No _____ (To be filled in by the candidate) **(Academic Sessions 2015 – 2017 to 2017 – 2019)**

PHYSICS 218-(INTER PART – I) Time Allowed : 2.40 hours

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

SECTION – I

2. Write short answers to any EIGHT (8) questions : **16**

(i) Calculate the distance covered by the light in free space in one year.

(ii) Show that the Einstein's equation $E = mc^2$ is dimensionally correct.

(iii) What do you mean by random error and systematic error?

(iv) Add the following upto appropriate precision 3.125, 1.2, 0.038.

(v) What is the unit vector in the direction of vector $\vec{A} = 2\hat{i} - \hat{j} + 2\hat{k}$?

(vi) Can the dot product of two vectors be equal to the product of their magnitudes? Explain.

(vii) State first and second condition of equilibrium alongwith their equation.

(viii) Water flows out from a pipe at $5kgs^{-1}$ and its velocity changes from $4ms^{-1}$ to zero on striking the wall. Find the force exerted by the water on the wall.

(ix) Show that range R and maximum range R_{max} are related as $\frac{R}{R_{max}} = \sin 2\theta$

(x) Can the velocity of an object reverse the direction when acceleration is constant? If so give an example?

(xi) Define viscosity and drag force.

(xii) Explain the working of carburetor of a motorcar using Bernoulli's principle.

3. Write short answers to any EIGHT (8) questions : **16**

(i) Derive work energy principle.

(ii) Explain methods of : (i) Direct combustion.
(ii) Fermentation to convert biomass into fuels.

(iii) A cup is dropped from a certain height, which breaks into pieces. What energy changes are involved?

(iv) When mud flies off the tyre of a moving bicycle, in what direction does it fly?

(v) What is difference between spin angular momentum and orbital angular momentum?

(vi) Define radian and find how many degrees are in one radian.

(vii) Does period depend on amplitude of vibrating body? Explain.

(viii) Define restoring force and what is its direction?

(ix) At which positions the velocity of a simple harmonic oscillator is maximum and minimum?

(x) How are beats useful in tuning musical instruments?

(xi) Astronomers use the Doppler effect to calculate the speed of distance stars. How?

(xii) What is the affect on phase of a wave when it is reflected from a boundary?

4. Write short answers to any SIX (6) questions : **12**

(i) Under what conditions two or more sources of light behave as coherent sources?

(ii) Why the Polaroid sunglasses are better than ordinary sunglasses?

(iii) An oil film spreading over a wet footpath shows colours. Explain how does it happen?

(iv) One can buy a cheap microscope for the use by the children. The images seen in such a microscope have coloured edges. Why is this so?

(v) How the light signal is transmitted through the optical fibre?

(vi) Give an example of a natural process that involves an increase in entropy.

(vii) Why is the average velocity of the molecules in a gas zero but the average of the square of velocities is not zero?

(viii) Give the statement of second law of thermodynamics and Carnot's theorem.

(ix) Is it possible to convert internal energy into mechanical energy? Explain with an example.

SECTION – II

Note : Attempt any THREE questions.

5. (a) Define vector product or cross product. Explain with right hand rule and give four characteristics of cross product. 5

(b) Find angle of projection of a projectile for which its maximum height and the horizontal range are equal. 3

6. (a) What is absolute gravitational potential energy? Derive an expression for it. 5

(b) What would be the orbiting speed to launch a satellite in a circular orbit 900 km above the surface of the earth? Mass of earth = $6 \times 10^{24}\, kg$, Radius of earth = 6400 km 3

7. (a) Define and explain entropy with an example. Does entropy decrease for reversible process? Why absolute value of entropy can not be determined? 5

(b) A heat engine performs 100 J of work and at the same time rejects 400 J of heat energy to the cold reservoir. What is the efficiency of the engine? 3

8. (a) What is simple pendulum? Show that its motion is simple harmonic. Also derive an expression for its time period. 5

(b) An organ pipe has a length of 50 cm. Find the frequency of its fundamental note and the next harmonic when it is/ opened at both ends. Speed of sound = $350\, ms^{-1}$. 3

9. (a) Discuss in detail the Young's double slit experiment to study the interference of light. 5

(b) A glass light pipe in air will totally internally reflect a light ray if its angle of incidence is at least 39°. What is minimum angle for total internal reflection if pipe is in water (n = 1.33)? 3