



KENDRIYA VIDYALAYA SANGATHAN- NEW DELHI

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Chapter wise Test papers for Class XI-Physics
ZIET- BHUBANESWAR



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Writer-speaks

NCERT Text book gives all the details about the syllabus that should be followed by the teachers and students of CBSE affiliated schools. This material is prepared with the intension to make its readers to go through the NCERT Text Book and check their thoroughness with respect to the topic. It also gives an idea about the type of questions that can be given under 2 marks, 3 marks and 1 mark questions.

Kindly go through the topic of a particular lesson before answering the questions. The advantage of this booklet is that you can find the answers to the questions in the page number that is mentioned against each question. Please don't forget to give your feedback to the following e-mail address.

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You can also give your suggestions with regard to this material. If you find any mistakes please convey to me through my mail address. Thank you for using this material.

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Table of Contents

PHYSICAL WORLD	4
Test Paper-I	4
Test Paper-II	6
UNITS AND MEASUREMENT	7
Test Paper-I	7
Test Paper-II	9
Test Paper-III	11
MOTION IN A STRAIGHT LINE	13
Test Paper-I	13
Test Paper-II	15
MOTION IN A PLANE	17
Test Paper-I	17
Test Paper-II	19
Test Paper-III	21
LAWS OF MOTION	22
Test Paper-I	22
Test Paper-II	23
Test Paper-III	25
WORK, ENERGY AND POWER	27
Test Paper-I	27
Test Paper-II	28
Test Paper-III	30
Test Paper-IV	32
SYSTEMS OF PARTICLES AND ROTATIONAL MOTION	34
Test Paper-I	34
Test Paper-II	36
Test Paper-III	38
GRAVITATION	40
Test Paper-I	40
Test Paper-II	42
MECHANICAL PROPERTIES OF SOLIDS	44
Test Paper-I	44

Test Paper-II	45
MECHANICAL PROPERTIES OF FLUIDS	46
Test Paper-I	46
Test Paper-II	48
Test Paper-III-(Applications of Bernoulli's Theorem).....	50
Test Paper-IV	51
Test Paper-V	53
THERMAL PROPERTIES OF FLUIDS	55
Test Paper-I	55
Test Paper-II	57
Test Paper-III	59
Test Paper-IV	61
THERMODYNAMICS	63
Test Paper-I	63
Test Paper-II	65
KINETIC THEORY	66
Test Paper-I	66
KINETIC THEORY	68
Test Paper-II	68
OSCILLATIONS	70
Test Paper-I	70
Test Paper-II	72
Test Paper-III	74
WAVES	75
Test Paper-I	75
Test Paper-II	77
Test Paper-III	79

PHYSICAL WORLD

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-I

Max marks: 30

Time: 90Mts

- | | | | |
|----|---|----|---|
| 1 | What is science? What is physics? | P1 | 2 |
| 2 | What is scientific method? Give the steps involved in it. | P1 | 3 |
| 3 | Name the experiment which established the nuclear model of atom. | P2 | 1 |
| 4 | What is the law which
a. Describes the fall of an apple to the ground
b. The motion of the moon around the earth and
c. The motion of planets around the earth. | P2 | 1 |
| 5 | What are the two principal thrusts in physics? Explain How they help in the Development of physics? | P2 | 3 |
| 6 | What is Classical Physics? What are the different subjects involved in classical physics? Briefly explain about them. | P3 | 3 |
| 7 | What is Quantum Physics? | P3 | 1 |
| 8 | Explain how physics is exciting? | P4 | 2 |
| 9 | When feather and stone are dropped from the same height, which one will reach the ground first? What is the effect of gravity on the mass of the object? How will you prove this? | P4 | 3 |
| 10 | What is the difference between a hypothesis and an axiom? | P4 | 2 |
| 11 | What are the two postulates on which Einstein's special theory of relativity is based? | P4 | 2 |

- 12 Match the following P5 3
- | <u>Group-A</u> | <u>Group-B</u> |
|------------------------|---|
| 1. Archimedes | a. Electromagnetic theory;
Light –an EM wave |
| 2. Galileo | b. X-Rays |
| 3. J C Bose | c. Theory of Relativity |
| 4. W K Roentgen | d. Principle of buoyancy |
| 5. Albert Einstein | e. Ultra short radio waves |
| 6. James Clerk Maxwell | f. Law of Inertia |
- 13 What are the fundamental forces in nature? Briefly explain. P8 3
- 14 Give the scientific principle involved in the following P7 1
- Production of ultra-high magnetic fields
 - Electron microscope.

PHYSICAL WORLD

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-II

Max marks: 20

Time: 60Mts

- | | | | |
|----|--|-----|---|
| 1 | Which year was declared as the International year of physics? | P8 | 1 |
| 2 | Name the force which plays key role in the formation and evolution of stars and galaxies. | P8 | 1 |
| 3 | Give the differences between gravitational force and Electromagnetic Force | P2 | 2 |
| 4 | When we hold a book in our hand gravitational force on the book is balanced by the 'Normal Force' provided by our hand. What is the force that is responsible for this Normal Force? | P9 | 1 |
| 5 | What is the force existing between the protons, neutrons, and a proton and a neutron? Give the properties of the force. Also state the elementary particles from which the protons and neutrons are built. | P9 | 3 |
| 6 | Between which particles & process the weak nuclear force appears? | P9 | 1 |
| 7 | Give the Achievements of the following scientists in unification of different forces | P10 | 3 |
| | a. Isaac Newton | | |
| | b. Hans Christian Oersted and Michael Faraday | | |
| | c. James Clerk Maxwell | | |
| 8 | Name the law obeyed by a chemical reaction .What is the difference between an exothermic reaction and an endothermic reaction. How a chemical reaction is different from a nuclear reaction? | P11 | 3 |
| 9 | What are the basic conservation laws of nature in all domains? | P12 | 1 |
| 10 | What is a conservation law? Can we prove it? Give some examples of conservation laws. | P12 | 2 |
| 11 | Give the difference between the law of Gravitation and acceleration due to gravity. | P12 | 1 |
| 12 | What is the value of acceleration due to gravity on the surface of the Moon? | P12 | 1 |

UNITS AND MEASUREMENT

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-I

Max marks: 30

Time: 90Mts

- | | | | |
|----|--|-----|---|
| 1 | Define Unit? | P16 | 1 |
| 2 | What are fundamental and derived units? | P16 | 1 |
| 3 | Name the system of units which is internationally accepted at present | P17 | 1 |
| 4 | Give the SI unit of measurement of Length. Also define the unit | P17 | 1 |
| 5 | Define Candela. | P17 | 1 |
| 6 | Briefly explain how large distances can be measured using parallax method. | P18 | 2 |
| 7 | Calculate the angle of (a) 1° (degree) (b) (minute of arc) and $1''$ (second of arc) in radians | P19 | 2 |
| 8 | A man wishes to estimate the distance of a nearby tower from him. He stands at a point A in front of the tower C and spots a very distant object O in line with AC. He then walks perpendicular to AC up to B, a distance of 100m, and looks at O and C again. Since O is very distant, the direction BO is practically the same as AO; but he finds the line of sight of C shifted from the original line of sight by an angle $\theta = 40^{\circ}$ (θ is known as 'parallax) estimate the distance of the tower C from his original position A. | P19 | 3 |
| 9 | The moon is observed from two diametrically opposite points A and B on Earth. The angle θ subtended at the moon by the two directions of observation is $1^{\circ} 54'$. Given the diameter of the Earth to be about 1.276×10^7 m, compute the distance of the moon from the Earth. | P19 | 3 |
| 10 | The Sun's angular diameter is measured to be $1920''$. The distance D of the Sun from the Earth is 1.496×10^{11} m. What is the diameter of the Sun? | P19 | 2 |

- 11 Briefly explain how you will estimate the molecular size of oleic acid. P20 3
- 12 If the size of a nucleus (in the range of 10^{-15} to 10^{-14} m) is scaled up to the tip of a sharp pin, what roughly is the size of an atom? Assume tip of the pin to be in the range of 10^{-5} m to 10^{-4} m. P20 2

13

Match the following

GROUP-A

1. 1 Fermi
2. 1 light year
3. 1 Astronomical Unit
4. 1 parsec

GROUP-B

- a. 1.496×10^{11} m
- b. 3.08×10^{16} m
- c. 9.46×10^{15} m
- d. 10^{-15} m

P21

2

- 14 Define one parsec. P21 1
- 15 Give the SI unit of mass. Give the location where the prototypes of International standard units of mass are available. Also define the standard unit of mass. P21 3
- 16 Give the SI value of the following units P18 2
- a. Roentgen
 - b. Curie
 - c. Barn
 - d. Carat

UNITS AND MEASUREMENT

Test Paper-II

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

MAX MARKS: 30

TIME: 90Mts

- | | | | |
|---|---|-----|---|
| 1 | What is the basis of atomic clock? | P22 | 1 |
| 2 | Define second | P22 | 1 |
| 3 | Name the institute which has been given the responsibility of maintenance and improvement of physical standards. Give the uncertainty in time realization measured through cesium atomic clocks | P22 | 1 |
| 4 | What is meant by error in measurement? | P22 | 1 |
| 5 | Distinguish between accuracy and precision | P22 | 1 |
| 6 | What are the different types of errors? Briefly explain. | P23 | 3 |
| 7 | Briefly explain how you will determine percentage error. | P24 | 3 |
| 8 | | P25 | 2 |

Two clocks are being tested against a standard clock located in a national laboratory. At 12:00:00 noon by the standard clock, the

	Clock I	Clock II
Monday	12:00:05	10:15:06
Tuesday	12:01:15	10:14:59
Wednesday	11:59:08	10:15:18
Thursday	12:01:50	10:15:07
Friday	11:59:15	10:14:53
Saturday	12:01:30	10:15:24
Sunday	12:01:19	10:15:11

If you are doing an experiment that requires precision time interval measurements, which of the two clocks will you prefer?

- | | | | |
|---|---|-----|---|
| 9 | We measure the period of oscillation of a simple pendulum. In successive measurements, the readings turn out to be 2.63s, 2.56s, 2.42s, 2.71s and 2.80s. Calculate the absolute errors, relative error or percentage error. | P25 | 3 |
|---|---|-----|---|

- 10 Show that when two quantities are added or subtracted, the absolute error in the final result is the sum of the absolute errors in the individual quantities. P25 2
- 11 The temperatures of two bodies measured by a thermometer are $t_1=20^\circ\text{C} \pm 0.5^\circ\text{C}$ and $t_2=50^\circ\text{C} \pm 0.5^\circ\text{C}$. Calculate the temperature difference and error there in. P26 2
- 12 Show that when two quantities are multiplied or divided, the relative error in the result is the sum of the relative errors in the multipliers. P26 2
- 13 The resistance $R=V/I$ where $V=(100\pm 5)\text{V}$ and $I=(10\pm 0.2)\text{A}$. Find the percentage error in R. P27 2
- 14 Two resistors of resistances $R_1=100 \pm 3$ ohm and $R_2=200 \pm 4$ ohm are connected (a) in series, (b) in parallel. Find the equivalent resistance of the (a) series combination, (b) parallel combination. Use for (a) the relation $R = R_1 + R_2$ and for (b) $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ and $\frac{\Delta R}{R^2} = \frac{\Delta R_1}{R_1^2} + \frac{\Delta R_2}{R_2^2}$ P27 2
- 15 a. Show that the relative error in a physical quantity raised to the power of k is the k times the relative error in the individual quantity. P27 2
- b. Find the relative error in Z, if $Z=A^4 B^{1/3} / C D^{3/2}$ 1

UNITS AND MEASUREMENT

Test Paper-III

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

MAX MARKS: 30

TIME: 90Mts

- 1 The period of oscillation of a simple pendulum is $T = 2\pi\sqrt{\frac{L}{g}}$
.Measured value of $L = 20.0\text{cm}$ known to 1mm accuracy and time for 100 oscillations of the pendulum is found to be 90s using a wrist watch of 1 s resolution. What is the accuracy in the determination of g ? P27 3
- 2 Give any four rules that applied in determining the number of significant figures with examples. P28 2
- 3 The mass of an object is measured to be 4.237g and its volume is measured to be 2.51cm^3 , then find the density of the substance with significant figures stating the reason for significant figures P29 3
- 4 State the rules for Arithmetic Operations with significant figures giving examples P29 2
- 5 State the rules for Rounding off the Uncertain Digits with examples P29 2
- 6 Each side of a cube is measured to be 7.203m. What are the total surface area and the volume of the cube to appropriate significant figures? P30 2
- 7 State the rules for determining the Uncertainty in the Results of Arithmetic Calculations with examples. P30 3
- 8 What is Dimensional formula and dimensional equation. P32 2

- 9 Consider an equation $\frac{1}{2}mv^2 = mgh$ where m is the mass of the body, v its velocity, g is the acceleration due to gravity and h is the height. Check whether this equation is dimensionally correct. P33 2
- 10 The SI unit of energy is $J = \text{kg m}^2\text{s}^{-2}$; that of speed v is ms^{-1} and of acceleration a is ms^{-2} . Which of the formulae for kinetic energy (K) given below can you rule out on the basis of dimensional arguments (m stands for the mass of the body ; P33 3
- a. $K = m^2v^3$
 - b. $K = (1/2)mv^2$
 - c. $K = ma$
 - d. $K = (3/16)mv^2$
- $K = (1/2)mv^2 + ma$
- 11 Consider a simple pendulum, having a bob attached to a string, which oscillates under the action of the force of gravity. Suppose that the period of oscillation of the simple pendulum depends on its length (l), mass of the bob (m) and acceleration due to gravity (g). Derive the expression for its time period using the method of dimensions. P33 3
- 12 State the principle of homogeneity of dimensions in an equation. P33
Also give any two limitations of dimensional analysis. & 3
34

MOTION IN A STRAIGHT LINE

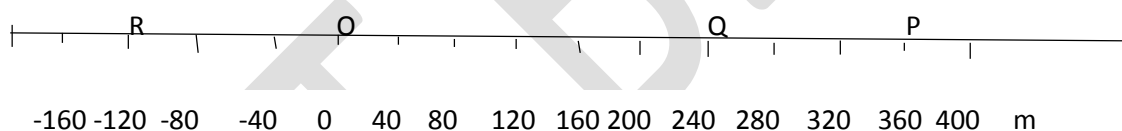
General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-I

MAX MARKS: 30

TIME: 90Mts

- | | | | |
|---|---|-----|---|
| 1 | What is rectilinear motion? | P39 | 1 |
| 2 | Give any two differences between path length and displacement. | P40 | 2 |
| 3 | Plot the Position-time graph of (a) stationary object, and (b) an uniform motion. | P41 | 2 |
| 4 | Plot the position-time graph for an object (a) moving with positive velocity (b) moving with negative velocity, and (c) at rest. | P42 | 3 |
| 5 | A car is moving along a straight line say along OP in the following figure. It moves from O to P in 18 s and returns from P to Q in 6.0s. What are the average velocity and average speed of the car in going (a) from O to P? and (b) from O to P and back to Q? | P43 | 3 |



X-axis, origin and positions of a car at different times.

- | | | | |
|----|--|-----|---|
| 6 | Plot the Position-time graph of a car for the data given in the question no.5 | P41 | 2 |
| 7 | Define instantaneous velocity. Give the formula for finding the instantaneous velocity. Find the instantaneous velocity for the data given in Q. No.5 at time $t=4s$ by plotting position –time graph. | P43 | 3 |
| 8 | The position of an object moving along x-axis is given by $x = a + bt^2$ where $a = 8.5m$, $b = 2.5ms^{-2}$ and t is measured in seconds. What is its velocity at $t=0s$ and $t= 2.0s$. What is the average velocity between $t=2.0s$ and $t=4.0s$? Give your conclusion. | P45 | 3 |
| 9 | Name the scientist Who concluded that the rate of change of velocity with time is a constant of motion for all objects in free fall. | P45 | 1 |
| 10 | Plot the position-time graphs for motion of an object moving with positive, negative and zero acceleration. | P46 | 3 |

-
- | | | | |
|----|--|-----|---|
| 11 | How will you determine the displacement of an object by using velocity-time graph? | P47 | 1 |
| 12 | Derive the equations of motion for uniformly accelerated motion using velocity-time graph. | P47 | 3 |
| 13 | Obtain equations of motion for constant acceleration using method of calculus. | P48 | 3 |

MOTION IN A STRAIGHT LINE

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-II

MAX MARKS: 20

TIME: 60Mts

- | | | | |
|---|--|-----|---|
| 1 | A ball is thrown vertically upwards with a velocity of 20ms^{-1} from the top of a multistory building. The height of the point from where the ball is thrown is 25.0m from the ground. (a) How high will the ball rise? And (b) how long will it be before the ball hits the ground? Take $g = 10\text{ms}^{-2}$. | P48 | 3 |
| 2 | Discuss the motion of an object under free fall. Neglect air resistance. | P49 | 2 |
| 3 | Plot the graphs of the following for a body under free fall.
a. Variation of acceleration with time.
b. Velocity and with time.
c. Distance with time | P49 | 3 |
| 4 | Show that "The distances traversed, during equal intervals of time, by a body falling from rest, stand to one another in the same ratio as the odd numbers beginning with unity (namely, 1:3:5:7 :.....). Or State and prove Galileo's law of odd numbers for the distances covered by an object during equal intervals of time. | P50 | 3 |
| 5 | Plot the position-time graph of the following.
a. Two objects moving with equal velocities
b. Two objects with unequal velocities, showing the time of meeting.
c. Two objects with velocities in opposite directions, showing the time of meeting. | P52 | 3 |
| 6 | Two parallel rail tracks run north-south. Train A move north with speed of 54kmh^{-1} and train B moves with a speed of 90 km h^{-1} . What is the
a. Velocity of B with respect to A? | P52 | 3 |

- b. Velocity of ground with respect to B? and
- c. Velocity of a monkey running on the roof of the train A against its motion (with a velocity of 18 km h^{-1} with respect to the train A) as observed by a man standing on the ground?

7 Give the dimensional formula and SI unit of measurement of the following quantities. P54

- a. Instantaneous acceleration
- b. Average velocity
- c. Displacement

3

MOTION IN A PLANE

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-I

MAX MARKS: 30

TIME: 90Mts

- | | | | |
|----|---|------|---|
| 1 | Differentiate between scalar quantities and vector quantities. | P65 | 2 |
| 2 | Compare path length of an object between two points with that of magnitude of displacement between the same two points. | P66 | 1 |
| 3 | Explain the following briefly. | | 3 |
| | a. Multiplication of vector by real numbers | P66 | |
| | b. Equality of vectors | ,67, | |
| | c. Triangle method of vector addition | 68 | |
| 4 | What is commutative law of vector addition? | P68 | 1 |
| 5 | What is Associative law of vector addition? | P68 | 1 |
| 6 | What is a null vector? Give the physical meaning of a null vector. | P68 | 2 |
| 7 | Give the properties of a null vector. | P68 | 2 |
| 8 | Rain is falling vertically with a speed of 35 ms^{-1} . Winds starts blowing after sometime with a speed of 12 m s^{-1} in east to west direction. In which direction should a boy waiting at a bus stop hold his umbrella? | P69 | 3 |
| 9 | Explain briefly subtraction of vectors. | P68 | 2 |
| 10 | Define a unit vector. How will you represent a unit vector? | P70 | 2 |
| 11 | What are the different ways of specifying a vector in a plane? | P70 | 2 |
| 12 | Find the magnitude and direction of the resultant of two vectors A and B in terms of their magnitudes and angle θ between them. | P72 | 3 |
| 13 | Two vectors A and B in x-y plane are given by $A = Ax\hat{i} + Ay\hat{j}$ and $B = Bx\hat{i} + By\hat{j}$ then find the vector representing the sum of the two vectors. | P71 | 2 |
| 14 | State the parallelogram law of two vectors. | P68 | 1 |

-
- 15 State the following laws. 2
- a. Law of cosines P72
 - b. Law of sines
- 16 Resolve a vector that lies in x-y plane into its components. P70 1

MOTION IN A PLANE

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-II

MAX MARKS: 30

TIME: 90Mts

- | | | | |
|---|---|-----|---|
| 1 | A motorboat is racing towards north at 25 km/h and the water current in that region is 60° east of south. Find the resultant velocity of the boat. | P72 | 3 |
| 2 | A position vector r of a particle located in a plane with reference to the origin of an x-y reference frame is given by $r = x\hat{i} + y\hat{j}$. What do you understand by x and y values. Also show the vector representation diagrammatically. | P73 | 2 |
| 3 | Define velocity of an object. Give the formula (in terms of vector) to find the velocity. Also give the vector diagram showing how you will determine the velocity using vector diagram. | P73 | 3 |
| 4 | Define average acceleration of an object in terms of vectors. Also give the vector diagram representing the same. | P73 | 2 |
| 5 | Explain briefly how you will determine the acceleration of an object using vector diagrams. Also state what difference that you will find in determining the velocity and acceleration of motion of an object in two or three dimensions. | P75 | 3 |
| 6 | The position of a particle is given by $r = 3.0t\hat{i} + 2.0t^2\hat{j} + 5.0\hat{k}$ where t is in seconds and the coefficients have the proper units for 'r' to be in meters. (a) Find $v(t)$ and $a(t)$ of the particle. (b) Find the magnitude and direction of $v(t)$ at $t = 1.0s$. | P75 | 3 |
| 7 | Derive the equations for finding the motion of an object moving with constant acceleration in a Plane. Also what conclusions can you draw from the equations? | P76 | 3 |
| 8 | A particle starts from origin at $t = 0$ with a velocity $5.0\hat{i}$ m/s and moves in x-y plane under action of a force which produces a constant acceleration of $(3.0\hat{i} + 2.0\hat{j})$ m/s ² . (a) What is the y-coordinate of the particle at the instant its x-coordinate is 84 m? (b) What is the speed of the particle at this time? | P76 | 3 |

- | | | | |
|----|--|-----|---|
| 9 | Give an expression for finding the relative velocity in two dimensions. | P76 | 1 |
| 10 | Rain is falling vertically with a speed of 35ms^{-1} . A woman rides a bicycle with a speed of 12 m s^{-1} in east to west direction. What is the direction in which she should hold her umbrella? | P76 | 2 |
| 11 | What is a projectile? Derive the equation of path of a projectile. | P77 | 3 |
| 12 | Galileo, in his book Two new sciences, stated that “for elevations which exceed or fall short of 45° by equal amounts, the ranges are equal”. Prove this statement. | P78 | 2 |

MOTION IN A PLANE

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-III

MAX MARKS: 20

TIME: 60Mts

- 1 Derive the expression for finding the following in case of a projectile. P78
 - a. Time of maximum height 5
 - b. Maximum height of a Projectile
 - c. Horizontal Range of a Projectile.
- 2 A hiker stands on the edge of a cliff 490m above the ground and throws a stone horizontally with an initial speed of 15 ms^{-1} . Neglecting air resistance, find the time taken by the stone to reach the ground, and the speed with which it hits the ground. (Take $g = 9.8 \text{ m s}^{-2}$) P78 3
- 3 A cricket ball is thrown at a speed of 28 m s^{-1} in a direction 30° above the horizontal. Calculate (a) the maximum height. (b) the time taken by the ball to return to the same level, and (c) the distance from the thrower to the point where the ball returns to the same level. P79 3
- 4 Discuss the effect of air resistance on the motion of a projectile. P79 2
- 5 What is meant by centripetal acceleration? Derive an expression for the same. P81 3
- 6 An insect trapped in a circular groove of radius 12cm moves along the groove steadily and completes 7 revolutions in 100s. (a) What is the angular speed, and the linear speed of the motion? (b) Is the acceleration vector a constant vector? What is its magnitude? P81 2
- 7 Give the dimensional formula and SI unit of the following quantities. P84
 - a. Angular speed 2
 - b. Centripetal acceleration
 - c. Horizontal range of a projectile
 - d. Time of flight of a projectile

LAWS OF MOTION

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-I

MAX MARKS: 30

TIME: 90Mts

- | | | | |
|----|--|---------------|---|
| 1 | Name the external agencies which can exert force on a body from a distance | P89 | 1 |
| 2 | An external force is required to keep a body in uniform motion. Clarify. | P90 | 1 |
| 3 | Explain why external forces are necessary to keep the bodies in motion? | P90 | 2 |
| 4 | State Newton's laws of motion | P91,
94,97 | 3 |
| 5 | An object placed on the surface of the earth is at rest. What can you say about the forces acting on it? | P92 | 2 |
| 6 | A car moving with uniform velocity. What is the net force acting on it? What can you say about the forces acting on it? | P92 | 2 |
| 7 | When the bus starts suddenly, a person standing in the bus get thrown backward with a jerk Why? | P93 | 3 |
| 8 | An astronaut accidentally gets separated out of his small spaceship accelerating in inter stellar space at a constant rate of 100 m s^{-2} . What is the acceleration of the astronaut the instant after he is outside the spaceship? (Assume that there are no nearby stars to exert gravitational force on him.) | P93 | 2 |
| 9 | Define momentum of a body. What is the formula to find out momentum? Is it a scalar or vector quantity? | P93 | 3 |
| 10 | Give the factors on which the force applied on an object depends upon. | P93 | 3 |
| 11 | Show that $F = ma$. What is the SI unit of Force | P95 | 3 |
| 12 | What is the effect of force acting on a body when it acts such that it makes some angle with the velocity of the body? Give an example where the vertical velocity of the body is changing and the horizontal velocity remains unaffected. | P95 | 2 |
| 13 | A bullet of mass 0.04 kg moving with a speed of 90 m s^{-1} enters a heavy wooden block and is stopped after a distance of 60 cm . What is the average resistive force exerted by the block on the bullet? | P95 | 3 |

LAWS OF MOTION

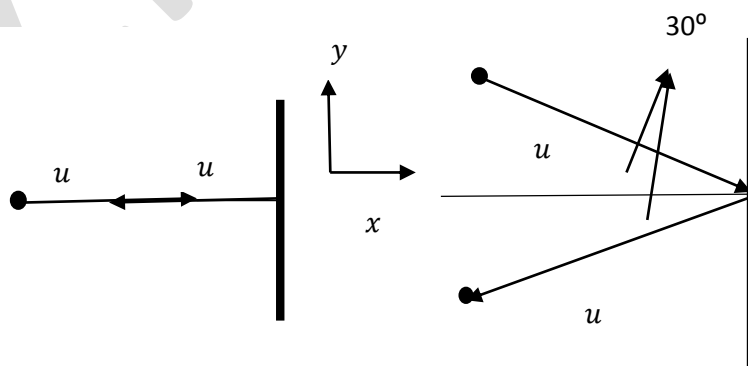
General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-II

MAX MARKS: 30

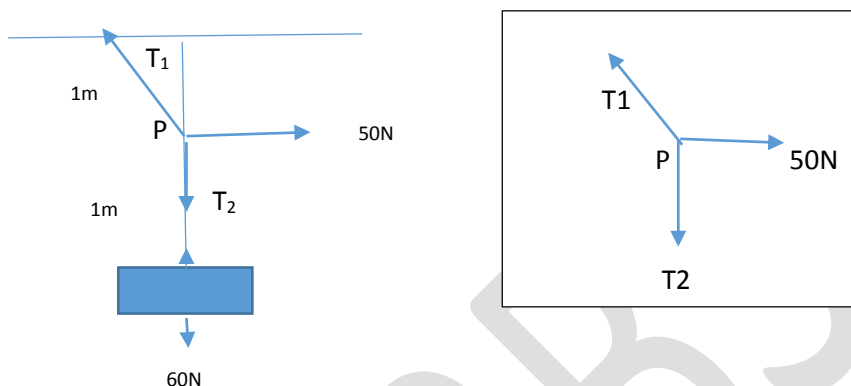
TIME: 90Mts

- | | | | |
|---|--|-----|---|
| 1 | The motion of a particle of mass m is described by $y = ut + \frac{1}{2}gt^2$. Find the force acting on the particle. | P96 | 2 |
| 2 | Define impulse.
A batsman hits back a ball straight in the direction of the bowler without changing its initial speed of 12 ms^{-1} . If the mass of the ball is 0.15kg , determine the impulse imparted to the ball (Assume linear motion of the ball) | P96 | 3 |
| 3 | The earth pulls a stone downwards due to gravity. Does the stone exert a force on the earth | P96 | 2 |
| 4 | According to Newton's Third law of motion For every action there is an equal and opposite reaction .Do the action and reaction forces act on the same body. Explain. Also state what is the effect of internal forces acting on the system? | P97 | 3 |
| 5 | Two identical billiard balls strike a rigid wall with the same speed but at different angles, and get reflected without any change in speed as shown in fig.
What is
(i). the direction of the force on the wall due to each ball?
(ii). The ratio of the magnitudes of impulses imparted to the balls by the wall? | P98 | 3 |



- | | | | |
|---|---|-----|---|
| 6 | State and prove the law of conservation of Momentum | P99 | 3 |
|---|---|-----|---|

- 7 Under what conditions a particle is said to be in equilibrium. Explain P99 3
- 8 A mass of 6 kg is suspended by a rope of length 2m from the ceiling. A force of 50 N in the horizontal direction is applied at the mid-point P of the rope, as shown. What is the angle the rope makes with the vertical in equilibrium? (Take $g=10\text{ms}^{-2}$). Neglect the mass of the rope. P99 2



- 9 What is contact force? Give two examples in mechanics. P100 2
- 10 What is the principle of working of a spring? P100 1
- 11 What is tension in a string? P100 1
- 12 What is meant by static frictional force? Give the factors on which the static frictional force depends upon. Also give the formula to find the limiting value of static friction. P101 2
- 13 State the law of Kinetic Friction. How does it vary from law of Static friction? 3
Give any two differences between static friction and kinetic friction. P101

LAWS OF MOTION

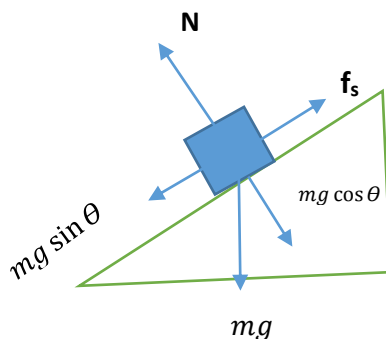
General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-III

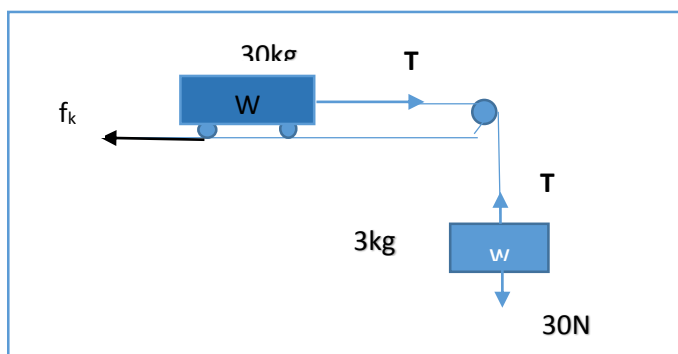
MAX MARKS: 30

TIME: 90Mts

- | | | | |
|---|--|------|---|
| 1 | A box lying in the compartment of an accelerating train is stationary relative to the train. Explain | P102 | 2 |
| 2 | Determine the maximum acceleration of the train in which a box lying on its floor will remain stationary, given that the co-efficient of static friction between the box and the train's floor is 0.15. | P102 | 2 |
| 3 | A mass of 4 kg rests on a horizontal plane. The plane is gradually inclined at an angle $\theta = 15^\circ$ with the horizontal, the mass just begins to slide. What is the co-efficient of static friction between the block and the surface? | P102 | 2 |



- | | | | |
|---|--|------|---|
| 4 | What is the acceleration of the block and trolley system shown in fig, if the co-efficient of kinetic friction between trolley and the surface is 0.04? What is the tension in the string? (Take $g=10\text{ms}^{-2}$). Neglect the mass of the string. | P102 | 3 |
|---|--|------|---|



- 5 Why do a sphere rolling without slipping on a horizontal plane will suffer no friction. What are the values of kinetic friction and static friction in this situation? P103 2
- 6 What are the different methods of reducing friction P103 2
- 7 What is Centripetal force? Discuss the role of centripetal force in case of motion a car on a level road. P104 3
- 8 Why banking of roads is required? Discuss the motion of a car on a banked road. P104 3
- 9 A cyclist speeding at 18km/hr on a level road takes a sharp circular turn of radius 3m without reducing the speed. The co-efficient of static friction between the tyres and the road is 0.1. Will the cyclist slip while taking the turn? P105 2
- 10 A circular race track of radius 300m is banked at an angle of 15° . If the coefficient of friction between the wheels of a race-car and the road is 0.2, what is the (a) optimum speed of the race car to avoid wear and tear on its tyres, and (b) maximum permissible speed to avoid slipping? P105 3
- 11 Define what is a free body diagram? P106 1
- 12 A wooden block of mass 2 kg rests on a soft horizontal floor. When an iron cylinder of mass 25kg is placed on top of the block, the floor yields steadily and the block and the cylinder together go down with an acceleration of 0.1ms^{-2} . What is the action of the block on the floor (a) before and (b) after the floor yields? Take $g= 10\text{ m s}^{-2}$. P106 3
- 13 Identify the action-reaction pairs in the Q No 12. What important conclusion can be drawn from the above? P107 2

WORK, ENERGY AND POWER

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-I

MAX MARKS: 30

TIME: 90Mts

- | | | | |
|----|--|------|---|
| 1 | Define Energy | P114 | 1 |
| 2 | What is meant Scalar product or dot Product of two vectors? | P115 | 2 |
| 3 | What are the laws obeyed by Scalar product of vectors | P115 | 2 |
| 4 | Find the angle between force $F=3\hat{i} + 4\hat{j} - 5\hat{k}$ unit and displacement $d= (5\hat{i} + 4\hat{j} - 3\hat{k})$ unit. Also find the projection of F on d. | P115 | 3 |
| 5 | State and Prove Work-Energy theorem | P116 | 3 |
| 6 | Consider a drop of mass 1.00g falling from a height of 1.00 km. It hits the ground with a speed of 50.0 m s^{-1} . (a) What is the work done by the gravitational force? What is the work done by the unknown resistive force? | P116 | 3 |
| 7 | Define work done by the force. Give the dimensional formula of force. What is the SI unit of Work? | P117 | 3 |
| 8 | Give examples where the work done by a force is zero, positive and negative. | P117 | 3 |
| 9 | A cyclist comes to a skidding stop in 10m. During this process, the force on the cycle due to the road is 200 N and is directly opposed to the motion. (a) How much work does the road do on the cycle? (b) How much work does the cycle do on the road? | P117 | 3 |
| 10 | What is meant by Kinetic Energy? Is it a scalar or vector quantity? Give the formula to find the Kinetic energy of an object of mass m has velocity v. | P117 | 2 |
| 11 | In a ballistics demonstration a police officer fires a bullet of mass 50.0 g with speed 200 ms^{-1} on soft plywood of thickness 2.00cm. The bullet emerges with only 10% of its initial kinetic energy. What is the emergent speed of the bullet? | P118 | 2 |
| 12 | How will you find the work done by a variable force? Explain briefly. | P118 | 3 |

WORK, ENERGY AND POWER

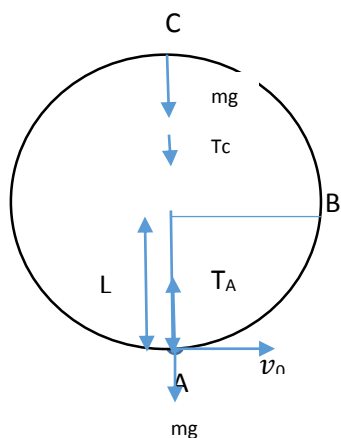
General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-II

MAX MARKS: 30

TIME: 90Mts

- | | | |
|---|--|------------------|
| 1 | A woman pushes a trunk on a railway platform which has a rough surface. She applies a force of 100 N over a distance of 10m. Thereafter, she gets progressively tired and her applied force reduces linearly with distance 50 N. The total distance through which the trunk has been moved is 20m. Plot the force applied by the woman and the frictional force, which is 50 N versus displacement. Calculate the work done by the two forces over 20m. | P119 3 |
| 2 | Prove Work-Energy theorem for a variable force. | P119 3 |
| 3 | A block of mass $m=1\text{kg}$ moving on a horizontal surface with speed $v_f = 1\text{ kg}$, moving on a horizontal surface with speed $v_i = 2\text{ms}^{-1}$ enters a rough patch ranging from $x = 0.10\text{m}$ to $x = 2.01\text{m}$. The retarding force F_r , on the block in this range is inversely proportional to x over this range.
$F_r = \frac{-k}{x}$ for $0.1 < x < 2.01\text{m}$
$=0$ for $x < 0.1\text{m}$ and $x > 2.01\text{m}$ where $k = 0.5\text{J}$. What is the final kinetic energy and speed v_f of the block as it crosses this patch? | P120 3 |
| 4 | Define Potential energy of a body. Give an example. Give the dimensional formula of Potential energy. | P120 2
121 |
| 5 | Derive an expression to find the potential energy of a body. | P120 2 |
| 6 | What is Gravitational potential energy of a body? What type of energy is possessed by a body at certain height from the surface of the earth? Name the type of energy possessed by the body when the body strikes the surface of the earth. | P121 2 |
| 7 | Give the differences between conservative and non-conservative forces. | P121 3 |
| 8 | State and prove the law of conservation of Mechanical energy | P121 3 |
| 9 | A bob of mass m is suspended by a light string of length L . It is imparted a horizontal velocity v_0 at the lowest point A such that it completes semicircular trajectory in the vertical plane with the string becoming slack only on reaching the topmost point C. This is shown in fig. (a) Obtain an expression for v_0 . (b) the speeds at points B and C. | P122 3
P122 3 |



- 10 Find the ratio of the kinetic energies at the points B and C. Comment on the nature of the trajectory of the bob after the bob reaches the point C. P123 2
- 11 Mention the forces that are acting on the body in the Q No.10 at the Point A P122 1

WORK, ENERGY AND POWER

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-III

MAX MARKS: 30

TIME: 90Mts

- | | | | |
|----|---|------|---|
| 1 | State Hooke's Law. Also give the equation representing the same. | P123 | 2 |
| 2 | Derive an expression to find the work done by the spring when the block attached to the spring is pulled through a distance of x_m . also give the plot showing the variation of F_s versus x | P123 | 3 |
| 3 | Plot the graph showing the variation of Potential energy and kinetic energy of a block attached to a spring obeying Hooke's law. Also show that the total mechanical energy remains constant in the case of the spring. | P124 | 3 |
| 4 | Show that spring force is a conservative force. | P123 | 3 |
| 5 | Consider a car of mass 1000kg moving with a speed 18.0km/hr on a smooth road and colliding with a horizontally mounted spring of spring constant $6.25 \times 10^3 \text{ N m}^{-1}$. What is the maximum compression of the spring? | P124 | 3 |
| 6 | By taking the value of coefficient of friction to be 0.5 Calculate the maximum compression of the spring in the Q No. 5 | P125 | 3 |
| 7 | What are exothermic and endothermic reactions? | P126 | 2 |
| 8 | Give the relationship between mass and energy. Also calculate energy associated with one kilogram of matter. | P126 | 2 |
| 9 | (a) Express the energy required to break one bond in DNA in eV
(b) The kinetic energy of an air molecule(10^{-21}) in eV | P127 | 2 |
| 10 | State the principle of conservation of energy | P128 | 1 |
| 11 | Define power. What is the expression to find the power? Give the dimensional formula of Power? What is the value of 1hp in terms of and watts | P128 | 3 |
| 12 | An elevator can carry a maximum load of 1800kg is moving up with a constant speed of 2ms^{-1} . The frictional force opposing the motion is 4000N. Determine | P128 | 2 |

the minimum power delivered by the motor to the elevator in watts as well as in horse power.

- 13 What is the unit of measurement of energy used in our electricity bills? P128 1

ZIET BBSR

WORK, ENERGY AND POWER

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-IV

MAX MARKS: 20

TIME: 60Mts

- | | | | |
|---|---|------|---|
| 1 | Define the following | P129 | 3 |
| | a. Elastic collision | | |
| | b. Completely inelastic collision | | |
| | c. Inelastic collision. | | |
| 2 | Discuss the collision in one dimension | P129 | 3 |
| 3 | Discuss the collision in two dimensions | P129 | 3 |
| 4 | Give the differences between elastic collision and inelastic collision. | P129 | 2 |
| 5 | What is meant by Head on collision? | P130 | 1 |
| 6 | Match the following | P133 | 3 |

GROUP-A

1. Work
2. Kinetic energy
3. Spring Constant
4. Power
5. Mechanical energy
6. Potential energy

GROUP-B

- a. $K = \frac{1}{2}mv^2$
- b. $P = F \cdot v$
- c. $E = K + V$
- d. $F = -kx$
- e. $V = mgh$
- f. $W = F \cdot d$

- | | | | |
|---|----------------------------|------|---|
| 7 | Match the following | P133 | 2 |
|---|----------------------------|------|---|

GROUP-A

1. Work
2. Potential energy
3. Spring Constant
4. Power

GROUP-B

- a. $[MT^{-2}]$
- b. $[ML^2T^{-2}]$
- c. $[ML^2T^{-2}]$
- d. $[ML^2T^{-2}]$

8	Convert 1KWH into joules	P128	2
9	What is the difference between the mass defect of a nuclear reaction with that of a chemical reaction?	P127	1

ZIET BBSR

SYSTEMS OF PARTICLES AND ROTATIONAL MOTION

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-I

MAX MARKS: 30

TIME: 90Mts

- | | | | |
|----|---|------|---|
| 1 | State and prove the law of conservation of linear momentum of a system of particles. | P149 | 3 |
| 2 | Explain the law of conservation of linear momentum of a system of particles with examples. | P149 | 3 |
| 3 | Define vector product of any two vectors. Give the rules for finding the vector product of two vectors. Give the expression to find the vector product of two vectors. | P151 | 3 |
| 4 | Find the scalar and vector product of two vectors; $a = (3\hat{i} - 4\hat{j} + 5\hat{k})$ and $b = (-2\hat{i} + \hat{j} - 3\hat{k})$ | P152 | 3 |
| 5 | Find the relationship between the linear velocity and angular velocity of a system of particles. | P153 | 3 |
| 6 | Define angular acceleration of a system of particles. Give the dimensional formula of it. Also state whether it is a scalar or vector quantity. | P154 | 2 |
| 7 | Explain with an example in case of rotational motion it is not the force alone, but how and where the force is applied is important in rotational motion. | P154 | 2 |
| 8 | What is the rotational analogue of force in rotational motion? What is the dimensional formula for finding the same? How is it different from work even though the dimensional formula is same as that of work? | P155 | 3 |
| 9 | Show that $\frac{dL}{dt} = \tau$ | P156 | 2 |
| 10 | State and prove law of conservation of angular momentum in rotational motion. | P157 | 2 |

-
- | | | | |
|----|---|------|---|
| 11 | Find the torque of a force $7\hat{i} + 3\hat{j} - 5\hat{k}$ about the origin. The force acts on a particle whose position vector is $\hat{i} - \hat{j} + \hat{k}$. | P157 | 2 |
| 12 | Show that the angular momentum about any point of a single particle moving with constant velocity remains constant throughout the motion. | P158 | 2 |

ZIET BBSR

SYSTEMS OF PARTICLES AND ROTATIONAL MOTION

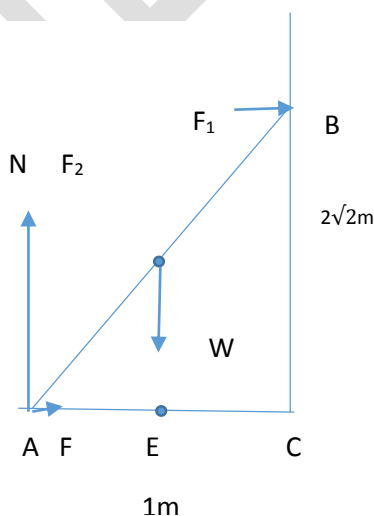
General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-II

MAX MARKS: 30

TIME: 90Mts

- | | | | |
|---|---|------|---|
| 1 | Give the conditions for the mechanical equilibrium of a rigid body. | P158 | 2 |
| 2 | Explain with examples the effect of forces that produce rotation without translation in a body? | P159 | 3 |
| 3 | Show that moment of a couple does not depend on the point about which you take the moments. | P160 | 2 |
| 4 | What is meant by Mechanical Advantage? What is its importance? | P160 | 3 |
| 5 | What are the differences between the Centre of mass and Centre of gravity of a body? | P162 | 2 |
| 6 | How will you determine the Centre of gravity of an irregular shaped body? | P161 | 3 |
| 7 | A metal bar 70 cm long and 4.00 kg in mass supported on two knife-edges placed 10cm from each end. A 6.00 kg load is suspended at 30 cm from one end. Find the reactions at the knife-edges | P162 | 3 |
| 8 | A 3m long ladder weighing 20 kg leans on a frictionless wall. Its feet rest on the floor 1m from the wall as shown in figure. Find the reaction forces of the wall and the floor. | P163 | 3 |



- 9 What is the analogue of mass in rotational motion? Give the expression for finding the same. P163 1
- 10 Define Moment of inertia of a body. Give the factors on which the moment of inertia of a body depends upon. What is the moment of inertia and kinetic energy of a light rod of length 'l' with a pair of masses rotating about an axis through the Centre of mass of the system and perpendicular to the rod. The total mass of the system is M. P164 3
- 11 What is meant by radius of gyration of a body? Give the dimensions of it. What is its value for a rod, about the perpendicular axis at its mid-point? P164 3
- 12 Give the practical use of Moment of Inertia. P164 2

SYSTEMS OF PARTICLES AND ROTATIONAL MOTION

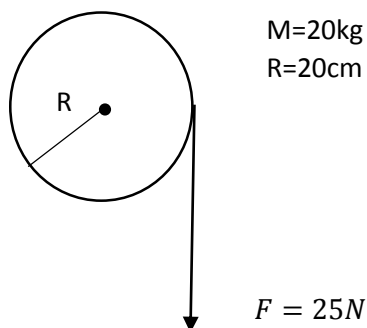
General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-III

MAX MARKS: 30

TIME: 90Mts

- | | | | |
|---|--|------|---|
| 1 | State and prove Parallel axis theorem | P166 | 3 |
| 2 | State and prove perpendicular axis theorem. | P166 | 3 |
| 3 | What is the moment of inertia of a disc about one of its diameters? | P166 | 3 |
| 4 | What is the moment of inertia of a rod of mass M , length l about an axis perpendicular to it through one end? | P167 | 2 |
| 5 | What is the moment of inertia of a ring about a tangent to the circle of the ring? | P167 | 2 |
| 6 | The angular speed of a motor wheel is increased from 1200 rpm to 3120 rpm in 16 seconds. (i) What is its angular acceleration, assuming the acceleration to be uniform? (ii) How many revolutions does the engine make during this time? | P168 | 3 |
| 7 | a. Give the equations of motion of a body moving with an initial angular velocity ω_0 attaining an angular velocity ω after a time interval of t secs and moving a constant angular acceleration α in rotational motion .
b. Obtain $\omega = \omega_0 + \alpha t$ from the first principles. | P168 | 3 |
| 8 | Explain why in the case of rotational motion about a fixed axis only those components of torques which are along the direction of the fixed axis need to be considered | P169 | 2 |
| 9 | A cord of negligible mass is wound round the rim of a fly wheel of mass 20 kg and radius 20 cm. A steady pull of 25 N is applied on the cord as shown in fig. The fly wheel is mounted on a horizontal axle with frictionless bearings.
a. Compute the angular acceleration of the wheel.
b. Find also the kinetic energy of the wheel, when 2m of the cord is unwound assuming that the wheel starts from rest. | P171 | 3 |



- 10 State and prove Conservation of angular momentum. P173 2
- 11 Give any two applications of conservation of angular momentum P173 2

12

Match the following

Group-A

1. The centre of gravity of an extended body is
2. A rigid body is in translational equilibrium if
3. A rigid body is in rotational equilibrium if
4. In pure translational motion at any instant of time

Group-B

- a. All particles of the body have the same velocity.
- b. That point where the total total gravitational torque on the body is zero.
- c. The total external Torque is zero
- d. The total external Force on it is zero.

P176

&142 2

GRAVITATION

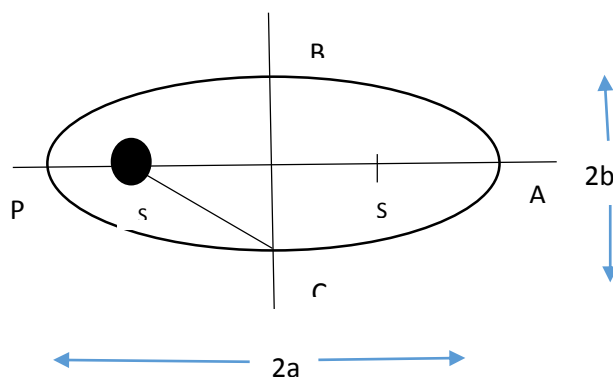
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Test Paper-I

MAX MARKS: 30

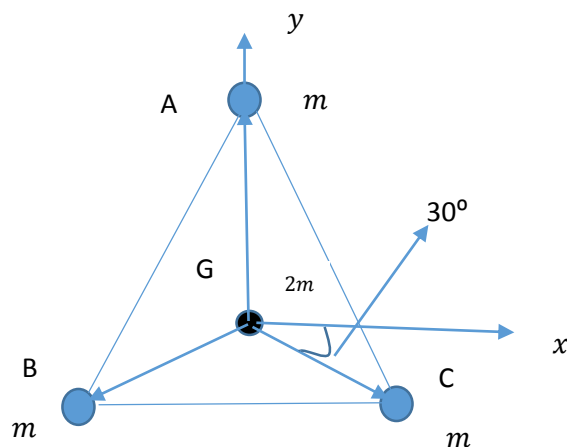
TIME: 90Mts

- | | | |
|---|------|---|
| 1 Who proposed the heliocentric model of planetary system? What was the proposition? | P183 | 2 |
| 2 What are the achievements of Kepler towards Planetary system? | P184 | 2 |
| 3 State Kepler's laws of planetary motion | P184 | 3 |
| 4 Let the speed of the planet at the perihelion P in figure be v_p and the Sun-planet distance SP be r_p . Relate $\{r_p, v_p\}$ to the corresponding quantities at the aphelion $\{r_A, v_A\}$. Will the planet take equal times to traverse BAC and CPB? | P185 | 2 |



An ellipse traced out by a planet around the sun. The closest point is P and the farthest point is A, P is called the perihelion and A the aphelion. The semimajor axis is half the distance AP.

- | | | |
|--|------|---|
| 5 State Universal Law of Gravitation. Also give the vector form of the force acting between any two bodies. | P187 | 2 |
| 6 What is a central force? What important conclusions can be drawn when the motion of a particle is under the central force? | P186 | 2 |
| 7 Three equal masses of m kg each are fixed at the vertices of an equilateral triangle ABC. | P188 | 3 |
| a. What is the force acting on a mass 2m placed at the centroid G of the triangle? | | |
| b. What is the force if the mass at the vertex A is doubled? | | |
| Take $AG=BG=CG=1m$ in the figure. | | |



Three equal masses are placed at the three vertices of the triangle ABC.
A mass $2m$ is placed at the centroid G.

- | | | | |
|----|--|------|---|
| 8 | What is the force of attraction due to a hollow spherical shell of uniform density on a point mass | P188 | 2 |
| | a. When it is situated outside the shell and | | |
| | b. When it is situated inside the shell. | | |
| 9 | Define acceleration due to gravity. Derive an expression to find the same. | P189 | 3 |
| 10 | Derive an expression to find the value of acceleration due to gravity at a point below and above the surface of the earth. | P190 | 3 |
| 11 | What is meant by gravitational potential energy? Derive an expression for the same. | P191 | 3 |
| 12 | Is gravitational potential energy conservative or non-conservative force? Give reason for the same. | P191 | 2 |
| 13 | What is the value of acceleration due to gravity at the Centre of the earth? | | 1 |

GRAVITATION

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-II

MAX MARKS: 30

TIME: 90Mts

- 1 Define escape velocity of a body. Derive an expression to find the same. P193 3
- 2 What is meant by a satellite? Name the natural satellite of the earth. How will you find out the speed of the satellite? P194 3
- 3 Define time period of a satellite. Also derive an expression to find the time period of the satellite. Also find the time period of a satellite very close to the surface of the earth. P194 3
- 4 The planet Mars has two moons, phobos and delmos. (i) phobos has a period 7 hrs, 39 minutes and an orbital radius of 9.4×10^3 Km. Calculate the mass of the Mars. (ii) Assume that earth and mars move in circular orbits around the sun, with the Martian orbit being 1.52 times the orbital radius of the earth. What is the length of the Martian year in days? P195 3
- 5 Given the following data: $g = 9.81 \text{ms}^{-2}$, $R_E = 6.37 \times 10^6 \text{m}$, the distance to the moon $R = 3.84 \times 10^8 \text{m}$ and the time period of the moon's revolution is 27.3 days. Obtain the mass of the Earth M_E in two different ways. P195 3
- 6 What is the expression to find the energy of an orbiting satellite? What is the physical significance of negative sign in the expression for energy of the satellite? What happens to the satellite if the value of energy is positive or zero. P196 3
- 7 A 400 kg satellite is in a circular orbit of radius $2R_E$ about the Earth? How much energy is required to transfer it to a circular orbit of radius $4R_E$? What are the changes in the kinetic and potential energies? P196 3
- 8 Give the differences between Geostationary and Polar satellites. P197 3

-
- 9 Define weight of an object. What is the principle involved in the measurement of weight of an object using a spring balance? What is the reading recorded by a spring balance of a body, when the spring balance is falling? P197 3
- 10 What is meant by weightlessness of a body? Explain why an astronaut floats inside a satellite? P197 3

ZIET BBSR

MECHANICAL PROPERTIES OF SOLIDS

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-I

MAX MARKS: 30

TIME: 90Mts

- | | | | |
|----|--|------|---|
| 1 | What is a rigid body? | P231 | 1 |
| 2 | What is meant by elasticity? Give an example | P231 | 1 |
| 3 | What is Plasticity? Give an example. | P231 | 1 |
| 4 | Define stress. Give the formula to find stress. Also give the SI unit of measurement of it. | P232 | 2 |
| 5 | What is longitudinal strain? Give the formula to find the longitudinal strain? | P232 | 2 |
| 6 | Give the differences between longitudinal stress and shearing stress. | P232 | 2 |
| 7 | Define volume strain. What is the SI unit of measurement of it? | P232 | 2 |
| 8 | State Hooke's Law. Also plot the stress –strain curve for a metal showing the different regions | P234 | 3 |
| | (i) elastic limit | | |
| | (ii) Permanent set | | |
| | (iii) Yield point | | |
| | (iv) Permanent set | | |
| 9 | Plot the stress-strain curve for the elastic tissue of Aorta. What do you call such a substance? | P235 | 3 |
| 10 | Define Young's Modulus of elasticity. What is the unit of measurement of Modulus of elasticity? Derive the formula to find the Young's Modulus of elasticity. | P235 | 3 |
| 11 | A structural steel rod has a radius of 10 mm and a length of 1.0m. A 100kN force stretches along its length. Calculate (a) stress, (b) elongation, and (c) strain on the rod. Young's modulus of structural steel is $2.0 \times 10^{11} \text{ N m}^{-2}$. | P236 | 3 |
| 12 | A copper wire of length 2.2 m and a steel wire of length 1.6m, both of diameter 3.0mm, are connected end to end. When stretched by a load, the net elongation is found to be 0.7.mm. Obtain the load applied. | P236 | 3 |
| 13 | Explain how will you determine the Young's Modulus of the Material of a wire | P237 | 3 |
| 14 | What is hydraulic stress? | P234 | 1 |

MECHANICAL PROPERTIES OF SOLIDS

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-II

MAX MARKS: 20

TIME: 60Mts

- 1 Define shear modulus of elasticity. Derive an expression to find the same. P238 3
- 2 A square lead slab of side 50 cm and thickness 10cm is subject to a shearing force of 9.0×10^4 N. The lower edge is riveted to the floor. How much will the upper edge be displaced? P238 3
- 3 What is meant Bulk Modulus? Write the expression for finding the Bulk modulus. What is the significance of negative sign in the expression for Bulk Modulus? How is it related to compressibility? P238 3
- 4 Why solids are less compressible than that of liquids or gases? The average depth of an Indian ocean is about 3000m. Calculate the fractional compression, $\Delta V/V$, of water at the bottom of the ocean, given that the bulk modulus of water is 2.2×10^9 N m⁻². (Take $g = 10$ ms⁻²) P239 3
- 5 Why the beams used in construction of bridges as supports have a cross-section of the type **I** Explain why? P240 3
- 6 Explain why the maximum height of a mountain on earth is 10 km? P241 3
- 7 What is meant by buckling? What is the amount of sag suffered by a bar of length l , breadth b , and depth d when loaded at the Centre by a load W . P240 2

MECHANICAL PROPERTIES OF FLUIDS

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-I

MAX MARKS: 30

TIME: 90Mts

- | | | | |
|----|---|------|---|
| 1 | What are fluids? What is the difference in the effect of shear stress on solids and fluids? | P246 | 2 |
| 2 | Define pressure. Is pressure scalar or vector quantity? Give the dimensional formula and the SI unit of measurement of Pressure. | P247 | 3 |
| 3 | What is the pressure exerted by the atmosphere at sea level? | P247 | 1 |
| 4 | Define density of a liquid. What is the unit of measurement of density of a liquid? Also give the dimensional formula of density of liquid. What is the effect of variation of pressure on the density of a liquid and gas? | P247 | 3 |
| 5 | What is the density of water at 4°C? How is it related to a substance? | P247 | 2 |
| 6 | The two thigh bones (femurs), each of cross-sectional area 10 cm^2 support the upper part of a human body of mass 40 kg. Estimate the average pressure sustained by the femurs. | P248 | 2 |
| 7 | Derive an expression to find the excess pressure at depth h below the surface of a liquid. | P248 | 3 |
| 8 | What is wind? | P248 | 1 |
| 9 | State and prove Pascal's Law | P248 | 3 |
| 10 | What is the pressure on a swimmer 10m below the surface of a lake? | P249 | 2 |
| 11 | Name the instrument used for measuring the atmospheric pressure. What is the unit of measurement of atmospheric pressure? Define the unit. | P249 | 2 |
| 12 | Mention the unit of pressure used in Medicine and physiology. Also give the unit of measurement of pressure used in meteorology. Give the conversion between torr & bar with Pascal | P250 | 2 |
| 13 | Name the instrument used for measuring pressure differences. Also explain how you will measure pressure differences using the same. | P250 | 3 |

- 14 The density of the atmosphere at sea level is 1.29 kg/m^3 . Assume that it does not change with altitude. Then how high would the atmosphere extend? P250 1

MECHANICAL PROPERTIES OF FLUIDS

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-II

MAX MARKS: 30

TIME: 90Mts

- 1 How does the atmospheric pressure values at the sea level help us in finding the approaching storm? P250 1
- 2 At a depth of 1000m in an ocean P251 3
 - (a) What is the absolute pressure?
 - (b) What is the gauge pressure?
 - (c) Find the force acting on the window of area 20 cm X 20 cm of a submarine at this depth, the interior of which is maintained at sea-level atmospheric pressure. (The density of sea water is $1.03 \times 10^3 \text{ kg m}^{-3}$, $g = 10 \text{ ms}^{-2}$)
- 3 Give the principle of working of Hydraulic Machines. Also explain with a neat diagram how hydraulic lift works. P251 3
- 4 Two syringes of different cross sections filled with water are connected with a tightly fitted rubber tube filled with water. Diameters of the smaller piston and larger piston are 1.0 cm and 3.0cm respectively. P252 3
 - (a) Find the force exerted on the larger piston when the force of 10 N is applied to the smaller piston.
 - (b) If the smaller piston is pushed in through 6.0cm, how much does the larger piston move out?
- 5 In a car lift compressed air exerts a force F_1 on a small piston having a radius of 5.0 cm. This pressure is transmitted to a second piston of radius 15 cm. If the mass of the car to be lifted is 1350 kg, calculate F_1 . What is the pressure necessary to accomplish this task? ($g = 9.8 \text{ ms}^{-2}$) P253 3
- 6 What is the principle & working of Hydraulic brakes? P253 3
- 7 Define streamline flow of a fluid. Also give the properties of streamline flow of liquid. P253 3

-
- | | | | |
|----|---|------|---|
| 8 | Derive the equation of continuity. Also give the principle on which the equation depends upon. | P253 | 3 |
| 9 | What are the differences between stream line flow and turbulent flow of a liquid? | P253 | 2 |
| 10 | State and prove Bernoulli's theorem. | P254 | 3 |
| 11 | Give the assumptions under which Bernoulli's principle is valid. Also state what happens to Bernoulli's equation when a fluid is at rest? | P255 | 2 |

MECHANICAL PROPERTIES OF FLUIDS

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-III-(Applications of Bernoulli's Theorem)

MAX MARKS: 20

TIME: 60Mts

- | | | | |
|---|--|------|---|
| 1 | State & prove Torricelli's Law | P255 | 3 |
| 2 | Name the device used to measure the flow of incompressible fluid. Also explain how you will measure the speed of flowing fluid at a point inside a tube. | P256 | 3 |
| 3 | Give any two applications of Venturimeter. | P256 | 1 |
| 4 | The flow of blood in a large artery of an anesthetized dog is diverted through a Venturimeter. The wider part of the meter has a cross-sectional area equal to the artery $A = 8\text{mm}^2$. The pressure drop in the artery is 24 Pa. What is the speed of the blood in the artery? Given that the density of blood is $1.06 \times 10^3 \text{ kg m}^{-3}$. | P257 | 3 |
| 5 | Explain how Bernoulli's principle helps in explaining Blood flow in artery and Heart Attack.) | P257 | 2 |
| 6 | What is meant by 'Dynamic Lift'? Explain how ' Magnus effect ' takes place in case of spinning ball. | P257 | 3 |
| 7 | A fully loaded Boeing aircraft has a mass of $3.3 \times 10^5 \text{ kg}$. Its total wing area is 500m^2 . It is in level flight with a speed of 960km/h .
a. Estimate the pressure difference between the lower and upper surfaces of the wings
b. Estimate the fractional increase in the speed of the air on the upper surface of the wing relative to the lower surface (The density of air is $\rho = 1.2 \text{ kg m}^{-3}$) | P258 | 3 |
| 8 | Explain how dynamic lift of aircraft wing takes place. | P258 | 2 |

MECHANICAL PROPERTIES OF FLUIDS

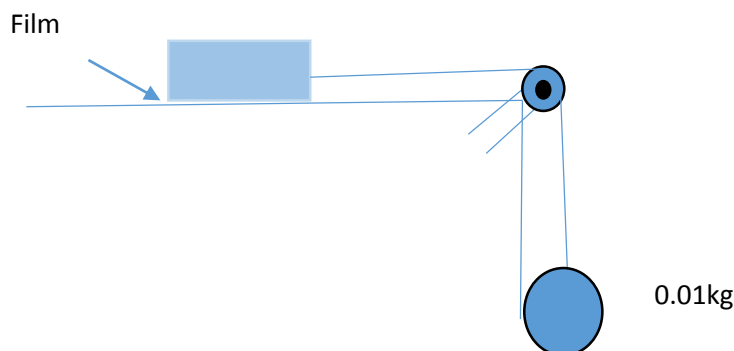
General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-IV

MAX MARKS: 30

TIME: 90Mts

- | | | | |
|---|---|------|---|
| 1 | Give the differences between viscosity and friction | P258 | 2 |
| 2 | How will you define the coefficient of viscosity? Give the SI unit of measurement of coefficient of viscosity. Also give the dimensional formula of Viscosity. | P259 | 2 |
| 3 | What is the effect of temperature on Viscosity of a liquid and a gas? | P259 | 1 |
| 4 | A metal block of area 0.10 m^2 is connected to a 0.010 kg mass via a string that passes over an ideal pulley(considered massless and frictionless) as in fig. A liquid with a film thickness of 0.30mm is placed between the block and the table. When released the block moves to the right with a constant speed of 0.085 ms^{-1} . Find the coefficient of viscosity of the liquid. | P259 | 3 |



- | | | | |
|---|---|-----|---|
| 5 | What is stokes Law? Give the factors on which viscous drag force on a body depends upon. | 260 | 2 |
| 6 | Derive an expression to find the terminal velocity of an object as it falls through a viscous medium. | 260 | 3 |
| 7 | The terminal velocity of a copper ball of radius 2.0 mm falling through a tank of oil at 20°C is 6.5cms^{-1} . Compute the viscosity of the oil at 20°C . Density of oil is $1.5 \times 10^3 \text{ kgm}^{-3}$, density of copper is $8.9 \times 10^3 \text{ kgm}^{-3}$. | 260 | 2 |

8	Give the differences between the laminar and turbulent flow.	P258 &260	2
9	What is Reynolds Number? Give the formula to find the Reynolds number. Give the physical significance of it. What are dimensions of it?	P260	2
10	What are the uses of Turbulence of a fluid?	P261	1
11	The flow rate of water from a tap of diameter 1.25 cm is 0.48L/min. The coefficient of viscosity of water is 10^{-3} Pas. After some time the flow rate is increased to 3L/min. Characterise the flow for both the flow rates.	P261	3
12	What is meant by surface tension? Why surface tension is associated only with liquids?	P261	2
13	Heat of evaporation of water is 40kJ/mol. Explain what do you understand from this?	P261	2
14	Why liquid do tends to have a least surface area?	P261	2
15	Water wets the glass surface but not mercury. Give reason	P261	1

MECHANICAL PROPERTIES OF FLUIDS

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-V

MAX MARKS: 30

TIME: 90Mts

- | | | | |
|----|--|------|---|
| 1 | Derive an expression to find the surface tension of a liquid. | P262 | 3 |
| 2 | Define surface tension in terms of surface energy | | |
| 3 | What can you say about the surface tension of a liquid when it is contact with two other liquids? On what factors does it depends upon? | P262 | 2 |
| 4 | What is the effect of temperature on the surface tension of a liquid? | P263 | 1 |
| 5 | Under what conditions a fluid will stick to a solid surface? What do you call such a property? How will you measure it | P263 | 3 |
| 6 | What is meant by Angle of contact? What is the physical significance of angle of contact | P263 | 2 |
| 7 | What is the relationship between angle of contact and S_{la} , S_{sa} , S_{sl} (where S_{la} , S_{sa} , S_{sl}) are surface tensions of liquid air interface, solid-air interface and solid-liquid interface respectively) when a drop of liquid is placed on the solid surface. Also state how does it helps in finding the nature of the angle of contact when a liquid is placed on a solid. | P264 | 3 |
| 8 | Why liquid drops are spherical in shape? Derive an expression to find the excess pressure inside a liquid drop. How is it different from a soap bubble? | P264 | 3 |
| 9 | What is meant by capillary rise of a liquid? On what factors does it depend upon? | P265 | 2 |
| 10 | Derive an expression to find the height through which the liquid rises inside a capillary tube. | P265 | 3 |
| 11 | Find the height through which water rises inside a capillary tube having radius 0.05cm. Given that the density and surface tension of water are 1gm/cc and 0.073Nm^{-1} . | P265 | 2 |
| 12 | Explain the detergent action on dirty clothes in comparison to water. | P265 | 2 |

- 13 The lower end of a capillary tube of diameter 2.00 mm is dipped 8.00cm below the surface of water in a beaker. What is the pressure required in the tube in order to blow a hemispherical bubble at its end in water? The surface tension of water at temperature of the experiment is $7.30 \times 10^{-2} \text{Nm}^{-1}$. Atmospheric pressure = $1.01 \times 10^5 \text{Pas}$. Density of water = 1000kg/m^3 , $g = 9.80 \text{ms}^{-2}$. Also calculate the excess pressure. P266 3
- 14 What difference do you identify between “ **excess pressure in a bubble of gas in a liquid** “ in comparison to “ **excess pressure in a bubble of liquid in a gas** “? P266 1

THERMAL PROPERTIES OF FLUIDS

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-I

MAX MARKS: 30

TIME: 90Mts

- | | | | |
|----|--|------|---|
| 1 | Define temperature. | P275 | 1 |
| 2 | Why do a glass of ice-cold water left on a hot summer day eventually warms up whereas a cup of tea on the same table cools down? | P274 | 1 |
| 3 | What are the difference between heat and temperature | P274 | 2 |
| 4 | Plot a graph showing the variation of Fahrenheit temperature with Celsius temperature. | | |
| 5 | What is the commonly used property that is made use of in measuring the temperature using thermometers? | P275 | 1 |
| 6 | Give the formula which is used to convert Fahrenheit scale of temperature to Celsius scale of temperature and vice versa. | P275 | 1 |
| 7 | Give the difference between a Liquid in glass thermometers and a thermometer that uses a gas in glass thermometers. What is an Ideal-gas equation? Give the two laws from which the ideal gas equation is derived. | P276 | 2 |
| 8 | Give the principle on which the working of a constant volume gas thermometer depends upon. How is temperature read from a constant volume thermometer? Also plot the variation of pressure with temperature for low density gases. | P276 | 3 |
| 9 | Give the formula to convert Celsius scale of temperature to Kelvin scale of temperature. What is the importance of absolute zero temperature? | P276 | 2 |
| 10 | A balloon partially inflated in a cool room grows to full size when placed in warm water. Give reason. | P277 | 1 |
| 11 | What is meant by thermal expansion? Mention different types of thermal expansion. | P277 | 2 |
| 12 | Define coefficient of linear expansion of solids. Derive an expression to find the coefficient of linear expansion of solids. Also give the factors on which the coefficient of linear expansion depends upon. | P277 | 3 |

- | | | | |
|----|---|------|---|
| 13 | Plot the graph showing the variation of Co-efficient of volume expansion of copper as a function of temperature. What important conclusion that you can draw form this graph? | P277 | 2 |
| 14 | What is meant by anomalous expansion of water? Explain how does this property of water supports the animal and plant life in lakes and ponds? | P278 | 3 |
| 15 | Discuss the effect of temperature on the coefficient of volume expansion of gases and liquids. | P278 | 3 |
| 16 | Derive the relation between coefficient of linear expansion and coefficient of volume expansion | P278 | 3 |

THERMAL PROPERTIES OF FLUIDS

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-II

MAX MARKS: 30

TIME: 90Mts

- 1 What is meant by thermal stress? Find the thermal stress developed in a steel rail of length 5m and area of cross section 40 cm^2 that is prevented from expanding while temperature rises by 10°C . The coefficient of thermal expansion of steel is $1.2 \times 10^{-5} \text{ K}^{-1}$. Also find the amount of external force required to bend the rails. P279 3
- 2 Show that the coefficient of area expansion, $(\Delta A/A)/\Delta T$, of a rectangular sheet of the solid is twice its linear expansivity α_l . P279 3
- 3 A blacksmith fixes iron ring on the rim of the wooden wheel of a bullock cart. The diameter of the rim and the iron ring are 5.243m and 5.231m respectively at 27°C . To what temperature should the ring be heated so as to fit the rim of the wheel? P279 2
- 4 What are the factors on which the quantity of heat required to raise the temperature of a substance depend? Give the relation to find the same. Define specific heat capacity of a substance. P280 3
- 5 What is meant by molar specific heat capacity of a substance? What is the SI unit of measurement of it? How does it vary from molar specific heat at constant volume? P280 3
- 6 Name the substance which has high specific heat capacity. Also explain why in desert areas, the earth surface warms up quickly during the day and cools quickly at night? P281 3
- 7 Name the device used for measuring heat. Give a brief description of a calorimeter P281 2
- 8 A sphere of aluminium of 0.047kg placed for sufficient time in a vessel containing boiling water, so that the sphere is at 100°C . It is then immediately transferred to 0.14kg copper calorimeter containing 0.25kg of water at 20°C . The temperature P281 3

- of water rises and attains a steady state at 23°C . Calculate the specific heat capacity of aluminium.
- 9 Define normal melting point of a substance. ? What are the two states of the substance which are in thermal equilibrium at melting point of a substance? Plot a graph showing the variation of temperature with time in case of water. Also briefly explain what will you understand from the graph? P282 3
- 10 What is meant by regelation? Also state why skating is possible on snow? P282 2
- 11 What do you call the point at which the liquid and vapour states of a substance coexist? What do you call such a state? P283 2
- 12 What is meant by triple point of a substance? State for what values of temperature and pressure the triple point of water exists? P283 1

THERMAL PROPERTIES OF FLUIDS

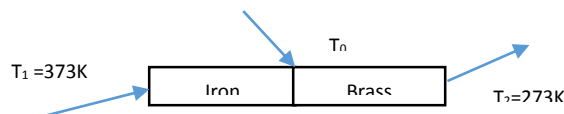
General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-III

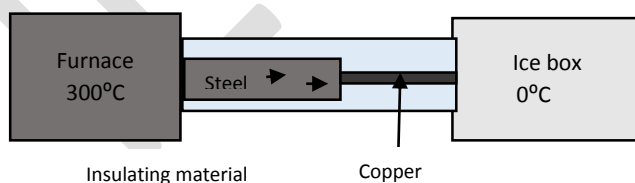
MAX MARKS: 30

TIME: 90Mts

- 1 What is meant by sublimation? Give an example for the same. What are the states of a substance which coexist in thermal equilibrium during the process of sublimation? P284 2
- 2 Why cooking is difficult on hills? How can we overcome this effect? What is normal boiling point? P284 2
- 3 Define what is meant by latent heat of fusion of ice. Give the factors on which the latent heat of fusion of ice depends upon. How does it vary from the latent heat of vaporization of water? Plot the graph showing the variation of Temperature versus heat from water at 1 atm pressure. P285 3
- 4 Explain why burns from steam are usually more serious than those from boiling water? P285 2
- 5 When 0.15 kg of ice of 0°C mixed with 0.30 kg of water at 50°C in a container, the resulting temperature is 6.7°C . Calculate the heat of fusion of ice. (Specific heat capacity of water is $4186\text{Jkg}^{-1}\text{K}^{-1}$) P285 2
- 6 Calculate the heat required to convert 3 kg of ice at -12°C kept in a calorimeter to steam at 100°C at atmospheric pressure. Given specific heat capacity of ice = $2100\text{J kg}^{-1}\text{K}^{-1}$, specific heat capacity of water = $4186\text{J kg}^{-1}\text{K}^{-1}$, latent heat of fusion of ice = $3.35 \times 10^5\text{J kg}^{-1}$ and latent heat of steam = $2.256 \times 10^6\text{J kg}^{-1}$. P286 3
- 7 An iron bar ($L_1 = 0.1\text{m}$, $A_1 = 0.02\text{m}^2$, $K_1 = 79\text{Wm}^{-1}\text{K}^{-1}$) and a brass bar ($L_2 = 0.1\text{m}$, $A_2 = 0.02\text{m}^2$, $K_2 = 109\text{W m}^{-1}\text{K}^{-1}$) are soldered end to end as shown in fig. The free ends of the iron bar and brass bar are maintained at 373 and 273 K respectively. Obtain expressions for and hence compute (i) the temperature of the junction of the two bars, (ii) the equivalent thermal conductivity of the compound bar, and (iii) the heat current through the compound bar. P288 3



- 8 Give the factors on which rate of flow of heat by conduction depends upon. Give the formula to find the same. Define thermal conductivity of a material. What is the importance of it? Give the SI unit of it P287 3
- 9 Why people prefer to give a layer of earth or foam insulation on the ceiling? P287 2
- 10 An Iron bar at temperature T_1 K having thermal conductivity K_1 and a Brass bar at temperature T_2 K having thermal conductivity K_2 are soldered end to end. Give the formula to find the junction temperature. P288 1
- 11 What are the different ways by which heat transfer takes place? What is meant by conduction? How can you compare the conductivities of gases, liquids and solids? P286 3
- 12 What is the temperature of the steel-copper junction in the steady state of the system shown in fig? Given that Length of the steel rod=15.0cm, length of the copper rod=10.0cm, temperature of the furnace =300°C, temperature of the other end = 0°C. The area of cross section of the steel rod is twice that of the copper rod.(Thermal conductivity of steel = $50.2 \text{ J s}^{-1} \text{ m}^{-1} \text{ K}^{-1}$; and of copper = $385 \text{ J s}^{-1} \text{ m}^{-1} \text{ K}^{-1}$) P288 3



- 13 Why some cooking pots have copper coating on the bottom? P287 1

THERMAL PROPERTIES OF FLUIDS

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-IV

MAX MARKS: 30

TIME: 90Mts

- 1 Name the process of heat transfer in which actual motion of matter takes place. P289 1
- 2 What is the difference between natural convection and forced convection? P289 3
Explain with examples
- 3 Explain how convection cycles are formed in the atmosphere? P289 3
- 4 What are trade winds? How they are formed? P289 2
- 5 What is meant by Radiation? Name the type of waves involved in the heat P290 3
transfer by radiation. Give any two properties of these waves. Give the factors on
which radiation depends upon.
- 6 Which coloured clothes will be comfortable to wear during summer and winter? P290 2
Why?
- 7 Why the bottoms of the utensils are blackened? P290 1
- 8 Name the device that is used to minimize the heat losses between the contents P290 2
and outside. Also explain how does it work
- 9 State Newton's law of cooling. Derive an expression to find the time of cooling of P291 3
a body through a particular range of temperature. Also plot the graph showing
the cooling of hot water with time.
- 10 Explain how you will verify Newton's law of cooling experimentally. P291 3
- 11 A pan filled with hot food cools from 94°C to 86°C in 2 minutes when the room P292 3
temperature is at 20°C . How long will it take to cool from 71°C to 69°C ?

12

Match the following

Group-A

1. Thermal Conductivity
2. Specific heat
3. Coefficient of volume expansion
4. Heat supplied to a system

Group-B

- a. $[ML^2T^{-2}]$
- b. $[MLT^{-3}K^{-1}]$
- c. $[K^{-1}]$
- d. $[L^2T^{-2}K^{-1}]$

P293 2

13

Match the following

Group-A

1. Coefficient of linear expansion
2. Heat supplied to a system
3. Specific heat
4. Thermal conductivity

Group-B

- a. $J s^{-1}K^{-1}$
- b. K^{-1}
- c. $J kg^{-1} K^{-1}$
- d. J

P293 2

THERMODYNAMICS

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-I

MAX MARKS: 30

TIME: 90Mts

- | | | | |
|----|---|------|---|
| 1 | What is Thermodynamics? | P299 | 1 |
| 2 | What do you understand from the word equilibrium of a system in mechanics? | P299 | 1 |
| 3 | When can you say that a system is in thermodynamic equilibrium? | P299 | 1 |
| 4 | State and explain " zeroth Law of Thermodynamics " | P300 | 2 |
| 5 | What is the difference between heat and temperature? | P300 | 1 |
| 6 | What is internal energy of a system? Give the factors on which the internal energy of a system depends up on. | P301 | 2 |
| 7 | What are the ways of changing internal energy of a system? | P301 | 2 |
| 8 | What are the modes which can alter the internal energy of a system? | P301 | 1 |
| 9 | What is the Internal energy of a gas enclosed in a box and the box is at rest? What is the internal energy of the gas if the box is moving with a velocity v ? | P302 | 2 |
| 10 | Differentiate between Heat and Work. Also state First Law of Thermodynamics . Find the change in internal energy for 1g of water in going from liquid to vapour phase. Given that latent heat of water is 2256J/g and at atmospheric pressure, 1 g of water has a volume of 1cm ³ in liquid phase and 1671 cm ³ in vapour phase. | P303 | 3 |
| 11 | Define specific heat capacity of a substance. Give the factors on which the specific heat capacity of a substance depends upon. Also give the SI unit of measurement of specific heat capacity | P303 | 2 |
| 12 | What is molar specific heat capacity of a substance? Give the formula to find the same. Give the factors on which molar specific heat capacity of the substance depends on. | P303 | 2 |
| 13 | Plot the graph showing the variation of variation of specific heat capacity of water with temperature. What conclusion that you can draw from this graph? | P304 | 2 |
| 14 | Define mechanical equivalent of heat. What is its value in SI unit? Give the importance of it | P304 | 2 |

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- | | | | |
|----|--|------|---|
| 15 | Derive the relation $C_p - C_v = R$ | P304 | 3 |
| 16 | How many kinds of thermodynamic state variables are there? What are they?
How identify the difference between them? | P305 | 3 |

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THERMODYNAMICS

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-II

MAX MARKS: 30

TIME: 90Mts

- Name the process in which the temperature of the system is kept constant. P306 3
Derive an expression to find the work done by the gas in increasing the volume from v_1 to v_2 for the same process.
- Name the process in which there is no heat flow between the system and the surroundings. Also derive an expression to find the work done in the process from the state (P_1, V_1, T_1) to the state (P_2, V_2, T_2) . P307 3
- Give the differences between Isothermal process and Adiabatic process P307 2
- Name the process in which pressure is maintained constant. How does it vary from an Isochoric process? P307 2
- What is a Heat engine? Explain the working of a Heat Engine. Also derive the expression to find the efficiency of Heat engine P308 3
- Explain the working of a Refrigerator. Derive the expression for coefficient of performance of a refrigerator. P309 3
- State "**second Law of thermodynamics**" given by Kelvin-Planck and Clausius. What do you understand from the statement? P310 2
- What is an irreversible process? Give some examples. What are the causes of irreversibility of these process? P310 3
- What is a reversible process? Give an example. Why is reversibility a basic concept in thermodynamics? P310 3
- Derive an expression for the efficiency of a Carnot engine. P311 3
- State & Prove Carnot theorem P312 3

KINETIC THEORY

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-I

MAX MARKS: 30

TIME: 90Mts

- | | | | |
|----|---|------|---|
| 1 | Who proposed atomic theory? Which laws were explained by him using this theory? | P319 | 2 |
| 2 | State law of definite proportions & multiple proportions. | P319 | 2 |
| 3 | Give the propositions of Dalton's theory. | P319 | 2 |
| 4 | State Gay Lussac's law. How does it vary from Avogadro's law? | P319 | 2 |
| 5 | What is the other name of Dalton's atomic theory? Why is it called so? | P319 | 2 |
| 6 | What is the size of an atom? In solids at what distance the atoms are spaced apart? What enables the liquid to flow? | P319 | 2 |
| 7 | What is meant by mean free path? What is the order of the mean free path in gases | P319 | 2 |
| 8 | Give the differences gases and solids | P319 | 2 |
| 9 | Why properties of gases are easier to understand than those of solids and liquids? | P320 | 1 |
| 10 | State Avogadro's Hypothesis? Also state at what conditions a Real gas approach ideal gas behaviour. | P320 | 2 |
| 11 | Define one mole. What is the value of gas constant in SI system? | P320 | 2 |
| 12 | What is an Ideal gas? Give the statements of the following laws | | |
| | a. Boyle's law | P320 | 3 |
| | b. Charles' Law | &321 | |
| | Give the formula to find the following values | | |
| | a. Number of moles | | |
| | b. Boltzmann constant | | |
| 13 | What is meant by Partial Pressure exerted by a gas? Also state Dalton's Law of Partial Pressures | P321 | 2 |
| 14 | A vessel contains two non-reactive gases: neon (monoatomic) and oxygen (diatomic). The ratio of their partial pressures is 3:2. Estimate the ratio of (i) | P322 | 3 |

number of molecules and (ii) mass density of neon and oxygen in the vessel.

Atomic mass of Ne= 20.0u and molecular mass of O_2 =32 u.

15 Give the postulates of kinetic theory of gases.

P323 2

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KINETIC THEORY

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-II

MAX MARKS: 40

TIME: 2Hrs

- | | | | |
|---|--|------|---|
| 1 | Using kinetic theory of gases derive an expression for finding the pressure of an Ideal gas. | P323 | 3 |
| 2 | What is the kinetic interpretation of temperature? | P325 | 2 |
| 3 | Find the mean square speed of a molecule in nitrogen gas at a temperature 300K.
Given that mass of nitrogen molecule is 28 gms and Avogadro number is 6.02×10^{26} | P325 | 2 |
| 4 | A flask contains argon and chlorine in the ratio of 2:1 by mass. The temperature of the mixture is 27°C. Obtain the ratio of (i) average kinetic energy per molecule, and (ii) root mean square speed v_{rms} of the molecules of the two gases. Atomic mass of argon = 39.9 u; Molecular mass of chlorine = 70.9u | P325 | 3 |
| 5 | Uranium has two isotopes of masses 235 and 238 units. If both are present in Uranium hexafluoride gas which would have the larger average speed? If atomic mass of fluorine is 19 units, estimate the percentage difference in speeds at any temperature. | P326 | 3 |
| 6 | State the number of coordinates required to specify the location of a molecule in the following cases | | 2 |
| | 1. A molecule free to move in space | | |
| | 2. A molecule constrained to move in a plane | | |
| | 3. A molecule constrained to move in a straight line | | |
| 7 | Give the translational degrees of freedom associated with the following. | | |
| | a. A molecule free to move in space | P327 | 2 |
| | b. A molecule constrained to move in a plane | | |
| | c. A molecule constrained to move in a straight line | | |
| 8 | What is the average value of kinetic energy for a gas in thermal equilibrium? What are the energies associated with | P328 | 3 |

- a. Monoatomic gas molecule
b. Diatomic gas molecule
- 9 What does the quadratic term occurring in the expression for energy indicates? P328 1
- 10 State the law of equipartition of energy. Also calculate the value of ratio of specific heats (γ) for a Mono atomic gas. P329 3
- 11 Calculate the value of ratio of specific heats (γ) for a (a) Diatomic gas and Poly atomic gas. P329 3
- 12 A cylinder of fixed capacity 44.8 litres contains helium gas at standard temperature and pressure. What is the amount of heat needed to raise the temperature of the gas in the cylinder by 15°C ? ($R= 8.31 \text{ J mol}^{-1}\text{K}^{-1}$) P330 3
- 13 Show that specific heat capacity of solids is $C= 3R$ P330 2
- 14 Calculate the specific heat capacity of water. P330 2
- 15 What happens to the specific heats of all substances as $T \rightarrow 0$? Why? P330 2
- 16 What is meant by mean free path? Derive an expression to find the mean free path of a gas molecule. P331 3
- 17 Estimate the mean free path for a water molecule in water vapour at 373K. Given that at STP number of molecules per unit volume is $n=2.7 \times 10^{25} \text{ m}^{-3}$ P332 1

OSCILLATIONS

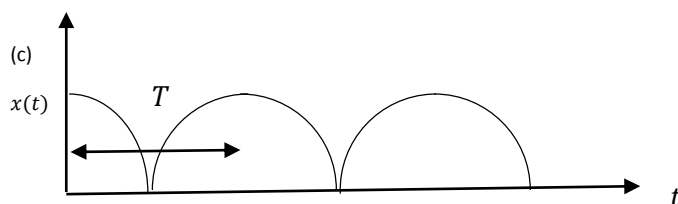
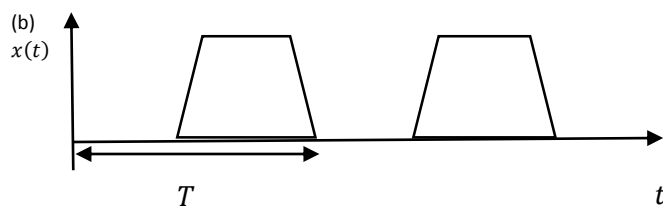
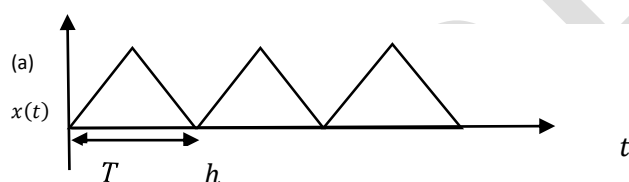
General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-I

MAX MARKS: 30

TIME: 90Mts

- 1 What is an oscillatory motion? Give examples P336 1
- 2 Give any four applications of oscillatory motion. P336 2
- 3 State whether the following motions are periodic or not. Give examples for each



- 4 What is the importance of equilibrium position in the path of motion of a body undergoing periodic motion? P337 2
- 5 Can you say that every oscillatory motion is periodic and vice versa. Give your answer with examples. P337 2
- 6 What is the difference between oscillation and vibration? P337 2
- 7 What is Simple Harmonic Motion? What are the characteristics of such motion? P337 2
- 8 What are damped oscillations? What is the cause of damping? P337 2
- 9 Define time period of oscillation. What is the SI unit of measurement of it? What is the relation between frequency and time period P337 3
On an average a human heart is found to beat 75 times in a minute. Calculate its frequency and period.
- 10 How will you define displacement in the case of oscillating simple pendulum? Does the term always referred in the context of position only. Give your answer with examples. Also give the equation representing the displacement. P338 3
- 11 Show that $f(t) = A \cos \omega t$ represents a periodic function. Also find the period of the function P339 3
- 12 Which of the following functions represent (a) Periodic and (b) non-periodic motion? Give the period for each case of periodic motion [ω is any positive constant]. P339 3
- $\sin \omega t + \cos \omega t$
 - $e^{-\omega t}$
 - $\log \omega t$
- 13 Define the following terms in the case of SHM P340 2
- Amplitude
 - Angular frequency
 - Phase
 - Phase constant

OSCILLATIONS

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-II

MAX MARKS: 30

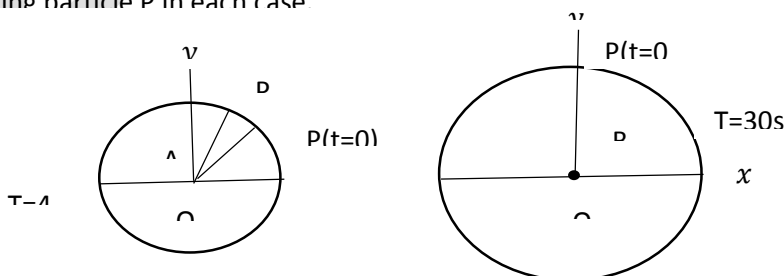
TIME: 90Mts

- 1 Plot the graph showing the variation of Displacement as a continuous function of time for simple harmonic motion P340 2
- 2 Plot a graph showing the P340 3
 - a. Variation of two curves have constants $\phi=0$ and $-\pi/4$ respectively.
 - b. Plots for $\phi=0$ for two different periods

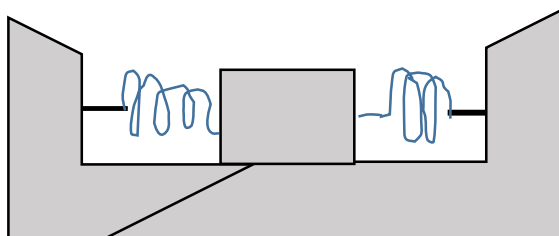
The amplitudes A is same for both the curves
- 3 Which of the following functions of time represent P341 3
 - (a) Simple harmonic
 - (b) Periodic but not simple harmonic?

Give the period for each case.

 - (1) $\sin \omega t - \cos \omega t$
 - (2) $\sin^2 \omega t$
- 4 Define Simple Harmonic Motion in terms of circular motion .Give the equation representing SHM giving the terms present in the equation. P342 2
- 5 Figure depicts two circular motions. The radius of the circle, the period of revolution, the initial position and the sense of revolution are indicated on the figures. Obtain the simple harmonic motions of the x-projection of the radius vector of the rotating particle P in each case. P342 3



- 6 Show that acceleration of the particle executing SHM is equal to the negative of the displacement. P343 3
- 7 Plot the graphs showing the displacement, velocity and acceleration of a particle in Simple Harmonic motion having the same period differ in phase. P344 3
- 8 A body oscillates with SHM according to the equation (in SI units),
 $x = 5 \cos(2\pi t + \frac{\pi}{4})$. P344 3
 At $t=1.5s$, calculate the (a) displacement, (b) speed and (c) acceleration of the body.
- 9 Derive the Force Law for Simple Harmonic Motion executed by a particle of mass m . P344 2
- 10 Two identical springs of spring constant k are attached to a block of mass m and to fixed supports as shown in fig. Show that when the mass is displaced from its equilibrium position on either side, it executes a simple harmonic motion. Find the period of oscillations. P345 2



- 11 Show that the total energy of a particle executing Simple Harmonic Motion is P346

$$E = \frac{1}{2} k A^2$$
 3
- 12 Draw the graph showing the variation of Kinetic energy, function of time and displacement of a particle in SHM. P346 1

OSCILLATIONS

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-III

MAX MARKS: 15

TIME: 30Mts

- | | | | |
|---|--|------|---|
| 1 | Draw the graph showing the variation of kinetic energy, potential energy and total energy as a function of time and displacement | P346 | 2 |
| 2 | A 5kg collar is attached to a spring of spring constant 500 Nm^{-1} . It slides without friction over a horizontal rod. The collar is displaced from its equilibrium position by 10.0cm and released. Calculate
(a) The period of oscillation
(b) The maximum speed and
(c) Maximum acceleration of the collar. | P348 | 3 |
| 3 | Show that the oscillations of a simple pendulum are simple harmonic in nature. | P349 | 3 |
| 4 | What is the length of a simple pendulum, which ticks seconds? | P350 | 2 |
| 5 | What are damped oscillations? What happens to the energy of the system in case of damped oscillations? What is the cause for damped oscillations? | P350 | 2 |
| 6 | What is meant by Resonance? Explain briefly with examples. | P354 | 2 |
| 7 | What are forced oscillations? | P352 | 1 |

WAVES

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-I

MAX MARKS: 30

TIME: 90Mts

- | | | | |
|----|---|------|---|
| 1 | What are waves? | P363 | 1 |
| 2 | How can you say that Communication involves different kinds of waves? | P363 | 2 |
| 3 | What are the differences between mechanical waves and electromagnetic waves | P364 | 2 |
| 4 | What are matter waves? Give any one application of these waves? | P364 | 2 |
| 5 | Explain briefly how propagation of sound waves takes place in air? | P364 | 2 |
| 6 | Give the differences between longitudinal and transverse waves | P366 | 2 |
| 7 | Why transverse waves are possible in solids and strings but not in fluids | P366 | 1 |
| 8 | Find the type of waves that can propagate through the following media
(a) Water (b) Air (c) steel | P366 | 3 |
| 9 | A steel bar propagates both longitudinal and transverse waves. Do they travel with the same speed? Give your answer with proper reason. | P366 | 2 |
| 10 | Given below are some examples of wave motion. State in each case if the wave motion is transverse, longitudinal or a combination of both. | P366 | 2 |
| | a. Motion of a kink in a longitudinal spring produced by displacing one end of the spring sideways. | | |
| | b. Waves produced in a cylinder containing a liquid by moving its piston back and forth. | | |
| | c. Waves produced by a motorboat sailing in water. | | |
| | d. Ultrasonic waves in air produced by a vibrating quartz crystal. | | |
| 11 | Give the equation representing the displacement of a progressive wave specifying the terms involved in it. Also give the graphical plot representing the same | P366 | 3 |
| 12 | Define the following terms with respect to a progressive wave | P367 | 2 |
| | a. Amplitude | | |
| | b. phase | | |
| | c. Wavelength and | | |

d. wavenumber

13 Define the following terms 3

(a) Time Period (b) Angular frequency (c) Frequency P368

Also give the SI unit of the quantities

14 A wave travelling along a string is described by

$y(x, t) = 0.005 \sin(80.0x - 3.0t)$, in which the numerical constants are in SI units.

Calculate (a) the amplitude (b) the wavelength (c) the period and frequency of the P368 3

wave. Also, calculate the displacement y of the wave at a distance $x = 30.0\text{cm}$ and time $t = 20\text{s}$?

WAVES

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-II

MAX MARKS: 40

TIME: 120Mts

- | | | | |
|---|--|------|---|
| 1 | Derive an expression to find the speed of a travelling wave. Also state the factors on which the speed of a mechanical wave depends upon | P369 | 3 |
| 2 | The speed of a transverse depends on mass density ' μ ' and tension 'T' in the string. Using dimensional analysis derive an expression to find the speed of a transverse | P370 | 2 |
| 3 | A steel wire 0.72m long has a mass of 5.0×10^{-3} kg. If the wire is under a tension of 60 N, what is the speed of transverse waves on the wire? | P370 | 2 |
| 4 | Given that the speed of a longitudinal wave depends on bulk modulus 'B' and density ' ρ ' of the medium, using dimensional analysis derive an expression to find the speed of a longitudinal wave. | P371 | 2 |
| 5 | Derive the Newton's formula to find the speed of a longitudinal wave in an ideal gas. What is the Laplace correction in obtaining the speed of sound in air? | P372 | 3 |
| 6 | Estimate the speed of sound in air at standard temperature and pressure. The mass of 1 mole of air is 29.0×10^{-3} kg. Also obtain the speed of sound in air by applying the Laplace correction. Given that $\gamma = \frac{cp}{cv} = \frac{7}{5}$ for air. | P372 | 3 |
| 7 | State and explain the principle of superposition of waves.
Give the equation of the waves that produce the phenomenon of interference. Also | P373 | 3 |
| 8 | state what is the nature of the waves that produce constructive interference and destructive interference? What is the difference between the constructive and destructive interference. | P374 | 3 |
| 9 | How the reflected wave differs from the incident wave? Give the equations representing the incident wave and the reflected wave. Also state what difference do you find when an incident wave is reflected from an open boundary and a close boundary. | P375 | 3 |

- 10 What are standing waves? Give the equations which can produce standing waves on superposition of waves. Give the characteristics of the stationary waves or standing waves. P375 3
- 11 Derive the expression for finding the harmonics of the waves produced for a stretched string fixed at both the ends. Also show diagrammatically the first five harmonics of vibrations for the same. P378 3

WAVES

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-III

MAX MARKS: 30

TIME: 90Mts

- | | | | |
|---|--|--------------|---|
| 1 | Why liquids and solids have higher speeds of sound than gases? | P371 | 2 |
| 2 | A pipe, 30.0cm long, is open at both ends. Which harmonic mode of the pipe resonates a 1.1 kHz source? Will resonance with the same source be observed if one end of the pipe is closed? Take the speed of sound in air as 330ms^{-1} . | P378 | 3 |
| 3 | What are beats? What type of waves produce beats? Give the equation of the waves that produce beats. Give the wave pattern representing beats. | P379
&380 | 3 |
| 4 | Two sitar strings A and B playing the note "DHA" are slightly out of tune and produce beats of frequency 5 Hz. The tension of the string B is slightly increased and the beat frequency is found to decrease to 3 Hz. What is the original frequency of B if the frequency of A is 427 Hz? | P380 | 2 |
| 5 | What is Doppler effect? Derive the expression for finding the Change in frequency when the observer is stationary, source is moving with a velocity v_s . | P381 | 3 |
| 6 | Derive the expression for change in frequency when the observer is moving but the source is stationary. | P382 | |
| 7 | Derive the expression for apparent change in frequency when both the source and Observer are moving. | P383 | 3 |
| 8 | Give the applications of Doppler effect. | P382 | 2 |
| 9 | A rocket is moving at a speed of 200ms^{-1} towards a stationary target. While moving, it emits a wave of frequency 1000Hz. Some of the sound reaching the target gets reflected back to the rocket as an echo. Calculate (1) the frequency of the sound as detected by the target and (2) the frequency of the echo as detected by the rocket. | P383 | 3 |

10

Match the following

Group-A

1. Speed of sound
2. Speed of a transverse wave
3. Speed of a progressive wave
4. Angular frequency of a wave
5. Incident wave
6. Reflected wave at a rigid boundary

Group-B

- a. $v = \sqrt{\frac{T}{\mu}}$
- b. $v = \sqrt{\frac{\gamma P}{\rho}}$
- c. $f = \frac{\omega}{2\pi}$
- d. $y(x, t) = -a \sin(kx + \omega t)$
- e. $y(x, t) = a \sin(kx - \omega t)$
- f. $v = \lambda\nu$

P384 3

- 11 Explain how reflection of sound in an open organ pipe such as flute helps in producing standing waves.

P380 3

12

Match the following

Group -A

- a. Beats
- b. Standing waves
- c. Interference
- d. Doppler effect

Group-B

1. It is the superposition of two waves of same frequency, same amplitude moving with same speed in the same direction
2. Waxing and waning of the intensity of the sound with a frequency equal to the difference in the two close frequencies of two waves
3. Apparent change in frequency of sound due to the relative motion of the observer and source
4. It is due to the superposition of two waves of same frequency, same amplitude moving with same speed in the opposite direction

2

P372

to

381

- 13 Give the formula to find the vibrating frequencies of (a) a stretched string of length L fixed at both the ends and (b) a pipe of length L with one end closed and other end open

P385 1

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