



LAKSHYA ADVANCED UNIT TEST (LAUT)

Test No.	Physics : Newton's Laws of Motion , Friction , Work, Energy & Power	Question Booklet Serial No.
1051381	Chemistry : Redox Complete , Gaseous State Complete Mathematics : Sequence and series, Locus & St. line complete	091016

Date : 09/10/2016

Maximum Marks : 240

Time Allotted : 3 Hours

Please read the instructions carefully.

1. Immediately fill the particulars on this page of the Test Booklet with Blue/Black ball point pen. Use of pencil is strictly prohibited.
2. The answer sheet is kept inside this test booklet. When you are directed to open the test booklet, take out the answer sheet and fill in the particulars carefully.
3. The test booklet consists of 57 questions. The maximum marks are 240.
4. **PCM Paper** is divided into 4 Sections.
 - (a) **Section I (01 - 08)** consists of 8 multiple choice questions which have **ONE OR MORE THAN ONE** correct answer. Each question carries +4 marks for correct answer and -1 marks for incorrect response.
 - (b) **Section II (09 - 10)** consists of 1 paragraph containing 2 questions, which have **ONLY ONE** correct answer. Each question carries +4 marks for correct response and -1 mark for incorrect response.
 - (c) **Section III (01)** contains 1 Matrix Match type question. Statements in the first column have to be matched with statements in the second column. 2 marks if you darken the bubble corresponding to only the correct answer and 0 mark in all other cases.
 - (d) **Section IV (01 - 08)** contains 8 Integer Type questions with single digit integer as answer, ranging from 0 to 9 and each question carries +4 marks for correct answer and 0 mark for incorrect response.
5. Use Black Ball Pen only for writing/marking responses on side-1 and side-2 of the Answer sheet. Use of pencil is strictly prohibited.
6. No candidate is allowed to carry any textual material, printed or written, bits of papers, paper, mobile phone, any electronic device, etc. except the admit card inside the examination hall/room.
7. Rough work is to be done on the space provided for this purpose in the test booklet only. This space is given at the bottom of each page.
8. On completion of the test, the candidate must hand over the answer sheet to the invigilator on duty in the room/hall. However, the candidates are allowed to take away this test booklet with them.
9. Do not fold or make any stray marks on the answer sheet.

Advice :

1. It is recommended to select easy questions and optimize your score.
2. Students are advised not to spend too much time on a particular question.

unless instruction is given

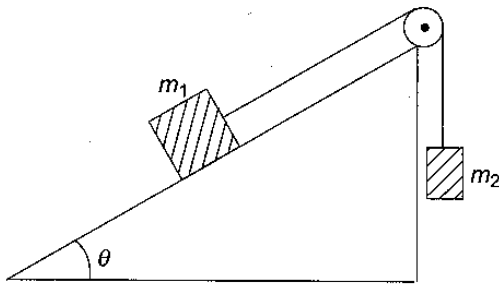
Do not open this booklet

PART A - PHYSICS

SECTION I (Multiple Answer Correct)

Section I consists of 8 multiple choice questions which have one or more than one correct answer. Each question carries +4 marks for correct answer and -1 marks for incorrect response.

1. Two blocks of masses m_1 and m_2 are connected by a string of negligible mass which passes over a frictionless pulley fixed on the top of an inclined plane. The coefficient of friction between mass m_1 and the plane is μ .



- a) If $m_1 = m_2$, the mass m_1 begins to move up the inclined plane when $\mu = \tan \theta$
- b) If $m_1 = m_2$, the mass m_1 begins to move up the inclined plane when $\mu = \sec \theta - \tan \theta$.
- c) If $m_1 = 2 m_2$, the mass m_1 begins to slide down the plane if $\mu = 2 \tan \theta$.
- d) If $m_1 = 2 m_2$, the mass m_1 begins to slide down the plane if $\mu = \tan \theta - \frac{1}{2} \sec \theta$.

2. A uniform chain of length L is placed on a rough horizontal table. The coefficient of friction between the chain and the table is μ . The maximum length of the chain that can hang from the edge of the table is l . Then

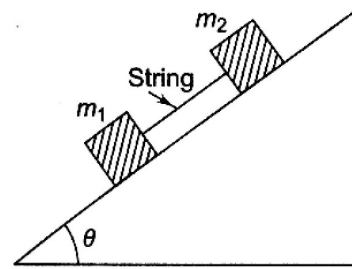
a) $l = \frac{\mu L}{(1 + \mu)}$

b) $l = \frac{L}{(1 + \mu)}$

c) If $\mu = 0.25$, $\frac{l}{L} = 20\%$

d) If $\mu = 0.25$, $\frac{l}{L} = 25\%$

3. Two blocks of masses m_1 and m_2 ($m_2 < m_1$) are placed on an inclined plane of inclination θ and joined by a string

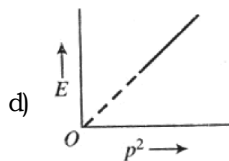
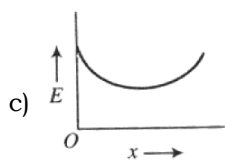
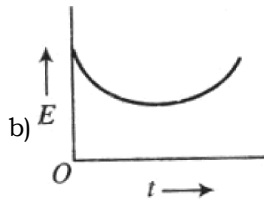
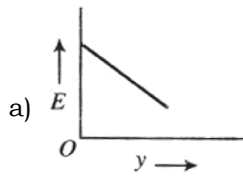


If the coefficient of friction between the blocks and the plane is μ ($\mu < \tan \theta$) and the blocks are released,

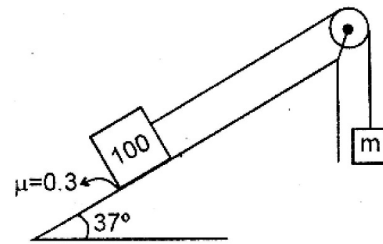
- a) the acceleration of the blocks is $g(\sin \theta - \mu \cos \theta)$.
- b) the acceleration of the blocks is zero.
- c) the tension in the string is zero.
- d) the tension in the string is $(m_1 + m_2)g(\sin \theta - \mu \cos \theta)$.

Space for Rough Work

4. A particle is projected from a point at an angle with the horizontal at $t = 0$. At an instant t , if p is the linear momentum, x is horizontal displacement, y is vertical displacement, and E is kinetic energy of the particle, then which of the following graphs are correct ?

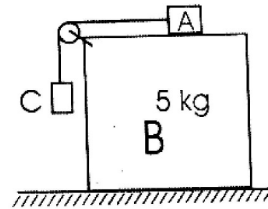


5. A body of mass 1 kg is taken from infinity to a point P . When the body reaches that point, it has a speed of 2 ms^{-1} . The work done by the conservative force is -5 J . Which of the following is true (assuming non-conservative and pseudo-forces to be absent.)
- Work done by the applied force is $+7\text{ J}$
 - The total energy possessed by the body at P is $+7\text{ J}$.
 - The potential energy possessed by the body at P is $+5\text{ J}$
 - Work done by all forces together is equal to the change in kinetic energy.
6. The value of mass m for which the 100 kg block remains in static equilibrium is



- 35 kg
- 37 kg
- 83 kg
- 85 kg

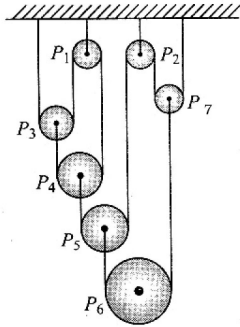
7. All the blocks shown in the figure are at rest. The pulley is smooth and the strings are light. Coefficient of friction at all the contacts is 0.2 . A friction force of 10 N acts between A and B . The block A is about to slide on block B . The normal reaction and frictional force exerted by the ground on the block B is.



- The normal reaction exerted by the ground on the block B is 110 N
- The normal reaction exerted by the ground on the block B is 50 N
- the frictional force exerted by the ground on the block B is 20 N
- the frictional force exerted by the ground on the block B is zero

Space for Rough Work

8. Seven pulleys are connected with the help of three light strings as shown in the figure given below. Consider P_3 , P_4 , and P_5 as light pulleys and pulleys P_6 and P_7 have masses m each. For this arrangement mark the correct statement(s).



- Tension in the string connecting P_1 , P_3 and P_4 is zero
- Tension in the string connecting P_1 , P_3 and P_4 is $mg/3$.
- Tension in all the 3 strings is same and equal to zero.
- Acceleration of P_6 is g downward that of P_7 is g upward.

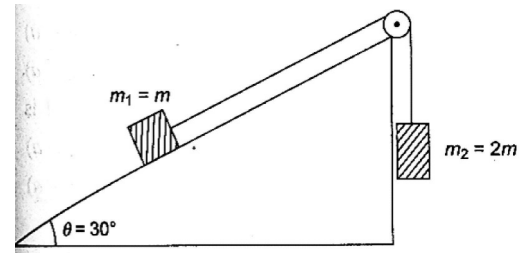
SECTION II (Paragraph Type)

Section II consists of 1 Paragraph based of 2 questions which have only one correct answers. Each question carries +4 marks for correct answer and -1 marks for incorrect response.

PARAGRAPH

Two blocks of masses $m_1 = m$ and $m_2 = 2m$ are connected by a light string passing over a frictionless pulley. The mass m_1 is placed on a

smooth inclined plane of inclination $\theta = 30^\circ$ and mass m_2 hangs vertically



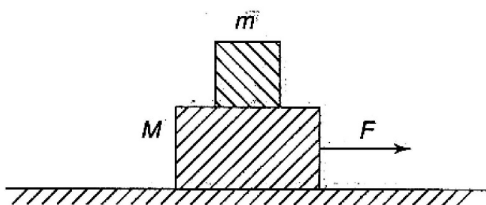
- If the system is released, the blocks move with an acceleration equal to
 - $\frac{g}{4}$
 - $\frac{g}{3}$
 - $\frac{g}{2}$
 - g
- If the system is released the tension in the string is
 - mg
 - $\frac{3mg}{2}$
 - $2mg$
 - $\frac{2mg}{3}$

Space for Rough Work

SECTION III (Matrix Match Type)

Section III consists of 1 matrix match type question in which each row have one or more than one match. Each question carries 2 marks for each correct row and 0 marks for incorrect response.

1. Two blocks of masses $M = 5 \text{ kg}$ and $m = 3 \text{ kg}$ are placed on a horizontal surface. The coefficient of friction between the blocks is $\mu_1 = 0.5$ and that between the blocks M and the horizontal surface is $\mu_2 = 0.7$. Given $F = 80 \text{ N}$. Taking $g = 10 \text{ ms}^{-2}$, match items in column I with those in column II

**Column I**

- (A) Frictional force between the blocks
 (B) Acceleration of the upper block
 (C) The maximum horizontal force F_{max} applied to M so that the two blocks move together
 (D) The common acceleration of the blocks if $F = 32 \text{ N}$.

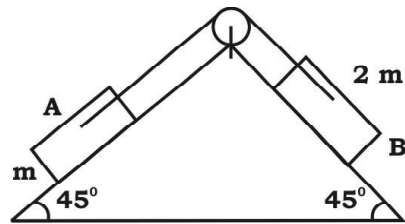
Column II

- (P) 3 ms^{-2}
 (Q) 96 N
 (R) zero
 (S) 9 N

SECTION IV (Integer Type)

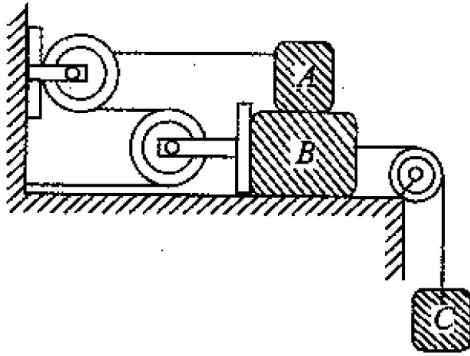
Section IV consists of 8 Integer type questions. Each is allotted +4 marks for correct response and 0 marks for incorrect response.

1. A block of mass 0.2 kg is held against a wall by applying a horizontal force of 5 N on the block. The coefficient of friction between wall and block is 0.5 . Find the magnitude (in newton) of the frictional force acting on the block. Take $g = 10 \text{ ms}^{-2}$.
2. Block A of mass m and block B of mass $2m$ are placed on a fixed triangular wedge by means of a massless string and a frictionless pulley. The coefficient of friction between block A and the wedge is $2/3$ and that between block B and the wedge is $1/3$. If the blocks are released from rest, the acceleration of block A is $\frac{ng}{9\sqrt{2}}$ (in ms^{-2}). find n ?

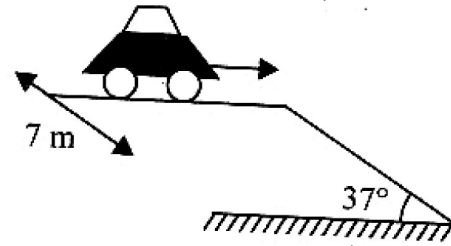


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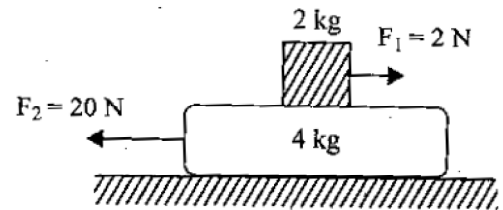
3. If the maximum value of mass of block C is $n \times 10^2$, so that neither A nor B moves. Find the value of n. (Given that the mass of A is 100 kg and that of B is 200 kg. Pulleys are smooth, and the friction coefficient between A and B and between B and horizontal surface is $\mu = 0.4$).



4. A car is going at a speed of 6 m/sec when it encounters a slope of angle 37° . The length of the sloping side is 7 m. The friction coefficient between the road and the tyre is 0.5. The drive applied brakes. The minimum speed of the car with which it can reach the bottom is W m/sec. Find W.

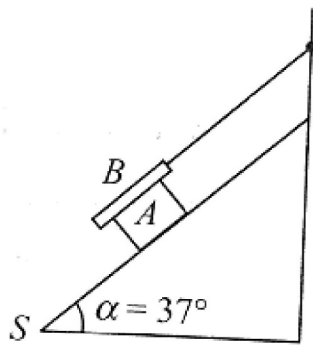


5. In the arrangement shown in the figure, the coefficient of friction between the blocks is $\mu = 1/2$. The force of friction acting between the blocks is W N. Find W.

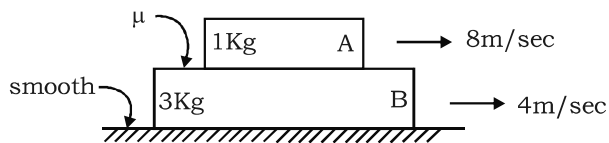


6. A block A of weight W slides down an inclined plane S of slope 37° at a constant velocity. The plank B, also of weight W, rests on the top of A. The plank B is attached by a cord to the plane. If the coefficient of kinetic friction is the same between the surfaces and between the surfaces S and A, the coefficient of friction is $\mu = \frac{1}{W}$. Find W.

Space for Rough Work



7. A block A of mass 1kg is placed on the rough surface of a block B of mass 3kg. Block B is placed on a smooth horizontal surface. The blocks are given velocities as shown. Find the net work done by the frictional force (in negative J)



8. A pump motor delivers water at a certain rate. The power of the motor is to be increased to obtain twice amount of water from the same pipe and in the same time. The power of the motor has to be increased by how many times (in integer)?

Space for Rough Work

PART B - CHEMISTRY

(Atomic Weight - C - 12, O - 16, K - 39, Mn - 55)

SECTION I (Multiple Answer Correct)

Section I consists of 8 Multiple choice questions which have more than one correct answer. Each question carries +4 marks for correct answer and -1 marks for incorrect response.

- Four gas balloons A, B, C, D of equal volumes containing, H_2 , N_2O , CO , CO_2 respectively were picked with needle and immersed in a tank containing CO_2 . Which of them will shrink after some time ?
 - A
 - B
 - C
 - both A and D
- 2.0 g of a tri-atomic gaseous element was found to occupy a volume of 448ml at 76cm of Hg and 273K. The mass of its atom is ?
 - 33.3 amu
 - 5.53×10^{-23} g
 - 33.3 g
 - 5.53 amu
- 1 mol $BaF_2 + 2$ mol $H_2SO_4 \rightarrow$ resulting mixture will be neutralised by ?
 - 1 mol of KOH
 - 2 mol of $Ca(OH)_2$
 - 4 mol KOH
 - 2 mol of KOH
- The oxidation number of Cr = + 6 in
 - $FeCrO_4$
 - $KCrO_3Cl$
 - CrO_5
 - $[Cr(OH)_4]^-$
- Which of the following reactions is not a redox reaction ?
 - $H_2O_2 + KOH \longrightarrow KHO_2 + H_2O$
 - $Cr_2O_7^{2-} + 2\overset{\ominus}{O}H \longrightarrow 2CrO_4^{2-} + H_2O$
 - $Ca(HCO_3)_2 \xrightarrow{\Delta} CaCO_3 + CO_2 + H_2O$
 - $H_2O_2 \longrightarrow H_2O + \frac{1}{2}O_2$
- Which of the following statements is/are correct?

In the reaction $xCu_3P + yCr_2O_7^{2-} \longrightarrow Cu^{2+} + H_3PO_4 + Cr^{3+}$

 - Cu in Cu_3P is oxidised to Cu^{2+} whereas P in Cu_3P is also oxidised to PO_4^{3-}
 - Cu in Cu_3P is oxidised to Cu^{2+} whereas P in Cu_3P is reduced to H_3PO_4 .
 - In the conversion of Cu_3P to Cu^{2+} and H_3PO_4 , 11 electrons are involved.
 - The value of x is 6.
- In the redox reaction $2S_2O_3^{2-} + I_2 \rightarrow S_4O_6^{2-} + 2I^-$
 - $S_2O_3^{2-}$ gets oxidised to $S_4O_6^{2-}$
 - $S_2O_3^{2-}$ gets reduced to $S_4O_6^{2-}$
 - I_2 gets reduced to I^-
 - I_2 gets oxidised to I^-
- Which of the following act both as oxidising as well as reducing agents?
 - HNO_2
 - SO_2
 - H_2O_2
 - H_2S

Space for Rough Work

SECTION II (Paragraph Type)

Section II consists of 1 Paragraph based of 2 questions which have only one correct answers. Each question carries +4 marks for correct answer and -1 marks for incorrect response.

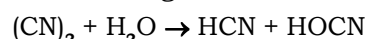
PARAGRAPH

Redox changes are of three types. These includes intermolecular redox reaction, intramolecular redox reactions and disproportionation.

The equivalent 'E' of reductant or oxidant is given by the expression :

$$E_{\text{red/oxi}} = \frac{\text{Molecular weight of reductant or oxidant}}{\text{Number of electron lost or gained by reductant or oxidant}}$$

9. The equivalent weight of cyanogen $(\text{CN})_2$ in the redox change is :



- a) $\frac{M}{2}$ b) M
c) $\frac{M}{3}$ d) $\frac{M}{24}$

10. The equivalent weight of KClO_3 in the redox reaction is : $2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$

- a) $\frac{M}{6}$ b) $\frac{M}{2}$
c) $\frac{M}{3}$ d) $\frac{M}{5}$

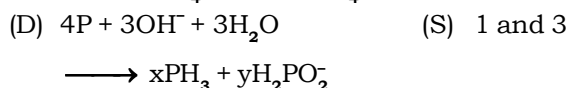
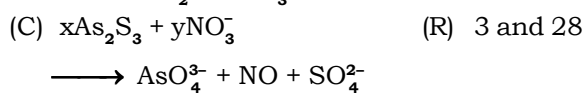
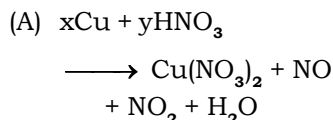
SECTION II (Matrix Match Type)

Section II consists of 2 matrix match type questions in which each row have one or more than one match. Each question carries 2 marks for each correct row and 0 marks for incorrect response.

1. Match the reactions in column I with the coefficients x and y given in column II.

Column I

Reaction



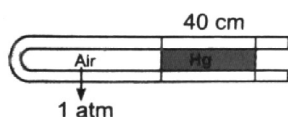
SECTION III (Integer Type)

Section III consists of 8 Integer type questions. Each is allotted +4 marks for correct response and 0 marks for incorrect response.

1. If x mL 5 M HCl is mixed with 20 mL 2 M HCl, a 2.6 M HCl is produced. The x is
2. If mole-fraction of ethanol in a ethanol-water mixture is 0.125, the number of moles of water per mol of ethanol in the mixture is

Space for Rough Work

3. 1.9 g of CH_xBr_y has the same number of atoms as in 0.6 g of H_2O . The value of $x + y$ is (M (Br) = 80)
4. If the following redox reaction is balanced with smallest whole number coefficient
- $$\text{Cr}_2\text{O}_7^{2-} + \text{H}^+ + \text{Ni} \longrightarrow \text{Cr}^{3+} + \text{Ni}^{2+}$$
- the stoichiometric coefficient of Ni in the balanced reaction is
5. Consider the following redox reaction :
- $$\text{NO}_2^- + \text{H}^+ + xe^- \longrightarrow \text{NO} + \text{H}_2\text{O}$$
- The value of x is
6. If Cu_2S is treated with acidic solution of KMnO_4 , it is oxidized completely to Cu^{2+} and SO_2 is liberated. Moles of KMnO_4 required for complete oxidation of 1.25 mol of Cu_2S is
7. Air is trapped in a horizontal glass tube by 40 cm mercury column as shown below :



If the tube is held vertical keeping the open end up, length of air column shrink to 1.9cm. Length in cm by which the mercury column shifts down is

8. If an ideal gas at 100 K is heated to 109 K, the pressure increases by x%, x is

Space for Rough Work

PART C - MATHS

SECTION I (Multiple Answer Correct)

Section I consists of 8 multiple choice questions which have one or more than one correct answer. Each question carries +4 marks for correct answer and -1 marks for incorrect response.

- Equation of a straight line passing through the origin and making with x -axis an angle twice the size of the angle made by the line $y = 0.2x$ with the x -axis is
 - $y = 0.4x$
 - $y = \frac{5}{12}x$
 - $6y - 5x = 0$
 - None of these
- Equation of a straight line passing through the point (4, 5) and equally inclined to the line $3x = 4y + 7$ and $5y = 12x + 6$ is
 - $9x - 7y = 1$
 - $9x + 7y = 71$
 - $7x + 9y = 73$
 - $7x - 9y + 17 = 0$
- If $a^2 + 9b^2 - 4c^2 = 6ab$ then the family of lines $ax + by + c = 0$ are concurrent at
 - $\left(\frac{1}{2}, \frac{3}{2}\right)$
 - $\left(-\frac{1}{2}, -\frac{3}{2}\right)$
 - $\left(-\frac{1}{2}, \frac{3}{2}\right)$
 - $\left(\frac{1}{2}, -\frac{3}{2}\right)$
- One side of a rectangle lies along the line $4x + 7y + 5 = 0$. Two of its vertices are (-3, 1) and (1, 1) then the equations of other sides are
 - $7x - 4y + 25 = 0$
 - $7x + 4y + 25 = 0$
 - $7x - 4y - 3 = 0$
 - $4x + 7y = 11$
- If the lines $ax + by + c = 0$, $bx + cy + a = 0$ and $cx + ay + b = 0$ are concurrent ($a + b + c \neq 0$) then
 - $a^3 + b^3 + c^3 - 3abc = 0$
 - $a + 2b = 3c$
 - $a = b = c$
 - $a^2 + b^2 + c^2 - ab - bc - ca = 0$
- Sum of the infinite G.P. is $p, 1, \frac{1}{p}, \frac{1}{p^2}, \dots, \infty$ is $\frac{9}{2}$, if value of p is
 - 3
 - $\frac{2}{3}$
 - $\frac{1}{2}$
 - $\frac{1}{3}$
- If the arithmetic mean of two positive numbers a and b ($a > b$) is twice their geometric mean then $a : b$ is
 - $(2 + \sqrt{3}) : (2 - \sqrt{3})$
 - $(7 + 4\sqrt{3}) : 1$
 - $1 : (7 - 4\sqrt{3})$
 - $2 : \sqrt{3}$
- The sides of a right triangle form a G.P. the tangent of the smallest angle is
 - $\sqrt{\frac{\sqrt{5} + 1}{2}}$
 - $\sqrt{\frac{\sqrt{5} - 1}{2}}$
 - $\sqrt{\frac{2}{\sqrt{5} + 1}}$
 - $\sqrt{\frac{2}{\sqrt{5} - 1}}$

Space for Rough Work

SECTION II (Paragraph Type)

Section II consists of 1 Paragraph based of 2 questions which have only one correct answers. Each question carries +4 marks for correct answer and -1 marks for incorrect response.

PARAGRAPH

If the lines with slopes m_1 and m_2 be equally inclined to a line with slope m , then

$$\frac{m_1 - m}{1 + mm_1} = \frac{m - m_2}{1 + mm_2}$$

9. Two equal sides of an isosceles triangle are given by the equations $7x - y + 3 = 0$ and $x + y - 3 = 0$ and its third side passes through the point $(1, -10)$, then possible equation of third side

- a) $3x + y + 7 = 0$ b) $x + 3y + 29 = 0$
 c) $3x + y + 31 = 0$ d) $x + 3y + 14 = 0$

10. The area of the triangle formed by angle bisectors of coordinate axes and the line $3x + 2y - 10 = 0$ is

- a) $\frac{25}{3}$ sq.units b) 20 sq.units
 c) $\frac{15}{4}$ sq.units d) 10 sq.units

SECTION III (Matrix Match Type)

Section III consists of 1 matrix match type questions in which each row have one or more than one match. Each question carries 2 marks for each correct row and 0 marks for incorrect response.

- | 1. Column I | Column II |
|---|---|
| (A) If $2a + b + 2c = 0$ ($a, b, c \in \mathbb{R}$) then the family of lines $ax + by + c = 0$ is concurrent at | (P) $(2, -1)$ |
| (B) If the lines $x + 3y + 2 = 0$, $3x - 2y - 5 = 0$ and $ax + by - 3 = 0$ are concurrent, then the ordered pair (a, b) can be | (Q) $\left(\frac{1}{2}, \frac{3}{2}\right)$ |
| (C) The coordinates of a point which is at a distance of $\frac{1}{\sqrt{2}}$ units from $(1, 1)$ in the direction of the line $x + y - 3 = 0$ is | (R) $(2, 1)$ |
| (D) The family of lines $(3 + \lambda)x + (1 + 5\lambda)y - 7(1 + \lambda) = 0$ ($\lambda \in \mathbb{R}$) is concurrent at | (S) $\left(1, \frac{1}{2}\right)$ |

Space for Rough Work

SECTION IV (Integer Type)

Section IV consists of 8 Integer type questions. Each is allotted +4 marks for correct response and 0 marks for incorrect response.

1. Area of triangle formed by the line $3x + 4y + 12 = 0$ with coordinates axes is _____
2. If the distance between the pair of parallel lines $x^2 + 2xy + y^2 - 8ax - 8ay - 9a^2 = 0$ is $25\sqrt{2}$ then $\frac{a}{5}$ is equal to _____
3. If A(0, 3), B(4, 0), C(6, 1) are vertices of triangle and internal angle bisector of C meet side \overline{AB} is $D\left(\frac{8\sqrt{k}}{1+k\sqrt{k}}, \frac{k+1}{1+k\sqrt{k}}\right)$, then k is _____
4. In a ΔABC , H is the orthocenter. If A = (1, 2), B(2010, 2011) C(-3, 5), then the distance between the orthocenter of triangle ΔABH , ΔBCH is _____
5. The minimum distance of the line $3x + 4y + 5k^2 = 0$ from (-1, 2) is _____
6. If a, b, c, d are in H.P. then value of $\frac{a^{-2} - d^{-2}}{b^{-2} - c^{-2}}$ is _____
7. If $\sum n, \frac{\sqrt{10}}{3} \sum n^2, \sum n^3$ are in G.P. then the value of n is _____
8. If a_1, a_2, \dots, a_{10} be in A.P. and h_1, h_2, \dots, h_{10} be in H.P. If $a_1 = h_1 = 2$ and $a_{10} = h_{10} = 3$ then $a_4 h_7$ is equal to _____

Space for Rough Work