

**FIITJEE**  
**ALL INDIA TEST SERIES**  
**JEE (Advanced)-2025**  
**CONCEPT RECAPITULATION TEST – III**  
**PAPER –2**  
**TEST DATE: 24-04-2025**

**Time Allotted: 3 Hours**

**Maximum Marks: 180**

**General Instructions:**

- The test consists of total 54 questions.
- Each subject (PCM) has 18 questions.
- This question paper contains **Three Parts**.
- **Part-I** is Physics, **Part-II** is Chemistry and **Part-III** is Mathematics.
- Each **Part** is further divided into **Two Sections: Section-A & Section-B**.

**Section – A (01 – 04, 19 – 22, 37 – 40):** This section contains **TWELVE (12)** questions. Each question has **FOUR** options. **ONLY ONE** of these four options is the correct answer.

**Section – A (05 – 10, 23 – 28, 41 – 46):** This section contains **EIGHTEEN (18)** questions. Each question has **FOUR** options. **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).

**Section – B (11 – 18, 29 – 36, 47 – 54):** This section contains **TWENTY FOUR (24)** numerical based questions. The answer to each question is a **Single Digit Integer, ranging from 0 to 9 both inclusive**.

**MARKING SCHEME**

**Section – A (Single Correct):** Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+3	If ONLY the correct option is chosen.
Zero Marks	:	0	If none of the options is chosen (i.e. the question is unanswered);
Negative Marks	:	-1	In all other cases.

**Section – A (One or More than One Correct):** Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+4	If only (all) the correct option(s) is (are) chosen;
Partial Marks	:	+3	If all the four options are correct but ONLY three options are chosen;
Partial marks	:	+2	if three or more options are correct but ONLY two options are chosen and both of which are correct;
Partial Marks	:	+1	If two or more options are correct but ONLY one option is chosen and it is a correct option;
Zero Marks	:	0	If none of the options is chosen (i.e. the question is unanswered);
Negative Marks	:	-2	In all other cases.

**Section – B:** Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+3	If ONLY the correct integer is entered;
Zero Marks	:	0	Question is unanswered;
Negative Marks	:	-1	In all other cases.

# Physics

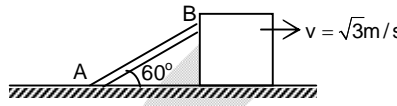
## PART – I

### Section – A (Maximum Marks: 12)

This section contains **FOUR (04)** questions. Each question has **FOUR** options. **ONLY ONE** of these four options is the correct answer.

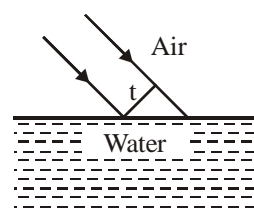
- A rod AB is shown in figure. End A of the rod is fixed on the ground. Block is moving with velocity  $\sqrt{3}$  m/s towards right. The speed of end B of the rod when rod makes an angle of  $60^\circ$  with the ground is

(A) 3 m/s (B) 2 m/s  
(C) 5 m/s (D) 2.5 m/s


- An object moves with the constant acceleration  $\vec{a}$ . Which of the following expression is/are also constant?

(A)  $\frac{d|\vec{v}|}{dt}$  (B)  $\left| \frac{d\vec{v}}{dt} \right|$   
(C)  $\frac{d(v^2)}{dt}$  (D)  $\frac{d\left(\frac{\vec{v}}{|\vec{v}|}\right)}{dt}$
- A monochromatic beam of width  $t$  is incident at  $45^\circ$  on an air water interface as shown in the figure. The refractive index of water is  $\mu$  and that of air is 1. The width of the beam in water is,

(A)  $(\mu - 1) T$  (B)  $\mu T$   
(C)  $\frac{\sqrt{\mu^2 - 1}}{\mu} t$  (D)  $\frac{(\sqrt{2\mu^2 - 1})}{\mu} t$

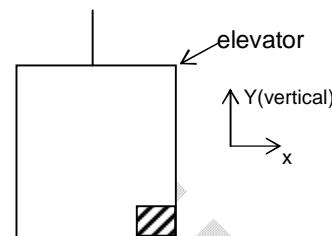

- A photon collides with a stationary hydrogen atom in ground state inelastically. Energy of the colliding photon is 10.2 eV. Almost instantaneously, another photon collides with same hydrogen atom inelastically with an energy of 15 eV. What will be observed by the detector?

(A) two photons of energy 10.2 eV  
(B) two photons of energy 1.4 eV  
(C) one photon of energy 10.2 eV and an electron of energy 1.4 eV  
(D) one electron having kinetic energy nearly 11.6 eV

**Section – A (Maximum Marks: 24)**

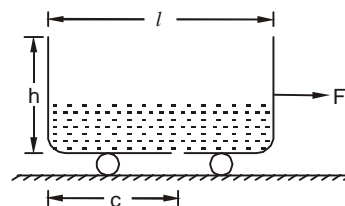
This section contains **SIX (06)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).

5. The 2 kg block is kept at the floor of an elevator as shown. The elevator is having an acceleration  $= (2\hat{i} + 2\hat{j})$  and starts from rest then in first 4 seconds
- (A) work done by all forces = 128 J  
 (B) work done by friction force = 64 J  
 (C) work done by normal reaction = 320 J  
 (D) work done by friction force in the frame of elevator = zero



6. The main scale of vernier calipers reads in mm and its vernier is divided into 10 divisions which coincides with 9 divisions of the main scale. It was also observed when two jaws are brought in contact the zero of the vernier scale coincided with the zero of the main scale. The length of a cube is measured with this vernier calipers. The main scale reads 10 mm and the first division of the vernier scale coincides with the main scale. If the mass of the cube is 2.7369 g then mark the correct alternatives
- (A) The density of the cube in appropriate significant figures is 2.6564.  
 (B) The density of the cube in appropriate significant figures is 2.66 g/cm<sup>3</sup>.  
 (C) If the zero mark of the vernier scale lies towards the left side of the zero of the main scale when the two jaws are brought in contact, the error will be positive and the correction will be negative.  
 (D) If the zero mark of the vernier scale lies towards the right side of the zero of the main scale when two jaws are brought in contact the error will be positive and the correction will be negative.

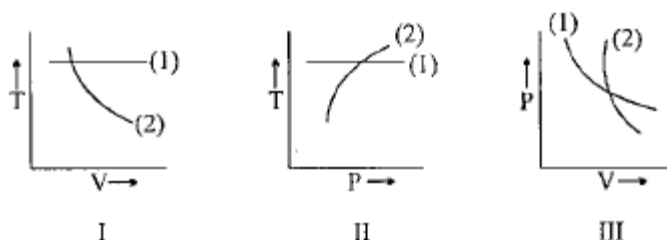
7. A rectangular vessel of dimension  $(l \times b \times h)$  and mass  $M$  contains a liquid of density  $\rho$ . The vessel has a orifice at its bottom at a distance  $c$  from the rear wall as shown in fig.



- (A) The maximum volume of the water that can be stored when the vessel is accelerated is  $\frac{hcb}{2}$ .  
 (B) The maximum volume of the water that can be stored when the vessel is accelerated is  $\frac{hcb}{2}$ .  
 (C) Force  $F$  that must be applied when maximum water is stored is  $\left[ M + \frac{hcb\rho}{2} \right] \frac{hg}{c}$   
 (D) Force  $F$  that must be applied when maximum water is stored is  $\left[ M + \frac{hcb\rho}{2} \right] \frac{lg}{c}$

8. A wave disturbance in a medium is described by  
 $y(x, t) = 0.02 \cos(50\pi t + \pi/2) \cos(10\pi x)$ ,  
 where 'x' and 'y' are in metre and 't' in seconds.  
 (A) A node occurs at  $x = 0.15$  m  
 (B) An antinode occurs at  $x = 0.3$  m  
 (C) The speed of the component wave is 5.0 m/s  
 (D) The wavelength is 0.2 m.

9.



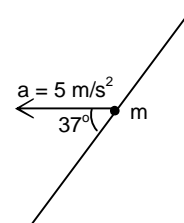
If (1) represents isothermal and (2) represents adiabatic, which of the graphs given above in respect of an ideal gas are correct?

- (A) (I) (B) (II)  
 (C) (III) (D) None of these
10. Two spherical black bodies A and B having radii  $r_A$  and  $r_B$  where  $r_B = 2r_A$  emit radiation with peak intensities at wavelength 400 nm and 800 nm respectively. If their temperature are  $T_A$  and  $T_B$  respectively in Kelvin scale, their emissive powers are  $E_A$  and  $E_B$  and energies emitted per second  $P_A$  and  $P_B$  then (both have same emissivity)
- (A)  $\frac{T_A}{T_B} = 2$  (B)  $\frac{P_A}{P_B} = 4$   
 (C)  $\frac{E_A}{E_B} = 8$  (D)  $\frac{E_A}{E_B} = 4$

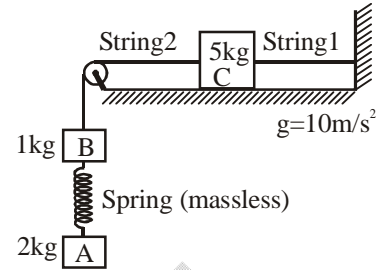
### Section – B (Maximum Marks: 24)

This section contains **EIGHT (08)** numerical based questions. The answer to each question is a **Single Digit Integer, ranging from 0 to 9 both inclusive**.

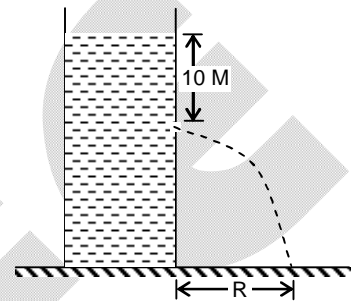
11. A bead of mass  $m$  is fitted onto a rough rod of length of 30.6 m and can move along it only. At the initial moment the bead is in the middle of the rod. The rod moves translationally in space with the constant acceleration  $a = 5 \text{ m/s}^2$  in a direction at an angle of  $37^\circ$  with the rod, find the time when the bead will leave the rod if the coefficient of friction between bead and rod is  $\mu = 0.2$  (Neglect the weight of bead)



12. The system shown in the figure is in equilibrium and all the blocks are at rest. Assume that the masses of the strings, the pulley and the spring are negligible w.r.t. the masses of the blocks and friction is absent. Find acceleration of the block C, just after cutting the string 1.

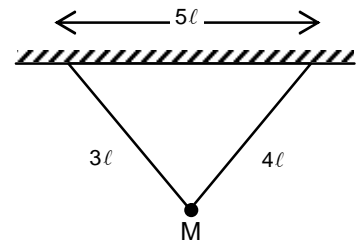


13. The range of water flowing out of a small hole made at a depth 10 M below water surface in a large tank is R. Find the extra force per unit area applied on water surface so that range becomes 2R. (in atm an approximate value).

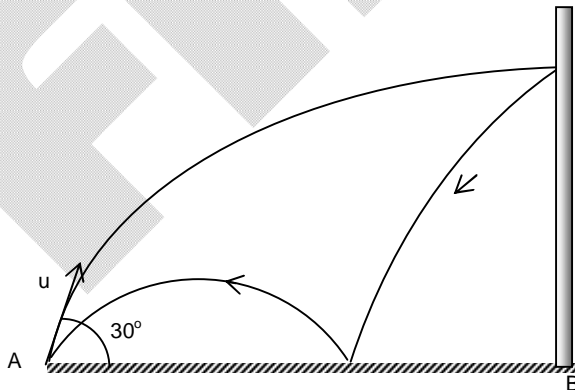


14. One mole of an ideal monoatomic gas at temperature  $T_0$  is expanding slowly while following the relation  $PV^{-1} = \text{constant}$ . When the final temperature is  $2T_0$ , the heat supplied to the gas is  $CRT_0$ , where c is an integer find the value of C.

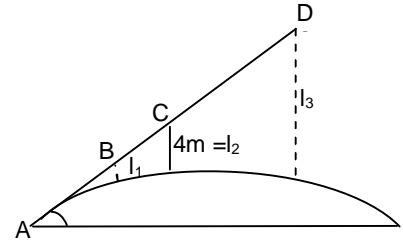
15. A particle of mass M is suspended by two massless strings as shown in the figure. M is given a small displacement perpendicular to the plane of the figure. If the time period of oscillation is  $6\pi$  second then x is ( $l = 150\text{m}$ )



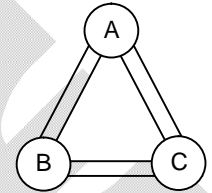
16. A particle is projected with speed u making an angle  $30^\circ$  with the horizontal from a point A on the ground towards a smooth vertical wall. The particle hits the wall at highest point of its trajectory after that it rebounds from the smooth ground and reaches point A as shown in the diagram. If coefficient of restitution e is same for all the collision then  $4e =$ .



17. A stream of water coming out from a pipe at point A as shown in figure. A rod AD is along the projected velocity of stream. There are four points A, B, C, D on the rod (AB = BC = CD) from which string of length  $l_1$ ,  $l_2$ ,  $l_3$  are hanging. These string are touching the trajectory of stream of water. If the length  $l_2 = 4\text{m}$  find  $l_3$



18. Three metallic blocks A, B and C have masses  $m$ ,  $m$  and  $2m$  respectively. Specific heat of A, B and C are  $C$ ,  $2C$  and  $C$  respectively. Initial temperature of A, B and C are  $10^\circ\text{C}$ ,  $5^\circ\text{C}$  and  $5^\circ\text{C}$  respectively. Now the blocks are connected by 3-identical rods as shown. Find the final temperature of block A on Celsius scale (Neglect any heat loss due to radiation).



## Chemistry

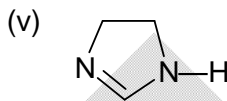
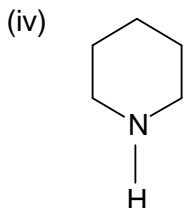
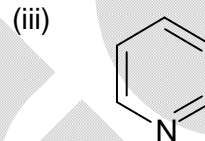
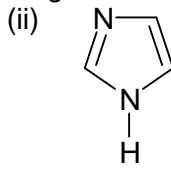
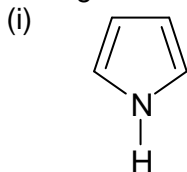
## PART – II

## Section – A (Maximum Marks: 12)

This section contains **FOUR (04)** questions. Each question has **FOUR** options. **ONLY ONE** of these four options is the correct answer.

19. Which of the following compound of carbon forms acidic solution when reacts with water at room temperature?  
 (A) CO (B)  $\text{COCl}_2$   
 (C)  $\text{CCl}_4$  (D)  $\text{CH}_4$

20. Arrange the following in decreasing order of basic strength?



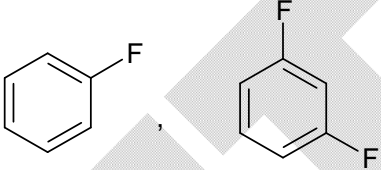
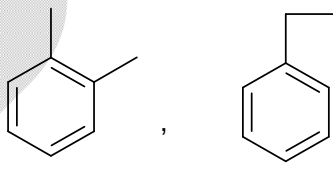
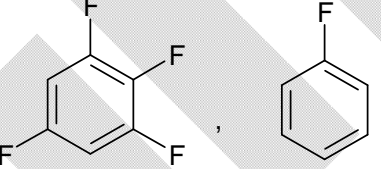
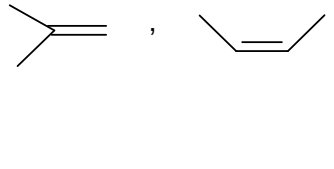
- (A)  $\text{iv} > \text{v} > \text{ii} > \text{iii} > \text{i}$  (B)  $\text{v} > \text{iv} > \text{ii} > \text{iii} > \text{i}$   
 (C)  $\text{i} > \text{ii} > \text{iii} > \text{iv} > \text{v}$  (D)  $\text{v} > \text{iv} > \text{iii} > \text{ii} > \text{i}$
21. For a dilute solution containing 2.5 g of a non-volatile non-electrolyte solute in 100 g of water, the elevation in boiling point at 1 atm pressure is  $2^\circ\text{C}$ . Assuming concentration of solute is much lower than the concentration of solvent, the vapour pressure (mm of Hg) of solution is (take  $K_b = 0.76 \text{ K kg mol}^{-1}$ )  
 (A) 724 (B) 740  
 (C) 736 (D) 718
22.  $\text{Ag}^+ + \text{NH}_3 \rightleftharpoons [\text{Ag}(\text{NH}_3)]^+; K_1 = 3.5 \times 10^{-3}$   
 $[\text{Ag}(\text{NH}_3)]^+ + \text{NH}_3 \rightleftharpoons [\text{Ag}(\text{NH}_3)_2]^+; K_2 = 1.7 \times 10^{-3}$   
 Then the formation constant of  $[\text{Ag}(\text{NH}_3)_2]^+$  is  
 (A)  $6.08 \times 10^{-6}$  (B)  $6.08 \times 10^6$   
 (C)  $6.08 \times 10^{-9}$  (D) None of these

## Section – A (Maximum Marks: 24)

This section contains **SIX (06)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).

23. Which of the following two compound(s) form different number of gases on heating?  
 (A)  $\text{LiNO}_3$  and  $\text{NaNO}_3$  (B)  $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$  and  $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$   
 (C)  $\text{FeSO}_4$  and  $\text{Fe}_2(\text{SO}_4)_3$  (D)  $\text{CaCO}_3$  and  $\text{BeCO}_3$



24. For the first order reaction  
 $2\text{N}_2\text{O}_5(\text{g}) \longrightarrow 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$   
 (A) the concentration of the reactant decreases exponentially with time  
 (B) the half-life of the reaction decreases with increasing temperature  
 (C) the half-life of the reaction depends on the initial concentration of the reaction  
 (D) the reaction proceeds of 99.6% completion in eight half-life duration
25. Choose the correct statement (s) from the following :  
 (A) Density of graphite is higher than that of diamond.  
 (B) Graphite has higher electrical and thermal conductivity than diamond.  
 (C) Graphite has higher C – C bond order than that of diamond.  
 (D) Graphite is thermodynamically more stable than diamond.
26.  $\text{CH}_3\text{OC}_2\text{H}_5 \xrightarrow{\text{HI}}$  Product(s)  
 Which of the following product(s) is/are formed in the above reaction?  
 (A)  $\text{CH}_3\text{OH}$  (B)  $\text{CH}_3\text{I}$   
 (C)  $\text{C}_2\text{H}_5\text{OH}$  (D)  $\text{C}_2\text{H}_5\text{I}$
27. In which of the following option(s) the dipole moment of the left side molecule is greater than that of the right side molecule?  
 (A)  $\text{NH}_3$ ,  $\text{NF}_3$  (B)  $\text{SCl}_2$ ,  $\text{BeCl}_2$   
 (C)  $\text{SF}_4$ ,  $\text{CF}_4$  (D)  $\text{PF}_5$ ,  $\text{IF}_5$
28. Which of the following pair has same net dipole moment  
 (A)  (B)   
 (C)  (D) 

### Section – B (Maximum Marks: 24)

This section contains **EIGHT (08)** numerical based questions. The answer to each question is a **Single Digit Integer, ranging from 0 to 9 both inclusive**.

29. What is the coordination number of beryllium in solid  $\text{BeCl}_2$ ?
30. Compound X dissociates according to the reaction  $2\text{X}(\text{g}) \rightleftharpoons 2\text{Y}(\text{g}) + \text{Z}(\text{g})$ , with degree of dissociation  $\alpha$  which is small compared with unity, if expression for  $\alpha$  in terms of equilibrium constant  $K_p$  and total pressure P is given as  $\alpha = \left( \frac{2K_p}{P} \right)^{1/n}$ . The value of n is



31. What is the sum of the number of equivalents of glucose and the number of equivalents of phenylhydrazine required to form one equivalent of glucosazone?
32. The nuclei of helium and beryllium move with same velocity. If the ratio of their de-Broglie wavelength  $\lambda_{\text{Be}^{4+}} : \lambda_{\text{He}^{2+}}$  is expressed as  $x : y$ , what is the value of  $(y - x)$ ?
33. How many electrons of chlorine have  $n + \ell = 4$ ?  
 $n$  = principal quantum number  
 $\ell$  = azimuthal quantum number
34. The total number(s) of stable conformers with non-zero dipole moment for the following compounds is/are
- $$\begin{array}{c} \text{Cl} \\ | \\ \text{Br} - \text{C} - \text{CH}_3 \\ | \\ \text{Br} - \text{C} - \text{Cl} \\ | \\ \text{CH}_3 \end{array}$$
35. 4.48 litre of an ideal gas at STP requires 12 calorie to raise the temperature by  $15^\circ\text{C}$  at constant volume. What is the value of  $C_p$  of the gas in calorie unit?
36. The half-life of a zero order reaction is 4 sec. How much seconds is needed for 75% completion of the reaction?

# **Mathematics**

## **PART – III**

### **Section – A (Maximum Marks: 12)**

This section contains **FOUR (04)** questions. Each question has **FOUR** options. **ONLY ONE** of these four options is the correct answer.

37. 3 Tangents are drawn at random to a given circle in a plane. The probability that the circle is inscribed in the triangle formed by them is
- (A)  $\frac{1}{2}$ 
(B)  $\frac{1}{3}$   
 (C)  $\frac{1}{4}$ 
(D)  $\frac{1}{8}$
38. The number of non – zero  $z \in \mathbb{C}$  satisfying  $z^3 = 18 + 26i$  where  $z = x + iy$  and  $x, y$  are integers, is  $(i = \sqrt{-1})$
- (A) 0
 (B) 1  
 (C) 2
 (D) 3
39. A monic quadratic trinomial  $P(x)$  is such that  $P(x) = 0$  and  $P(P(P(x))) = 0$  have a common root, then
- (A)  $P(0) \cdot P(1) > 0$ 
(B)  $P(0)P(1) < 0$   
 (C)  $P(0)P(1) = 0$ 
(D) Data insufficient
40. If  $A$  and  $B$  are orthogonal square matrices of same order and  $|A| + |B| = 0$ , then the matrix  $A + B$  is always
- (A) Invertible
 (B) Singular  
 (C) Non – Null matrix
 (D) None of these

### **Section – A (Maximum Marks: 24)**

This section contains **SIX (06)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).

41. Let  $f(x)$  be twice differentiable function such that  $f''(x) < 0$  in  $[0, 2]$ . Then
- (A)  $f(0) + f(2) = 2f(c), 0 < c < 2$ 
(B)  $f(0) + f(2) = 2f(1)$   
 (C)  $f(0) + f(2) > 2f(1)$ 
(D)  $f(0) + f(2) < 2f(1)$
42. Let  $f(x) = x + \frac{8}{9}x^3 - \tan x$ , where  $0 < x < \frac{\pi}{6}$ , then
- (A)  $f'(x) > 0$ 
(B)  $f''(x) > 0$   
 (C)  $f'''(x) > 0$ 
(D)  $f(x) > 0$

43. A function  $y = f(x)$  satisfies the following conditions  
 (i)  $f(1) = 1$   
 (ii) The tangent at any point of the graph of  $f(x)$  cuts off on the  $y$  – axis an intercept equal to the square of the abscissa of the point of tangency  
 Which of the following are correct?  
 (A) The graph of  $y = f(x)$  passes through the origin  
 (B)  $y = f(x)$  denotes a conic where coordinates of focus are  $\left(1, \frac{3}{4}\right)$   
 (C) The area enclosed by  $f(x)$ , and the line  $y + 3 = 0$  is  $\frac{32}{3}$ .  
 (D)  $y = f(x)$  has no maxima.
44. If  $f(x + y) = f(x) + f(y) + |x|y + xy^2 \forall x, y \in \mathbb{R}$  and  $f'(0) = 0$ , then  
 (A)  $f$  is differentiable for all  $x \in \mathbb{R}$   
 (B)  $f$  is non differentiable for at least one  $x \in \mathbb{R}$   
 (C)  $f$  is twice differentiable for all  $x \in \mathbb{R}$   
 (D)  $f$  is twice differentiable for all  $x \in \mathbb{R} - \{0\}$
45. The sequence 1, 3, 4, 9, 10, 12, 13,.....consists of all those positive integers which are powers of 3 or sums of distinct powers of 3. The hundredth term of this sequence is less than  
 (A) 982 (B) 983  
 (C) 981 (D) 980
46. A parallelogram is constructed with its sides parallel to the asymptotes of the hyperbola  $x^2 - 2y^2 - 4x + 4y - 2 = 0$  and one of its diagonals is a chord of the same hyperbola. If the other diagonal passes through a fixed point  $(a, b)$   $a, b \in \mathbb{R}$  then  
 (A)  $a + b = 3$  (B)  $a - b = 3$   
 (C)  $\sum_{r=1}^{a+b} r = 6$  (D)  $\sum_{r=1}^{a-b} r = 6$

### Section – B (Maximum Marks: 24)

This section contains **EIGHT (08)** numerical based questions. The answer to each question is a **Single Digit Integer, ranging from 0 to 9 both inclusive**.

47. A coin of radius 1 cm is thrown at random onto an infinite chessboard with a side length of each square as 4 cm. If the probability that the coin intersects at most one side of a square is  $\frac{p}{q}$  (where  $p$  and  $q$  are coprime) then find the value of  $p + q - 2$
48. If the maximum value of  $\left| \sqrt{x^4 - 7x^2 - 4x + 20} - \sqrt{x^4 + 9x^2 + 16} \right|$  is  $P$ , find the value of  $[P]$  (where  $[.]$  denotes GIF)

49. An infinite geometric progression has a positive common ratio and third term equal to 8. The smallest possible value of its sum is P then sum of digits of P is
50. The line  $y = mx + 1$  touches the curves  $y = -x^4 + 2x^2 + x$  at two distinct points  $P(x_1, y_1)$  and  $Q(x_2, y_2)$ , then the value of  $\frac{x_1^2 + y_1^2}{x_2^2 + y_2^2}$  (where  $x_1 > x_2$ ) is
51. Let  $P(x) = x^6 - x^5 - x^3 - x^2 - x$ ,  $Q(x) = x^4 - x^3 - x^2 - 1$ . If  $\alpha, \beta, \gamma, \delta$  are roots of  $Q(x) = 0$ , then find the value of  $P(\alpha) + P(\beta) + P(\gamma) + P(\delta)$
52. Let  $f(n)$  denotes the square of the sum of the digits of natural number  $n$ , where  $f^2(n)$  denotes  $f(f(n))$ ,  $f^3(n)$  denotes  $f(f(f(n)))$  and so on. Then, the value of  $\frac{f^{201}(2011) - f^{2016}(2011)}{f^{2017}(2011) - f^{2018}(2011)}$ , is
53. Let  $f: \mathbb{R}^+ \rightarrow \mathbb{R}$  be a differentiable function with  $f(1) = 3$  and  $\int_1^{xy} f(t) dt = y \int_1^x f(t) dt + x \int_1^y f(t) dt \forall x, y \in \mathbb{R}^+$ ,  $f(e) = ?$
54. For all  $x, y \in \mathbb{R}_1$  the range of  $\frac{(x+y)(1-xy)}{(1+x^2)(1+y^2)}$  is  $[a, b]$  then  $a + b$  is