FIITJEE
ALL INDIA TEST SERIES
JEE (Advanced)-2025
FULL TEST – V
PAPER –2
TEST DATE: 18-02-2025

Time Allotted: 3 Hours   **Maximum Marks: 180**

General Instructions:

- The test consists of total 51 questions.
- Each subject (PCM) has 17 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 **Three Sections**: **Section-A, Section-B & Section-C**.

    Section – A *(01 – 04, 18 – 21, 35 – 38):* This section contains **TWELVE (12)** questions. Each question has **FOUR** options. **ONLY ONE** of these four options is the correct answer.

    Section – A *(05 –07, 22 – 24, 39 – 41):* This section contains **NINE (09)** questions. Each question has **FOUR** options. **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).

    Section – B *(08 – 13, 25 – 30, 42 – 47):* This section contains **EIGHTEEN (18)** numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.

    Section – C *(14 –17, 31 – 34, 48 – 51):* This section contains **SIX (06) paragraphs.** Based on each paragraph, there are **TWO (02)** questions of numerical answer type. The answer to each question is a **NUMERICAL VALUE (XXXXX.XX).** If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.

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	:	+4	If ONLY the correct integer is entered;
Zero Marks	:	0	Question is unanswered;
Negative Marks	:	0	In all other cases.

Section – C: 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	:	0	In all other cases.

Physics   PART – I

### SECTION – A
(One Options Correct Type)
*This section contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.*

1. A small block is connected to one end of a massless spring of un-stretched length 4.9 m. The other end of the spring (see the figure) is fixed. The system lies on a horizontal frictionless surface. The block is stretched by 0.2 m and released from rest at t = 0. It then executes simple harmonic motion with angular frequency $\omega = \dfrac{\pi}{3}\,\text{rad/s}$.
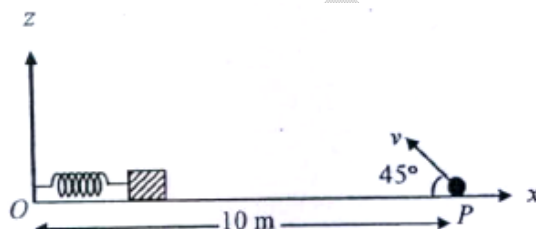
   Simultaneously at t = 0, a small pebble is projected with speed v from point P at an angle of 45° as shown in the figure. Point P is at a horizontal distance of 10 m fro O. If the pebble hits the block at t = 1s, the value of v is (take g = 10 m/s^2)

   (A) $\sqrt{50}\,\text{m/s}$ (B) $\sqrt{51}\,\text{m/s}$

   (C) $\sqrt{52}\,\text{m/s}$ (D) $\sqrt{53}\,\text{m/s}$

2. A cyclic process ABCA shown in V-T diagram is performed with a constant mass on an ideal gas. The same process on a PV diagram is represented as
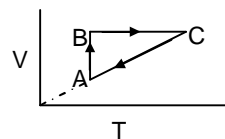
   (A)

   (B)

   (C)

   (D)

3. Force acting on a particle moving in a straight line varies with the velocity of the particle as $F = \dfrac{k}{v}$, where k is a constant. The work done by this force in time t is:

   (A) $\dfrac{k}{v^2}t$ (B) 2kt

   (C) kt   (D) $\dfrac{2kt}{v^2}$

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4. A uniform rod of length 'l' is pivoted at point 'A'. It is struck by a horizontal force which delivers an impulse 'J' at a distance 'x' from point 'A' as shown in figure, impulse delivered by pivot is zero if 'x' is equal to

(A) $\dfrac{l}{2}$ 　　　　　　　　　　(B) $\dfrac{l}{3}$

(C) $\dfrac{2l}{3}$ 　　　　　　　　　(D) $\dfrac{3l}{4}$
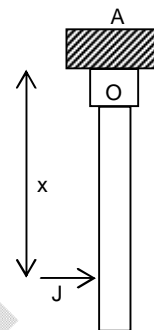
SECTION – A
(One or More than one correct type)
*This section contains **THREE (03)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).*

5. In a cylindrical region of radius R, there exists a time varying magnetic field B such that $\dfrac{dB}{dt} = k(> 0)$. A charged particle having charge q is placed at the point P at a distance d (> R) from its centre O. Now, the particle is moved in the direction perpendicular to OP (see figure) by an external agent upto infinity so that there is no gain in kinetic energy of the charged particle. Choose the correct statement/s.
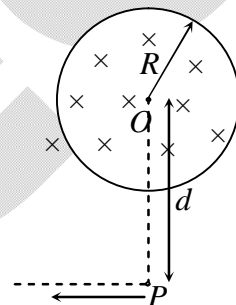
(A) Work done by external agent is $\dfrac{q\pi R^2}{4}k$ if d = 2R

(B) Work done by external agent is $\dfrac{q\pi R^2}{8}k$ if d = 4R

(C) Work done by external agent is $\dfrac{q\pi R^2}{4}k$ if d = 4R

(D) Work done by external agent is $\dfrac{q\pi R^2}{4}k$ if d = 6R

6. A sound wave is traveling along positive *x*-direction. Displacement (*y*) of particles from their mean positions at any time *t* is shown in the figure.
   (A) Particle located at S has zero velocity.
   (B) Particle located at T has its velocity in the negative direction.
   (C) Change in pressure at S is zero
   (D) Particles located near R are under compression.
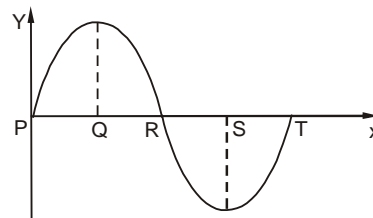
7. Consider a case of thin film interference as shown. Thickness of film is equal to wave length of light in μ_2
   (A) Reflected light will be maximum if $\mu_1 < \mu_2 < \mu_3$
   (B) Reflected light will be maximum if $\mu_1 < \mu_2 > \mu_3$
   (C) Transmitted light will be maximum if $\mu_1 > \mu_2 > \mu_3$
   (D) Transmitted light will be maximum $\mu_1 > \mu_2 < \mu_3$
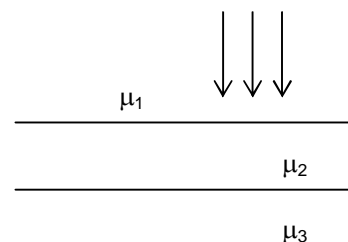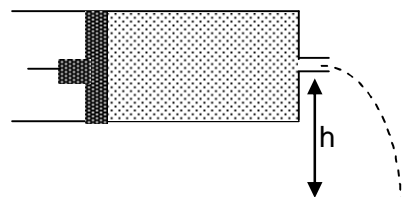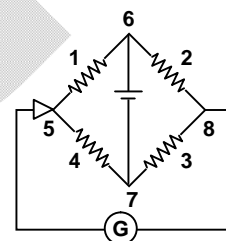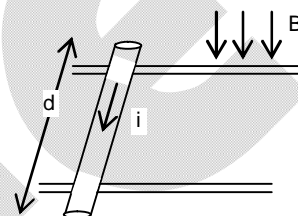
SECTION – B

(Numerical Answer Type)

*This section contains **SIX (06)** Numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.*

8. A piece of ice (heat capacity = 2100 J kg^{-1} ^{0}C^{-1} and latent heat = 3.36 x 10^5 J kg^{-1}) of mass m grams is at -5^{0}C at atmospheric pressure. It is given 420 J of heat so that the ice starts melting. Finally when the ice-water mixture is in equilibrium, it is found that 1 gm of ice has melted. Assuming there is no other heat exchange in the process, the value of m is

9. A cylindrical uniform rod of mass 0.72 kg and radius 6 cm rests on two parallel rails, that are d = 50 cm apart. The rod caries a current I = 48A (In the direction shown) and rolls along the rails without slipping. If it starts from rest, uniform magnetic field of magnitudes 0.25 T is directed perpendicular to the rod and the rail, then find the friction force(In N) between rod and rails

10. Four wires of equal length 8 m are arranged as shown in the figure. Wires, 2, 3 and 4 are of equal cross sectional area and wire 1 is of half the cross section of these wires. By how much distance pointer at point 5 must be moved to get null point?

11. A tube has two area of cross-sections as shown in figure. The diameter of the tube are 8mm and 2mm. Find range (in m) of water falling on horizontal surface, if piston is moving with a constant velocity of 0.25 m/s, h = 1.25m (g = 10 m/s^2)

12. Two rods are of same material and have same length and area. Heat ΔQ flow through them in 12 minutes, when they joined side by side. If now both the rods are joined in parallel, then in what time (in minutes) the same amount of heat ΔQ will flow.

13. A bus is moving towards a huge wall with a velocity of 5 m/s. The driver sounds a horn of frequency 200Hz. The frequency of the beats heard by a passenger of the bus will be (In Hz) nearly (velocity of sound in air = 338 m / s)

SECTION – C
(Numerical Answer Type)

*This section contains **TWO (02) paragraphs**. Based on each paragraph, there are **TWO (02)** questions of numerical answer type. The answer to each question is a **NUMERICAL VALUE (XXXXX.XX)**. If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.*

Paragraph for Question Nos. 14 and 15

Three capacitors of $2\mu F$, $3\mu F$ and $5\mu F$ are independently charged with batteries of emf's 5V, 20V and 10V respectively. After disconnecting from the voltage sources, these capacitors are connected as shown in figure with their positive polarity plates connected to A and negative polarity plates are earthed. A battery of 20V and an uncharged capacitor of $4\mu F$ capacitance are connected to the circuit as shown with a switch S.
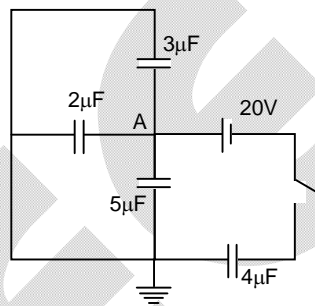
14.   Potential of junction A after closing the switch is x/7 Volts, then x is _____

15.   Charge on $4\mu F$ capacitor after closing the switch is y/7 Volts, then y is _____

Paragraph for Question Nos. 16 and 17

A charge particle of charge 1C and mass 10gm is moving with velocity $10\ \hat{i}$ m/s in horizontal plane consisting of magnetic field $-0.1\hat{k}$ T of width $\dfrac{\sqrt{3}}{2}$ m and electric field $-0.1\ \hat{j}$ N/C of width d. Particle enters the magnetic field at $t = 0$ perpendicularly and follows the path as shown in the figure and strikes the wall AB perpendicularly at A′ (neglect gravity)
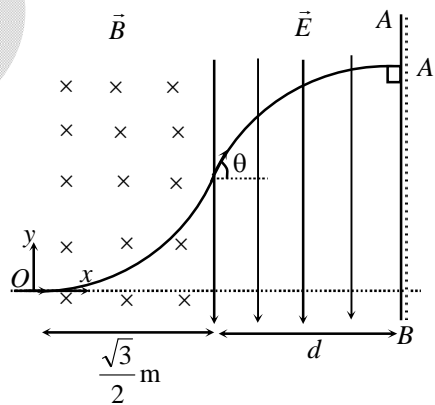
16.   The time *t* after which it strikes the wall is _____ seconds.

17.   The width of electric field is $\dfrac{\sqrt{3}}{2}$ k metres, then k is _____
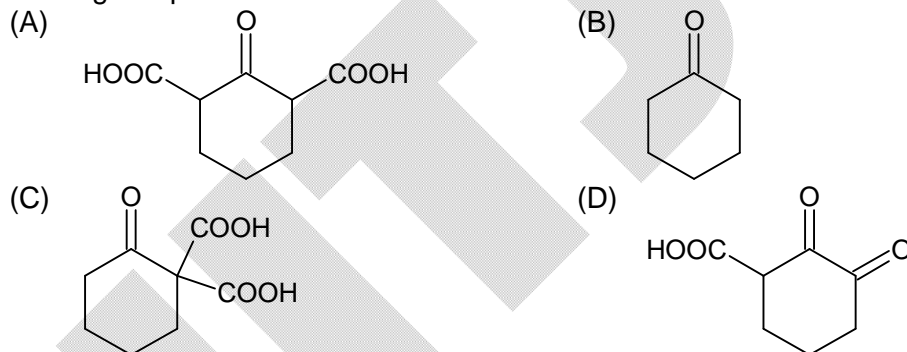
Chemistry PART – II

SECTION – A
(One Options Correct Type)
*This section contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.*

18. Which acid radical does not form any gas when treated with acids?
    (A) CO_3^{2-}
    (B) SO_3^{2-}
    (C) HCO_3^-
    (D) PO_4^{3-}

19. Which of the following property of a thermodynamical system does not change in isothermal process?
    (A) Entropy
    (B) Free energy
    (C) Internal energy
    (D) PV-work

20.
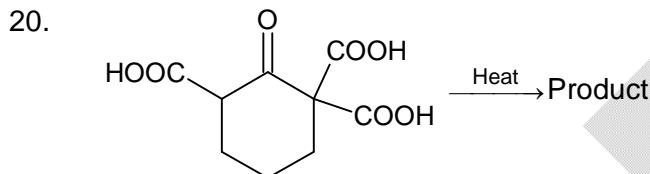
The organic product of above reaction is:
(A)

(B)

(C)

(D)

21. 0.4 M $CaCl_2$ solution is isotonic with (consider 100% dissociation of salts)
    (A) 0.4 M Urea
    (B) 0.2 M $Al_2(SO_4)_3$
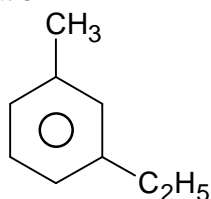   (C) 0.4 M $AlCl_3$
    (D) 0.6 M KCl

SECTION – A
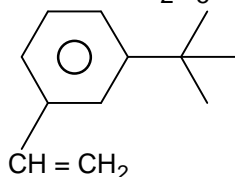### (One or More than one correct type)

*This section contains **THREE (03)** 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).*

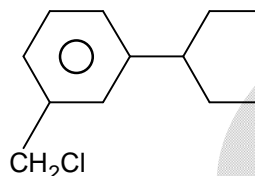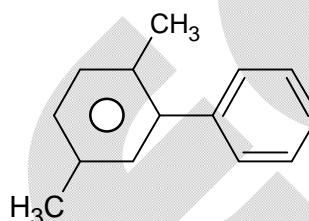22. Which of the following compound(s) form dicarboxylic acid(s) on alkaline permanganate oxidation?

(A)

(B)

(C)

(D)

23. Which of the following reaction(s) undergo disproportionation?

(A) $H_3PO_3 \xrightarrow{\Delta}$ (B) $P_4 + NaOH \longrightarrow$

(C) $H_2SO_4 + C_6H_{12}O_6 \xrightarrow{\Delta}$ (D) $H_2O_2 \xrightarrow{\Delta}$

24. Which of the following property/properties of a solid change(s) due to Frenkel defect?
(A) Density decreases   (B) Melting point decreases
(C) Conductivity increases   (D) Density increases

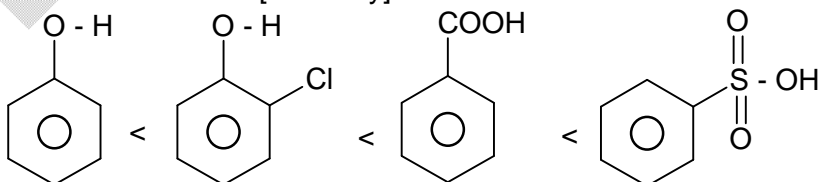## SECTION – B

(Numerical Answer Type)

*This section contains **SIX (06)** Numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.*

25. A decapeptide (Mol. Wt. 796) on complete hydrolysis gives glycine (Mol. Wt. 75), alanine and phenylalanine. Glycine contributes 47.0 % to the total weight of the hydrolyzed products. The number of glycine units present in the decapeptide is
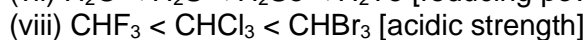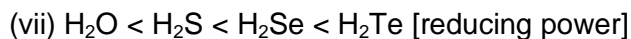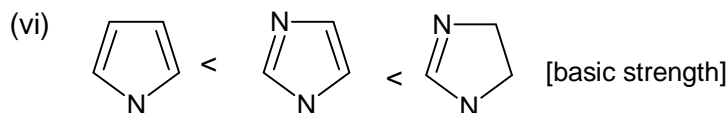
26. How many are indicating correct order for given characteristic or property?
(i) $NH_3 > SbH_3 > AsH_3 > BiH_3$ [Boiling point]
(ii) $CH_4 < CH_3Cl < CH_2Cl_2 < CHCl_3 < CBrCl_3$ [density]
(iii) $CCl_4 < CHCl_3 < CH_2Cl_2 < CH_3Cl$ [dipole moment]
(iv) $RF < RCl < RBr < RI$ [reactivity]
(v)

[acidic strength]

(vi)

 < <   [basic strength]

(vii) $H_2O < H_2S < H_2Se < H_2Te$ [reducing power]

(viii) $CHF_3 < CHCl_3 < CHBr_3$ [acidic strength]

(ix) $RI < RBr < RCl < R-F$ [thermal stability]

27.

 $+CH_3CHO \xrightarrow{\text{dil.NaOH}} (X)$

$\downarrow$ Heat

(Y)
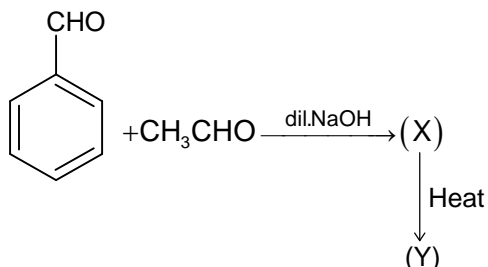
The sum of the number of stereoisomers possible for X and Y is

28.

$Na_2SO_3 \xrightarrow{BaCl_2} \underset{\text{White}}{(P)} \downarrow + NaCl$

$\downarrow Na_2O_2$

$(Q) \xrightarrow{BaCl_2} \underset{\text{White}}{(R)} \downarrow + NaCl$
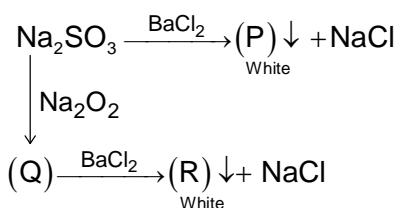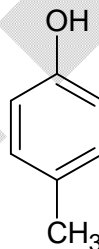
What is the molar mass difference between (R) and (P)?

29. $PCl_3 + P_4O_{10} + Cl_2 \longrightarrow (X)$
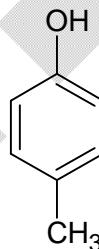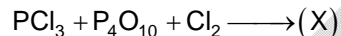
One mole of (X) reacts with three moles of to produce one mole of a synthetic product(Y). How many total number of atoms are present in (Y)?

30.   At a particular temperature magnesium metal adopts body centre cubic(b.c.c) lattice. If the edge-length of the unit cell is $2\overset{\circ}{A}$, what is it's density in g/cc unit?
[Assume $N_A = 6 \times 10^{23}$]

SECTION – C
(Numerical Answer Type)

*This section contains **TWO (02) paragraphs**. Based on each paragraph, there are **TWO (02)** questions of numerical answer type. The answer to each question is a **NUMERICAL VALUE (XXXXX.XX)**. If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.*

Paragraph for Question Nos. 31 and 32

An aqueous solution of $CuSO_4$ was prepared by completely dissolving 25.52 g of anhydrous copper sulphate in 500 mL water. The resulting solution was electrolyzed by passing 193 ampere current for one minute through platinum electrodes. In the process, a certain amount of copper gets deposited at cathode and O_2 gas is evolved at anode.
[Assume that no electrolysis of H_2O takes place], [Mol. mass of $CuSO_4 = 159.5$ g mol^{-1}]
Answer the following questions on the basis of above write up.

31. What is the molarity of the solution after electrolysis?

32. The mass of O_2 gas in gram liberated at anode is:

Paragraph for Question Nos. 33 and 34
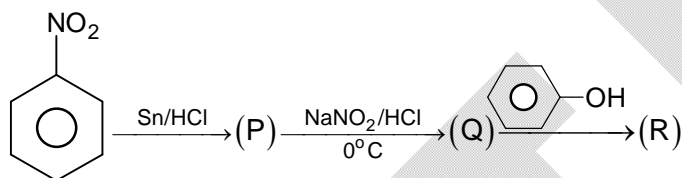
Answer the following questions on the basis of above reaction sequence.

33. If the number of pi-bond(s) is/are present in one molecule of (R) is x, what is the value of x/2?

34.

If the ratio of sigma to pi-bonds present in (R) is x : y, what is the value of $\left(\dfrac{x+y}{10}\right)$?

Mathematics   PART – III

SECTION – A
(One Options Correct Type)
*This section contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.*

35. Which of the following is incorrect?

(A) If A is a $n \times n$ matrix such that $a_{ij} = (i^2 + j^2 - 5ij) \cdot (j - i) \forall i$ and j then trace $(A) = 0$

(B) If A is a $n \times n$ matrix such that $a_{ij} = (i^2 + j^2 - 5ij) \cdot (j - i) \forall i$ and j then trace $(A) \neq 0$

(C) If P is a 3×3 orthogonal matrix, α, β, γ are the angle made by a straight line with OX,

OY, OZ and $A = \begin{bmatrix} \sin^2 \alpha & \sin \alpha \cdot \sin \beta & \sin \alpha \cdot \sin \gamma \\ \sin \alpha \cdot \sin \beta & \sin^2 \beta & \sin \beta \cdot \sin \gamma \\ \sin \alpha \cdot \sin \gamma & \sin \beta \cdot \sin \gamma & \sin^2 \gamma \end{bmatrix}$ and $Q = P^T A P$, then $PQ^6 P^T = 32A$

(D) If matrix $A = \begin{bmatrix} a_{ij} \end{bmatrix}_{3 \times 3}$ and matrix $B = \begin{bmatrix} b_{ij} \end{bmatrix}_{3 \times 3}$ where $a_{ij} + a_{ji} = 0$ and $b_{ij} - b_{ji} = 0 \ \forall \ i$ and j then $A^6 B^7$ is a singular matrix

36. The number of values of k for which the equation $x^3 - 3x + k = 0$ has two distinct roots lying in the interval (0, 1) is

(A) three   (B) two

(C) infinitely many   (D) zero

37. A vector of magnitude $\sqrt{29}$ which makes equal angles with vectors $\hat{i} + \hat{j} - 2\hat{k}, \ 2\hat{i} - \hat{j} + 3\hat{k}, \ \hat{i} - \hat{j} + \hat{k}$ is $a\hat{i} + b\hat{j} + c\hat{k}$ then $a + b + c$ can be

(A) −1   (B) 2

(C) −2   (D) 5

38. If $x \in R$, then the roots of the equation $x^4 + 4x^3 - 8x^2 + k = 0$ with respect to the values of k, $(k \in [0, 2014])$ is **(select incorrect option)**

(A) for $k \in [0, 3]$: 4 real and distinct roots

(B) for $k \in (3, 128)$: two real and two imaginary roots

(C) for $k \in (128, 583)$: no real root

(D) for $k \in (0, 3)$: four real and distinct roots

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SECTION – A
(One or More than one correct type)

*This section contains **THREE (03)** 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).*

39. If A and B are two orthogonal matrices of order n and $\det(A) + \det(B) = 0$, then which of the following must be correct

    (A) $\det(A + B) = \det(A) + \det(B)$

    (B) $\det(A + B) = 0$

    (C) $A + B = 0$

    (D) None of above are always correct

40. If $\int \dfrac{e^{x-1}}{\left(x^2 - 5x + 4\right)} 2x\, dx = AF(x - 1) + BF(x - 4) + C$ and $F(x) = \int \dfrac{e^x}{x} dx$, then

    (A) $A = -2/3$ (B) $B = (4/3)e^3$

    (C) $A = 2/3$ (D) $B = (8/3)e^3$

41. Which of the following is /are true ?

    (A) $\displaystyle\int_0^1 \sin(x^2 + 2x + 1)dx - \int_1^2 \sin x^2 dx = 0$

    (B) $\displaystyle\int_{-1}^1 e^{\sin x}dx - \int_0^1 e^{\sin(2x+1)}dx = 0$

    (C) $\displaystyle\int_{-5}^{-4} \sin(x^2 - 3)dx + \int_{-2}^{-1} \sin(x^2 + 12x + 33)dx = 0$

    (D) $\displaystyle\int_{-4}^4 \cos x^2\, dx - 8\int_0^1 \cos 16(2x - 1)^2 dx = 0$

SECTION – B

(Numerical Answer Type)

*This section contains **SIX (06)** Numerical based questions. The answer to each question is a **NON-NEGATIVE INTEGER VALUE**.*

42. A, B, C and D cut a pack of 52 cards successively in the order given. If the person who cuts a spade first receives Rs. 350 and if the expectation of A is λ then $\left[\dfrac{\lambda}{64}\right]$ is equal to (where [.] denotes greatest integer function)_____

43. A and B are two independent events. The probability that both A and B occur is 1/6 and the probability that at least one of them occurs is 2/3. Find $8P(A) + 9P(B)$ if $P(A) > P(B)$.

44. Let $(x^3 + px^2 + 2x - 5)^{19} (x^2 + qx - 41)^8 (x^4 - x^3 + x - 7)^6 = x^{97} + 391x^{96} + a_{95}x^{95} + a_{94}x^{94} + \ldots a_1x + a_0$ be an identity, where p, q, $a_{95}\ldots a_0$ are integers. Compute the smallest positive value of p.

45. Let $a_1, a_2, a_3, \ldots, a_{4001}$ are in A.P such that $\dfrac{1}{a_1 a_2} + \dfrac{1}{a_2 a_3} + \ldots + \dfrac{1}{a_{4000} a_{4001}} = 10$ and $a_2 + a_{4000} = 50$ then $|a_1 - a_{4001}|$ is equal to

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46.   Four students appeared in three examinations. The number of possible ways in which we can have result, such that neither any students fails in all the examinations nor there is an examination which is not cleared by any student is k, then find $k - 2100$.

47.   The straight line $\dfrac{x}{4} + \dfrac{y}{3} = 1$ intersects the ellipse $\dfrac{x^2}{16} + \dfrac{y^2}{9} = 1$ at two points *A* and *B*, there is a point *P* on this ellipse such that the area of ΔPAB is equal to $6(\sqrt{2} - 1)$, the number of such points (*P*) is

SECTION – C
(Numerical Answer Type)
*This section contains **TWO (02) paragraphs**. Based on each paragraph, there are **TWO (02)** questions of numerical answer type. The answer to each question is a **NUMERICAL VALUE (XXXXX.XX)**. If the numerical value has more than two decimal places, truncate/round-off the value to **TWO** decimal places.*

Paragraph for Question Nos. 48 and 49

Let y = f(x) is a curve and P(x, y) be any point on it. The tangent and the normal drawn at P meets x-axis at T and N respectively PT and PN are called length of tangent and length of normal at P. If M is the foot of perpendicular drawn from P on x-axis, then MT and MN are called length of sub-tangent and length of sub-normal at P. Answer the following questions.

48.   The equation of the curves passing through (0, 1), if the length of sub-normal at any point of the curve remains unity is $y^a = \pm bx + c$, where $a + b + c$ is

49.   The equation of the curve passing through (1, 2), if the intercepts of normal on x-axis is equal to thrice of the abscissa of point P is $px^q - y^r + k = 0$ then $p + q + r + k$ equals to

Paragraph for Question Nos. 50 and 51

If m > 0, n > 0, the definite integral $I = \displaystyle\int_0^1 x^{m-1}(1-x)^{n-1}\,dx$ depends upon the values of m and n and is denoted by β (m, n), called the beta function.

e.g. $\displaystyle\int_0^1 x^4(1-x)^5\,dx = \int_0^1 x^{5-1}(1-x)^{6-1}\,dx = \beta(5,\ 6)$ and

$\displaystyle\int_0^1 x^{5/2}(1-x)^{-1/2}\,dx = \int_0^1 x^{7/2-1}(1-x)^{1/2-1}\,dx = \beta\left(\dfrac{7}{2},\ \dfrac{1}{2}\right)$. Obviously, β (n, m) = β (m, n).

50.   The integral $\displaystyle\int_0^{\pi/2} \cos^{2m}\theta \sin^{2n}\theta\,d\theta$ is equal to $\dfrac{1}{w}\beta\left(m + \dfrac{1}{u},\ n + \dfrac{1}{v}\right)$ where $u + v + w$ equals to

51.   If $\displaystyle\int_0^\infty \dfrac{x^{m-1}}{(1+x)^{m+n}}\,dx = k\int_0^\infty \dfrac{x^{n-1}}{(1+x)^{m+n}}\,dx$, then k is equal to