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

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:

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.*
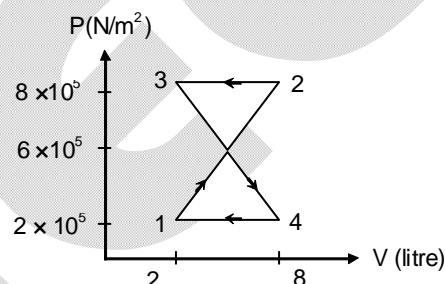
1. Two identical sources P and Q emit waves in same phase and of same wavelength. Spacing between P and Q is 3λ. The maximum distance from P along the x–axis at which a minimum intensity occurs is given by

    (A) 6.58λ (B) 2.25λ
    (C) 8.75λ (D) 0.55λ
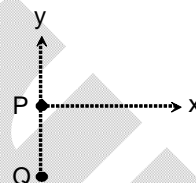
2. The work done in the process 1 – 2– 3–4 shown on P-V diagram is
   (A) 300 J
    (B) 600 J
    (C) 900 J
    (D) 1200J

3. Two pendulums of same amplitude but time period 3s and 7s start oscillating simultaneously from two opposite extreme positions. After how much time they will be in phase?

    (A) $\dfrac{21}{8}s$ (B) $\dfrac{21}{4}s$

    (C) $\dfrac{21}{2}s$ (D) $\dfrac{21}{10}s$

4. Two rings made of same material and thickness, one of radius R and other of radius R/2 are welded together at point A. Now, it is hanged on a nail at wall, the nail touching both the rings at A. Now it is slightly displaced in the plane of rings and released. The period of small oscillations is

    (A) $2\pi\sqrt{\dfrac{2R}{5g}}$ (B) $2\pi\sqrt{\dfrac{5R}{6g}}$

    (C) $2\pi\sqrt{\dfrac{9R}{5g}}$ (D) $2\pi\sqrt{\dfrac{5R}{2g}}$
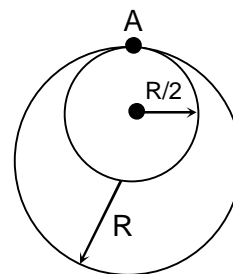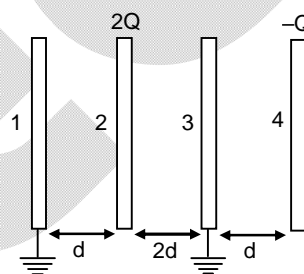
SECTION – A
(One or More than one correct type)

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. S_1, S_2 and S_3 are the different sizes of windows 1, 2 and 3 respectively, placed in a vertical plane. A particle is thrown up in that vertical plane. Find the correct options :
   (A) average speed of the particle passing the windows may be equal if $S_1 < S_2 < S_3$
   (B) average speed of the particle passing the windows may be equal if $S_1 > S_2 > S_3$
   (C) if $S_1 = S_2 = S_3$, the change in speed of the particle while crossing the windows will satisfy $\Delta V_1 < \Delta V_2 < \Delta V_3$
   (D) if $S_1 = S_2 = S_3$, the time taken by particle to cross the windows will satisfy $t_1 < t_2 < t_3$

6.   Four conducting plates are placed nearby as shown plates 1 and 3 are grounded and 2 and 4 are given charge 2Q and –Q respectively. Which of the following are correct?
   (A) Charge on plate 1 will be $\left(\dfrac{-4Q}{3}\right)$ finally.
   (B) Charge on plate 3 will be $\left(\dfrac{-2Q}{3}\right)$ finally.
   (C) Charge on right surface of plate 2 will be $\dfrac{2Q}{3}$ finally.
   (D) Charge on right surface of plate 4 is zero.

7.   Hydrogen gas absorbs radiations of wavelength λ_0 and consequently emit radiations of 6 different wavelengths of which two wavelengths are shorter than λ_0. Choose the correct statement(s).
   (A) The final excited state of the atom is n = 4.
   (B) The initial state of the atom may be n = 2.
   (C) The initial state of the atom may be n = 3.
   (D) There are three transitions belonging to Lyman series.

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.   Potential energy of a particle moving along x-axis is given by U = $\dfrac{x^3}{3} - \dfrac{9x^2}{2} + 20x$. Find out position of stable equilibrium state.

9.   In a hemispherical shell of radius R, a rod of mass $\left(\dfrac{\sqrt{3}}{2}\right)$ kg is placed horizontally. The length of rod is R. Find the normal reaction at any end of the rod (in N).

10. A solid and rigid sphere of mass m = 80 kg and radius 0.2 m is spun about a horizontal axis at an angular speed of ω and then dropped without initial speed onto a stationary cart of mass M = 200 kg from a height of h = 1.25 m. It hits the cart exactly at the centre. The cart can roll smoothly, its deformation in the collision is perfectly elastic, and the collision is momentary. The sphere keeps sliding throughout the entire duration of the collision. The coefficient of kinetic friction between the sphere and the cart is μ = 0.1. The sphere rebounds from the cart and falls back onto it again. The minimum possible length of the cart is X. The value of $\dfrac{10x}{4}$ is.
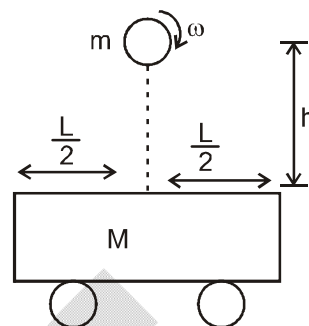

11. Inner surface of a cylindrical shell of length l and of material of thermal conductivity k is kept at constant temperature T_1 and outer surface of the cylinder is kept at constant temperature T_2 such that $(T_1 > T_2)$ as shown in figure. Heat flows from inner surface to outer surface radially outward. Inner and outer radii of the shell are R and 2R respectively. Due to lack of space this cylinder has to be replaced by a smaller cylinder of length $\dfrac{l}{2}$, inner and outer radii $\dfrac{R}{4}$ and R respectively and thermal conductivity of material nk. If rate of radial outward heat flow remains same for same temperatures of inner and outer surface i.e. T_1 and T_2, then find the value of n.
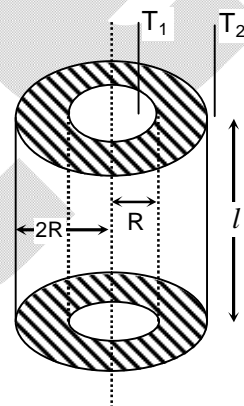
12. A ball of mass 1 kg moving with velocity 10 m/s collides perpendicularly on a smooth stationary wedge of mass 2kg. If the coefficient of restitution is e = 7/20 then find the velocity of ball after the collision. [in ms^{-1}]
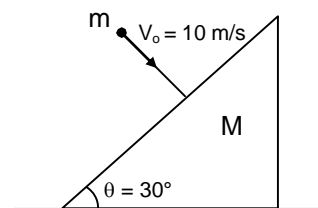
13. A point object is moving along the principle axis of a concave mirror at rest of focal length 30cm with speed 5m/s towards the mirror. Find the speed (in m/s) of image of object when object is at a distance 60cm from mirror.
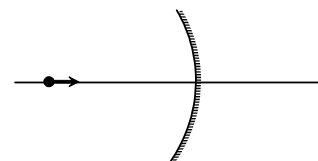
SECTION – C
(Numerical Answer Type)

*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

A block of mass 6 kg is kept on a rough horizontal surface and is pulled by time varying force
$F = Kt$ where $K = 5 Ns^{-1}$, acting at an angle 37° with horizontal. It is observed that motion of block has started at $t = 4$ sec. and just after that acceleration of block is $2/3$ m/s^2 ($g = 10$ m/s^2).

14. Co-efficient of static friction between block & surface is _____.

15. Velocity (in m/s) of block when it breaks off the surface is equal to _____.

Paragraph for Question Nos. 16 and 17

In a photoelectric effect, a point source of green light of power 40 W emits mono-energetic photons that can just emit photoelectrons from an isolated metallic sphere of radius $r = 1$ cm, placed at a distance of 1m from the light source. Now, four other separate sources of violet, blue, red and yellow light emitting same number of photons as that of green light are brought near the source of green light. Assume one photoelectron is emitted out of every 10^6 incident photons on sphere.
(Take $\lambda_{violet} = 4136$ Å, $\lambda_{blue} = 5000$ Å, $\lambda_{red} = 7200$ Å, $\lambda_{green} = 4963$ Å, $hc = 12408$ eV Å)
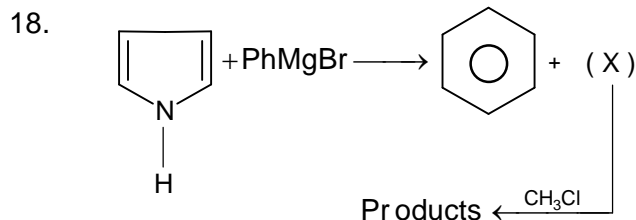
16. No. of photoelectrons emitted from the sphere per second is 2.5×10^x. Find the value of 'x'.

17. The potential (in Volt) of the sphere when emission of photoelectrons will stop is_____.
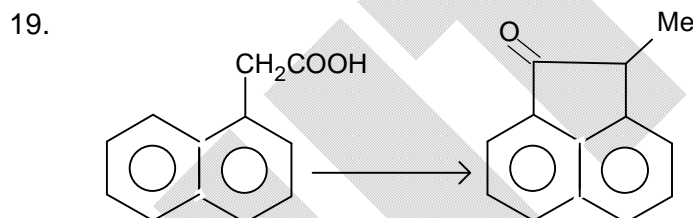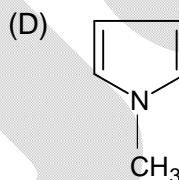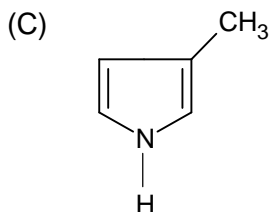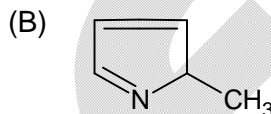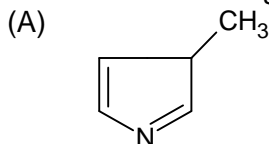
Chemistry   **PART – II**

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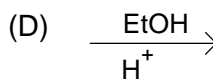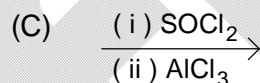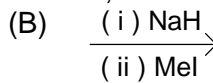### (One Options Correct Type)
*This section contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.*

18.

Which of the following is not an end product of above reaction?

(A)

(B)

(C)

(D)

19.

Out of the required reagents for the above conversion, the reagent that is first used is:

(A) $\xrightarrow[\text{(ii) H}^+]{\text{(i) NaOH}}$

(B) $\xrightarrow[\text{(ii) MeI}]{\text{(i) NaH}}$

(C) $\xrightarrow[\text{(ii) AlCl}_3]{\text{(i) SOCl}_2}$

(D) $\xrightarrow[\text{H}^+]{\text{EtOH}}$

20. The reaction $X_{(g)} + 2Y_{(g)} \longrightarrow Z_{(g)}$ is an elementary process. In an experiment, the initial partial pressure of X and Y are 0.4 and 1 atm respectively. When the partial pressure of Z is 0.3 atm, the rate of the reaction relative to the initial rate is:

(A) $\dfrac{1}{1.5}$

(B) $\dfrac{1}{35}$

(C) $\dfrac{1}{25}$

(D) $\dfrac{1}{15}$

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21. In a solid $Y^{\ominus}$ occupies FCC and cation $X^{\oplus}$ occupies all octahedral voids. If all the ions present on the horizontal plane which bisect the unit cell into two equal halves are removed, then the formula of a distorted unit cell is:
    (A) XY (B) X_7Y_8
    (C) X_3Y_4 (D) X_4Y_3

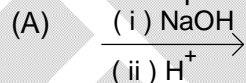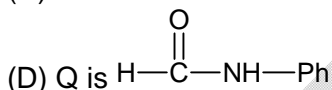## SECTION – A
(One or More than one correct type)
*This section contains **THREE (03)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).*

22. Which of the following reaction(s) is/are possible in aqueous solutions?
    (A) $Mg(NO_3)_2 + NaCl \longrightarrow$ (B) $BeSO_4 + BaS \longrightarrow$
    (C) $BaSO_4 + HCl \longrightarrow$ (D) $BaCO_3 + CH_3COOH \longrightarrow$

23. $PhCHO + NH_2OH \xrightarrow{\Delta} P \xrightarrow{H^+} Q \xrightarrow{\text{hydrolysis}} R + H-\overset{\overset{\textstyle O}{\|}}{C}-OH$

    Choose the correct statement
    (A) P is syn form of geometrical isomer
    (B) P is anti form of geometrical isomer
    (C) P is more basic than R
    (D) Q is $H-\overset{\overset{\textstyle O}{\|}}{C}-NH-Ph$

24. The correct statement(s) regarding the complex $[Cu(CN)_4]^{3-}$ is/are
    (A) the oxidation state of copper is +1
    (B) the crystal field stabilization energy(CFSE) is zero
    (C) it shows colour due to d-d transition
    (D) it is paramagnetic in nature

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. PCl_2F_3 exists as a monomer in gaseous state. The crystal of PCl_2F_3 contains cations and anions. How many fluorine atoms(s) is/are present in the anion?

26. $Pb(NO_3)_2 \xrightarrow[0°C]{HCl} (A)\downarrow$ White ppt.

    $\Big\downarrow$ 1. CH_3COONa 2. Na_2CrO_4

    $(B)\downarrow$ Yellow ppt.

    The precipitation of (B) is enhanced by adding CH_3COOH. If the oxidation number of lead in the ppt.(B) is +x and that of Cr in the ppt.(B) is +y, what is the value of $\dfrac{x+y}{2}$?
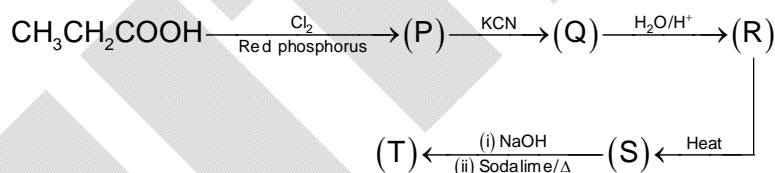
27. $Zn(s) \mid Zn^{2+}(0.01 \text{ M}) \mid\mid H^+(pH = x) \mid H_2(1 \text{ bar, g}) \mid Pt(s)$
The emf of the above electrochemical cell(E_{Cell}) is 0.46 V. What is the pH(value of x)?
$$\left[E^o_{Zn^{2+}/Zn} = -0.76 \text{ V}\right] \left[\text{Assume } \frac{2.303RT}{F} = 0.06\right]$$

28.   The energy of the first orbit of hydrogen atom is -13.6 eV. If the ground state electron of He^+ ion absorbs x eV energy to excite into the second orbit, what is the value of 10x?

29.   The equilibrium constant K_P of a reversible reaction is given as
$$\log K_P = -\frac{100}{2.303T} + \frac{\Delta S^o}{R}$$
What is the standard enthalpy change(ΔH^o) in joule of the reaction at 500 K? [R = 8 JK^{-1} mol^{-1}]

30.   A thermodynamic system contains one mole of an ideal gas under a pressure of 0.2 atm. The system was heated from 150 K to 400 K at constant pressure. If the quantity of reversible work done due to this process is $-x$ KJ mol^{-1}, what is the value of x? [R = 8 JK^{-1} mol^{-1}]

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

$$CH_3CH_2COOH \xrightarrow[\text{Red phosphorus}]{Cl_2} (P) \xrightarrow{KCN} (Q) \xrightarrow{H_2O/H^+} (R)$$

$$(T) \xleftarrow[\text{(ii) Sodalime}/\Delta]{\text{(i) NaOH}} (S) \xleftarrow{\text{Heat}} $$

Answer the following questions on the basis of about write up.

31.   If the molar mass of (S) is x g mol^{-1}, what is the value of $\frac{x}{5}$?

32.   If the ratio of carbon atoms to hydrogen atoms in (T) is x : y, what is the value of $\left(\frac{x+y}{2.5}\right)$?

Paragraph for Question Nos. 33 and 34

One mole of a trivalent chloride(MCl_3) of metal M was added to one Kg of water. The degree of dissociation of MCl_3 is 0.8. No hydrolysis takes place for M^{3+} ions. The resulting aqueous solution of the salt was cooled to $-x^o$C at 1 atm pressure. In this process 70 g of ice is formed.

   [K_f of H_2O = 1.86 K Kg mol^{-1}]

Answer the following questions.

33.   The van't Hoff factor of the salt MCl_3 is

34.   What is the value of x?

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. A continuous function $f(x)$ satisfy the differential equation $\dfrac{f(x)}{1+x^2} = 1 + \int_0^x \dfrac{f^2(t)}{1+t^2} dt$ then the value of $f(-2)$ is

(A) $\dfrac{15}{17}$

(B) $\dfrac{3}{7}$

(C) 1

(D) -2

36. Three points on the parabola $y^2 = 4ax$ are $A(t_1)$, $B(t_2)$ and $C(t_3)$. The orthocenter of the triangle ABC is the focus. Then the value of $(t_1 - 1)(t_2 - 1)(t_3 - 1)$ is

(A) 4

(B) -4

(C) 0

(D) -5

37. $\dfrac{1}{\cot 9^\circ - 3\tan 9^\circ} + \dfrac{3}{\cot 27^\circ - 3\tan 27^\circ} + \dfrac{9}{\cot 81^\circ - 3\tan 81^\circ} + \dfrac{27}{\cot 243^\circ - 3\tan 243^\circ} =$

(A) $\tan 9^\circ$

(B) $10\cot 81^\circ$

(C) $10\cot 9^\circ$

(D) $\tan 81^\circ$

38. Consider real numbers a and b are such that $a > b > 0$ then the minimum value of

$\sqrt{2}a^3 + \dfrac{3}{ab - b^2}$ is

(A) $3 + 8\sqrt{2}$

(B) $4 + \dfrac{3}{\sqrt{2} - 1}$

(C) 10

(D) 5

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. One of the asymptotes (with negative slope) of a hyperbola passes through (2, 0) whose transverse axis is given by x – 3y + 2 = 0; if it is given that the line y = 7x – 11 can intersect the hyperbola at only one point (2, 3); then which of the followings is/are true ?
(A) Equation of hyperbola is $7x^2 + xy - y^2 + 10x - 4y - 3 = 0$
(B) Equation of other Asymptote of the hyperbola is 7x – y – 6 = 0
(C) Equation of other Asymptote of the hyperbola is x +y – 2 = 0
(D) Equation of hyperbola is $7x^2 + 6xy - y^2 - 20x - 4y - 3 = 0$

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40.   Consider the function g defined by $g(x) = \begin{bmatrix} x^2 \sin\dfrac{\pi}{x} + (x-1)^2 \sin\left(\dfrac{\pi}{x-1}\right), & x \neq 0,1 \\ 0, & \text{if } x = 0,1 \end{bmatrix}$ then

which of the following statement (s) is/are correct?

(A) $g(x)$ is differentiable $\forall x \in R$

(B) $g'(x)$ is discontinuous at $x = 0$ but continuous at $x = 1$

(C) $g'(x)$ is discontinuous at both $x = 0$ and $x = 1$

(D) Rolle's theorem is applicable for $g(x)$ in [0, 1]

41.   The real parameters m and n are such that the graph of the function

$f(x) = \sqrt[3]{8x^3 + mx^2} - nx$ has the horizontal asymptote $y = 1$ then

(A) $|m + n| = 10$ (B) $|m + n| = 14$

(C) $|m - n| = 10$ (D) $|m - n| = 2$

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.   Consider the polynomial

$x^n + a_1 x^{n-1} + a_2 x^{n-2} + \ldots\ldots\ldots + a_n = 0$ with coefficients $a_1, a_2 \ldots\ldots\ldots a_n$ belongs to $\{1, -1\}$. If roots are real then maximum value of n is

43.   The number of functions from f : A → B where A = {a_1, a_2, a_3, a_4, a_5, a_6}, B = {1, 2, 3, …, 9} such that $f(a_{i+1}) > f(a_i) \forall i \in N$ and $f(a_i) \neq i$ is

44. $\vec{a}, \vec{b}$ and $\vec{c}$ be three non – coplanar vectors, and $\vec{d}$ be a non zero vector, which is perpendicular to $(\vec{a} + \vec{b} + \vec{c})$. Now if $\vec{d} = \sin x (\vec{a} \times \vec{b}) + \cos y (\vec{b} \times \vec{c}) + 2(\vec{c} \times \vec{a})$, then

minimum value of $x^2 + y^2$ is equal to $\dfrac{\lambda \pi^2}{4}$, where λ is

45. $f : R \to R, f(x) = \dfrac{3x^2 + mx + n}{x^2 + 1}$. If the range of this function is $[-4, 3)$, then find the value of $m^2 + n^2$.

46.   If l_1 and l_2 be the length of the focal chord other than latus rectum of ellipse $\dfrac{x^2}{4} + \dfrac{y^2}{3} = 1$

which are perpendicular to each other, then $12\left(\dfrac{l}{l_1} + \dfrac{l}{l_2}\right) =$

47.   For x, y numbers, such that $\log_{10} x + \log_{10} y \geq \log_{10}\left(x^2 + y\right)$, then the minimum value of

$x + y$ is $k\sqrt{k} + k + 1$ then k=

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

Consider the set P defined as $P = \{S = 0,$ where 'S' represents any conic with directrix

$x + ky + 7 = 0, k \in R\}$ and consider a circle $C : x^2 + y^2 = 16$

If each member of P intersects the circle C such that common chord is always along the x-axis and is of maximum length.

If members of P are parabolas only, then

48.   If P contains exactly 2 elements, then Number of integral values of k is

49.   If P contains exactly 1 element, the Number of real values of k is

Paragraph for Question Nos. 50 and 51

The sequence $\{a_n\}$ is defined by $a_0 = 1$, $a_1 = 3$ and

$a_n = a_{n-1} + \dfrac{a^2_{n-1}}{a_{n-2}}$ for $n \geq 2$ and

the sequence $\{b_n\}$ is defined by $b_0 = 1$, $b_1 = 1$ and

$b_n = b_{n-1} + \dfrac{b^2_{n-1}}{b_{n-2}}$ for $n \geq 2$

50.   Evaluate: $\displaystyle \lim_{n \to \infty} \sum \frac{b_n}{a_n}$

51.   The value of $\dfrac{1}{1013}\left(\dfrac{a_{2024}}{b_{2024}}\right)$ is