Sample Papers

JEE Advanced

Paper-01

Time: 3 Hours ***Maximum Marks: 183***

Topics Covered:

Physics	***:***	*Units & Measurements, Kinematics (1 & 2-D Motion), NLM (Including Friction), Electrostatics, Capacitance*
Chemistry	***:***	*Atomic Structure, Redox Reaction, Periodic Properties, General Organic Chemistry, Solutions, p-Block Elements*
Mathematics	***:***	*Sets, Relation & Functions, Binomial Theorem, Matrices & Determinants, Relations, Functions, Inverse Trigonometry*

Read the Important Instructions Carefully:

1. *You are allowed to take away the Question Paper at the end of the examination.*
2. *Do not tamper with or mutilate the ORS. Do not use the OMR for rough work.*
3. *Use a **BLACK BALL POINT PEN** to darken the bubbles on the ORS.*
4. *The OMR is machine-gradable. Ensure that the bubbles are darken in the correct way.*
5. *Darken the bubbles **ONLY IF** you are sure of the answer. There is **NO WAY** to erase or "un-darken" a darkened bubble.*

PART-I : PHYSICS

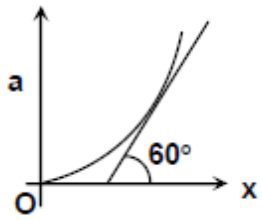
SECTION-1 (MAXIMUM MARKS : 28)

- *This section contains **SEVEN** questions*
- *Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct*
- *For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS*
- *For each question, marks will be awarded in one of the following categories:*

Full Marks	***:***	***+4***	***If only the bubble(s) corresponding to all the correct option(s) is(are) darkened***
Partial Marks	***:***	***+1***	***For darkening a bubble corresponding to each correct option, provided NO incorrect option is darkened***
Zero Marks	***:***	***0***	***If none of the bubbles is darkened***
Negative Marks	***:***	***–2***	***In all other cases***

- *For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will results in +4 marks; darkening only (A) and (D) will result in +2 marks; and darkening (A) and (B) results in –2 marks, as a wrong option is also darkened*

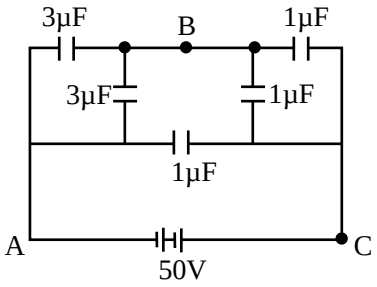
1. A particle starts moving with initial velocity 3 m/s along x-axis from origin. Its acceleration is varying with x in parabolic nature as shown in figure. At x = $\sqrt{3}$ m tangent to the graph makes an angle 60° with positive x-axis as shown in diagram. Then at x = $\sqrt{3}$



(A) $v = \sqrt{(\sqrt{3}+9)}$ m/s (B) a = 1.5 m/s^2 (C) $v = \sqrt{12}$ m/s (D) a = 3 m/s^2

2. Four charges, all of the same magnitude, are placed at the four corners of a square. At the centre of the square, the potential is V and the field is E. By suitable choices of the signs of the four charges, which of the following can be obtained –
(A) V = 0, E = 0 (B) V = 0, E ≠ 0 (C) V ≠ 0, E = 0 (D) V ≠ 0, E ≠ 0

3. In the circuit diagram shown below :



Space for Rough Work

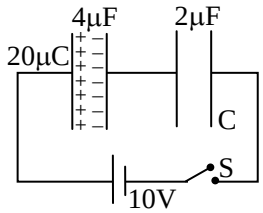
(A) The effective capacity between A and C is $\frac{3}{2}\mu F$

(B) The effective capacity between A and C is $\frac{5}{2}\mu F$

(C) The potential difference between A and B in steady state is $\frac{75}{2}$ volt

(D) The potential difference between B and C in steady state is $\frac{75}{2}$ volt

4. A 4 μF capacitor is given 20 μC charge and is connected with an uncharged capacitor of capacitance 2 μF as shown in figure. When switch S is closed –



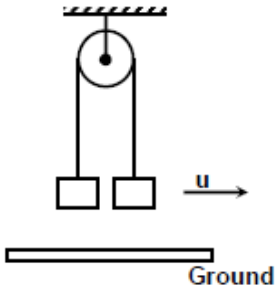
(A) charged flown through the battery is $\frac{40}{3}\mu C$

(B) charge flown through the battery is $\frac{20}{3}\mu C$

(C) work done by the battery is $\frac{200}{3}\mu J$

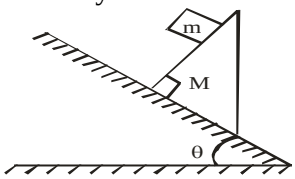
(D) work done by the battery is $\frac{100}{3}\mu J$

5. Two equal masses hang on either side of a pulley at the same height from the ground. The mass on the right is given a horizontal speed, after some time.



(A) The mass on the left will be nearer to ground.
(B) The mass on the right will be nearer to ground.
(C) Both the masses will be at equal distance from the ground.
(D) Nothing can be said regarding their positions.

6. In the following figure all surfaces are smooth. The system is released from rest, then



(A) Acceleration of wedge > gsinθ.

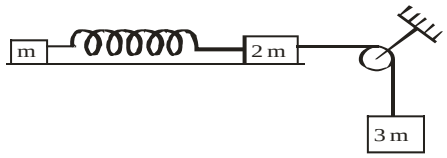
(B) Acceleration of $m = g\sqrt{1 + 2\cos^2\theta}$.

(C) Acceleration of m is g.

(D) Acceleration of wedge is g sinθ.

Space for Rough Work

7. A block of mass m is connected with another block of mass 2m by a light spring. 2m is connected with a hanging mass 3m by an inextensible light string. At the time of release of block 3m.



(A) Tension in the string is $\frac{6}{5}$ m g .

(B) Acceleration of m is zero.

(C) Acceleration of 3m is $\frac{g}{2}$.

(D) Acceleration of 2m is $\frac{3g}{5}$.

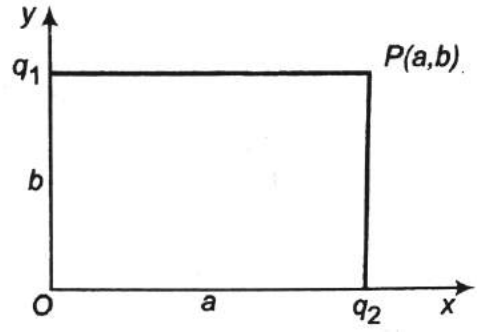
SECTION-2 (MAXIMUM MARKS : 15)

- *This section contains **FIVE** questions*
- *The answer to each question is a **SINGLE DIGIT INTEGER** ranging 0 to 9, both inclusive*
- *For each question, darken the bubble corresponding to the correct integer in the ORS*
- *For each question, marks will be awarded in <u>one of the following categories</u>:*

Full Marks : ***+3*** ***If only the bubble corresponding to the correct answer is darkened***

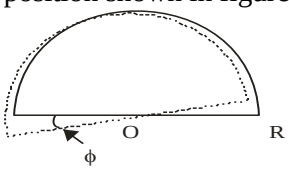
Zero Marks : ***0*** ***If all other cases***

8. Two point charges $q_1 = 2\mu C$ and $q_2 = 1\mu C$ are placed at distances b = 1 cm and a = 2 cm from the origin of the y and x axes as shown in figure. The electric field vector at point P(a, b) will subtend an angle θ with the x-axis given by tan θ = K. Find value of K.



9. The electric field in a region is given by $\vec{E} = (3\hat{i} - 4\hat{j})$ N/C. Find out the work done (in joule) in displacing a particle of charge 1C by 1 m along the line 4y = 3x + 9.

10. A capacitor consists of two stationary parallel plates shaped as a semi-circular disc of radius R and a movable plate made of dielectric with relative permittivity, K = 10 and capable of rotating about an axis O between the stationary plates. The thickness of movable plate is equal to d which is practically the separation between the stationary plates. A potential difference $V = \sqrt{\left(\frac{4d}{\varepsilon_0 R^2}\right)}$ is applied to the capacitor. Find the magnitude of the moment of forces relative to the axis O acting on the movable plate in the position shown in figure.



Space for Rough Work

11. A bird flies for 4 s with a velocity of |t – 2| m/s in a straight line, where t = time in second. Find the distance it covers in metres.

12. The radii of a spherical capacitor are equal to a and b(b > a). The space between them is filled with a dielectric of dielectric constant K and resistivity ρ. At t = 0, the inner electrode is given a charge q_0. The Charge q on the inner electrode as a function of time is given by $q = q_0 e^{-\frac{t}{N\rho K\varepsilon_0}}$; then N is

SECTION-3 (MAXIMUM MARKS : 18)

- *This section contains **SIX** questions of matching type*
- *This section contains **TWO** tables (each having 3 columns and 4 rows)*
- *Based on each table, there are **THREE** questions*
- *Each question has **FOUR** options (A), (B), (C), and (D). **ONLY ONE** of these four options is correct*
- *For each question, darken the bubble corresponding to the correct option in the ORS*
- *For each question, marks will be awarded in <u>one of the following categories</u>:*

Full Marks** : **+3** **If only the bubble corresponding to the correct option is darkened

Zero Marks** : **0** **If none of the bubbles is darkened

Negative Marks** : **–1** **In all other cases

Answer Q.13, Q.14 and Q.15 by appropriately matching the information given in the three columns of the following table.

A car is negotiating a curve of radius R = 20 m on a banked road with banking angle θ and coefficient of friction μ. Take speed of car as v.

Column 1		Column 2		Column 3	
(I)	$v = 10\sqrt{2}$ m/s	(i)	μ = 0.2	(P)	θ = 30°
(II)	v = 20 m/s	(ii)	μ = 0.4	(Q)	θ = 45°
(III)	v = 50 m/s	(iii)	μ = 0.6	(R)	θ = 37°
(IV)	v = 5 m/s	(iv)	μ = 0.8	(S)	θ = 60°

13. In which case will the friction be zero?
(A) (I) (i) (Q) (B) (II) (ii) (R) (C) (II) (iii) (R) (D) (I) (iii) (R)

14. In which of the following cases, sliding occurs?
(A) (I) (i) (Q) (B) (II) (iv) (S) (C) (IV) (i) (S) (D) (IV) (iv) (P)

15. In which case will friction be outwards of curve?
(A) (IV) (iv) (S) (B) (III) (i) (Q) (C) (II) (ii) (P) (D) (II) (iii) (Q)

Space for Rough Work

Answer Q.16, Q.17 and Q.18 by appropriately matching the information given in the three columns of the following table.

Three concentric spherical metallic shells A, B and C of radii a, b and c ($a < b < c$) have charge densities of σ, $-\sigma$ and σ respectively, then answer the following questions:

Column 1 (Point under consideration)		**Column 2 (Electric field)**		**Column 3 (Electric potential)**	
(I)	At the surface of A	(i)	0	(P)	$\frac{\sigma}{\epsilon_0}\left(\frac{a^2}{c}-\frac{b^2}{c}+c\right)$
(II)	At the surface of B	(ii)	$\frac{\sigma}{\epsilon_0}$	(Q)	$\frac{\sigma}{\epsilon_0}\left(\frac{a^2}{b}-b+c\right)$
(III)	At the surface of C	(iii)	$-\frac{\sigma}{\epsilon_0}$	(R)	$\frac{\sigma}{\epsilon_0}(a-b+c)$
(IV)	At the centre of spheres	(iv)	$\frac{2\sigma}{\epsilon_0}$	(S)	$\frac{\sigma}{\epsilon_0}(a-b-c)$

16. Which of the following combination is correct for B?
(A) (II) (i) (P) (B) (II) (i) (Q) (C) (II) (ii) (Q) (D) (II) (iii) (P)

17. Which of the following combination is correct for C?
(A) (III) (i) (Q) (B) (III) (iv) (P) (C) (III) (ii) (P) (D) (III) (ii) (Q)

18. Which of the following combination is correct?
(A) (I) (i) (R) (B) (I) (ii) (Q) (C) (IV) (i) (S) (D) (IV) (i) (R)

Space for Rough Work

PART-II : CHEMISTRY

SECTION-1 (MAXIMUM MARKS : 28)

- *This section contains **SEVEN** questions*
- *Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct*
- *For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS*
- *For each question, marks will be awarded in one of the following categories:*

Full Marks	***:***	***+4***	***If only the bubble(s) corresponding to all the correct option(s) is(are) darkened***
Partial Marks	***:***	***+1***	***For darkening a bubble corresponding to each correct option, provided NO incorrect option is darkened***
Zero Marks	***:***	***0***	***If none of the bubbles is darkened***
Negative Marks	***:***	***–2***	***In all other cases***

- *For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will results in +4 marks; darkening only (A) and (D) will result in +2 marks; and darkening (A) and (B) results in –2 marks, as a wrong option is also darkened*

19. The vapour pressure of a dilute solution of a solute is influenced by:
(A) Temperature of solution (B) Mole fraction of solute
(C) Melting point of solute (D) Degree of dissociation of solute

20. Which statement is/are true about resonance?
(A) It decreases the energy of system
(B) The hybridization of atoms do not change due to resonance.
(C) Resonance hybrid is more stable than any resonating structure.
(D) Resonating structures cannot be isolated at any temperature.

21. Which of the following elements gain one electron more readily in comparison to other elements of the same group?
(A) S(g) (B) N(g) (C) O(g) (D) Cl(g)

22. Iodine reacts with hypo to give:
(A) NaI (B) Na_2SO_3 (C) $Na_2S_4O_6$ (D) Na_2SO_4

23. The spectrum of He^+ is expected to be similar to that of:
(A) Li^{2+} (B) He (C) H (D) Na

24. There are two samples of HCl having molarity 1M and 0.25N. Find the volume of these sample taken in order to prepare 0.75N HCl solution (Assume no water is used):
(A) 20 mL, 10 mL (B) 100 mL, 50 mL (C) 40 mL, 20 mL (D) 50 mL, 25 mL

25. Which is/are true for ideal solutions?
(A) The volume change on mixing is zero. (B) The enthalpy of mixing is zero
(C) The entropy of mixing is zero (D) The enthalpy of mixing is negative.

Space for Rough Work

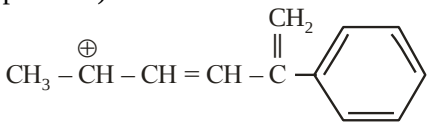
SECTION-2 (MAXIMUM MARKS : 15)

- *This section contains **FIVE** questions*
- *The answer to each question is a **SINGLE DIGIT INTEGER** ranging 0 to 9, both inclusive*
- *For each question, darken the bubble corresponding to the correct integer in the ORS*
- *For each question, marks will be awarded in <u>one of the following categories</u>:*

Full Marks** : **+3** **If only the bubble corresponding to the correct answer is darkened

Zero Marks** : **0** **If all other cases

26. Find the total number of positions where positive charge can be delocalised by true resonance (excluding the given position)



27. In an atom, the total number of electrons having quantum numbers n = 4, $|m_\ell| = 1$ and $m_s = -1/2$ are.

28. How many facts related to $CHCl_3$ + ethyl methyl ketone solutions are correct?
(A) It shows negative deviation
(B) It forms maximum boiling azeotropic mixture.
(C) $\Delta S > 0$
(D) $\Delta G < 0$
(E) Components can be separated by fractional distillation.

29. An oxide of a metal contains 40% oxygen by weight. What is the equivalent weight of the metal? Report your answer by dividing it by 2.

30. Among the following species, how many have their ionic size greater than O^{2-} ?
Se^{2-}, F^-, N^{3-}, P^{3-}

SECTION-3 (MAXIMUM MARKS : 18)

- *This section contains **SIX** questions of matching type*
- *This section contains **TWO** tables (each having 3 columns and 4 rows)*
- *Based on each table, there are **THREE** questions*
- *Each question has **FOUR** options (A), (B), (C), and (D). **ONLY ONE** of these four options is correct*
- *For each question, darken the bubble corresponding to the correct option in the ORS*
- *For each question, marks will be awarded in <u>one of the following categories</u>:*

Full Marks** : **+3** **If only the bubble corresponding to the correct option is darkened

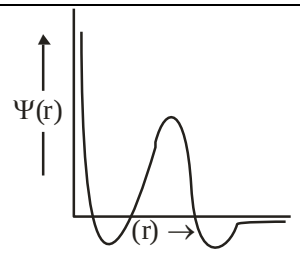
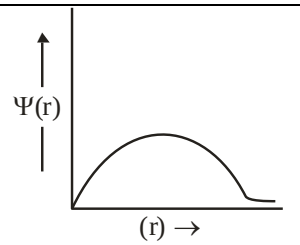
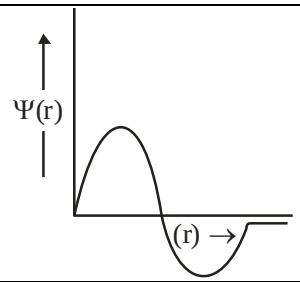
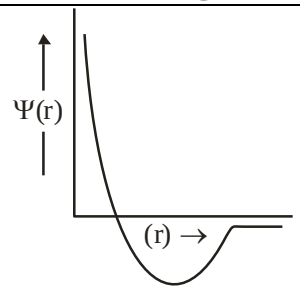
Zero Marks** : **0** **If none of the bubbles is darkened

Negative Marks** : **–1** **In all other cases

Space for Rough Work

Answer Q.31, Q. 32 and Q.33 by appropriately matching the information given in the three columns of the following table.

Column-I: Subshell Column-II: Number of spherical nodes Column-III: Radial plot

Column-I		**Column-II**		**Column-III**	
(I)	3d	(i)	1	(P)	
(II)	4s	(ii)	3	(Q)	
(III)	4f	(iii)	0	(R)	
(IV)	3p	(iv)	2	(S)	

31. The only correct combination for the last electron of K is:
(A) (IV) (i) (R) (B) (IV) (iv) (Q) (C) (II) (ii) (P) (D) (II) (iii) (Q)

32. The only correct combination for the last electron of Sc is: (Atomic number of Sc is 21)
(A) (II) (ii) (P) (B) (II) (iii) (Q) (C) (I) (iv) (R) (D) (I) (iii) (Q)

33. The only correct combination for the last electron of Cl^- is:
(A) (IV) (i) (R) (B) (IV) (iv) (P) (C) (III) (iii) (Q) (D) (II) (ii) (P)

Space for Rough Work

Answer Q.34, Q. 35 and Q.36 by appropriately matching the information given in the three columns of the following table.

Column-I: Property; Column-II: Variation of property; Column-III: Magnitude					
Column-I		**Column-II**		**Column-III**	
(I)	Electron affinity (EA_1)	(i)	Decreases along the period	(P)	Highest in halogen in their respective periods
(II)	Ionization energy (IE_1)	(ii)	Directly proportional to $Z_{eff.}$	(Q)	Highest in noble gases in their respective periods
(III)	Electronegativity	(iii)	Decreases down the group	(R)	Highest in alkali metals in their respective periods
(IV)	Electropositive character	(iv)	Inversly proportional to size	(S)	Moderate in noble gases in their respective periods

34. The only correct combination for the energy required to knock out most loosely bounded electron from isolated gaseous atom is:
(A) (I) (ii) (P) (B) (I) (i) (R) (C) (II) (iii) (Q) (D) (II) (iv) (R)

35. The only correct combination for the energy involved during the gain of electron is:
(A) (I) (ii) (P) (B) (I) (iii) (Q) (C) (III) (ii) (P) (D) (III) (iii) (Q)

36. The only correct combination for the tendency of an atom to attract shared pair of electrons towards itself in bound state is:
(A) (I) (ii) (P) (B) (I) (iii) (Q) (C) (III) (ii) (P) (D) (III) (iii) (Q)

Space for Rough Work

PART-III : MATHEMATICS

SECTION-1 (MAXIMUM MARKS : 28)

- *This section contains **SEVEN** questions*
- *Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct*
- *For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS*
- *For each question, marks will be awarded in <u>one of the following categories</u>:*

Full Marks	**:**	***+4***	***If only the bubble(s) corresponding to all the correct option(s) is(are) darkened***
Partial Marks	**:**	***+1***	***For darkening a bubble corresponding to each correct option, provided NO incorrect option is darkened***
Zero Marks	**:**	***0***	***If none of the bubbles is darkened***
Negative Marks	**:**	***–2***	***In all other cases***

- *For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will results in +4 marks; darkening only (A) and (D) will result in +2 marks; and darkening (A) and (B) results in –2 marks, as a wrong option is also darkened*

37. If $f(x) = \sin\{[x + 5] + \{x - \{x - \{x\}\}\}$ for $x \in \left(0, \frac{\pi}{4}\right)$ is invertible, where {.} and [.] represent fractional part and greatest integer functions respectively, then $f^{-1}(x)$ is

(A) $\sin^{-1}x$ (B) $\frac{\pi}{2} - \cos^{-1}x$ (C) $\sin^{-1}\{x\}$ (D) $\cos^{-1}\{x\}$

38. If $f(x) = (h_1(x) - h_1(-x))\,(h_2(x) - h_2(-x)) \ldots (h_{2n+1}(x) - h_{2n+1}(-x))$, where $h_1(x), h_2(x), \ldots h_n(x)$ are defined everywhere and $f(200) = 0$, then f(x) is

(A) one-one (B) many one (C) odd (D) even

39. System of equation
$x + 3y + 2z = 6$
$x + \lambda y + 2z = 7$
$x + 3y + 2z = \mu$ has

(A) unique solution if $\lambda = 2, \mu \neq 6$ (B) infinitely many solution if $\lambda = 4, \mu = 6$
(C) no solution if $\lambda = 5, \mu = 7$ (D) no solution if $\lambda = 3, \mu = 5$

40. If $\alpha = \tan^{-1}\left(\frac{4x - 4x^3}{1 - 6x^2 + x^4}\right)$, $\beta = 2\sin^{-1}\left(\frac{2x}{1 + x^2}\right)$ and $\tan\frac{\pi}{8} = k$, then

(A) $\alpha + \beta = \pi$ for $x \in \left[1, \frac{1}{k}\right)$ (B) $\alpha = \beta$ for $x \in (-k, k)$

(C) $\alpha + \beta = -\pi$ for $x \in \left[1, \frac{1}{k}\right)$ (D) $\alpha + \beta = 0$ for $x \in (-k, k)$

41. $N = 144^{255} + 192^{255}$ then N is divisible by

(A) 7 (B) 35 (C) 49 (D) 28

Space for Rough Work

42. If $\sum_{r=0}^{n} \frac{r}{{}^{n}C_{r}} = \sum_{r=0}^{n} \frac{n^2 - 3n + 3}{2.{}^{n}C_{r}}$, then

(A) n = 1 (B) n = 2 (C) n = 3 (D) None of these

43. If A and B are two invertible matrices of the same order, then adj (AB) is equal to

(A) adj B adj A (B) $|B||A| B^{-1} A^{-1}$ (C) $|B||A| A^{-1} B^{-1}$ (D) $|A||B| (AB)^{-1}$

SECTION-2 (MAXIMUM MARKS : 15)

- *This section contains **FIVE** questions*
- *The answer to each question is a **SINGLE DIGIT INTEGER** ranging 0 to 9, both inclusive*
- *For each question, darken the bubble corresponding to the correct integer in the ORS*
- *For each question, marks will be awarded in <u>one of the following categories</u>:*

Full Marks : +3 If only the bubble corresponding to the correct answer is darkened

Zero Marks : 0 If all other cases

44. If $f(x) = 4x^3 - x^2 - 2x + 1$ and $g(x) = \begin{cases} \text{Min.}\{f(t) : 0 \le t \le x\} & ; 0 \le x \le 1 \\ 3 - x & ; 1 < x \le 2 \end{cases}$, then the value of λ if

$\frac{\lambda}{2} = g(1/4) + g(3/4) + g(5/4)$, is _____.

45. The period of $f(x) = \sin \frac{\pi}{4} [x] + \cos \frac{\pi x}{2}$, where $[\cdot]$ denotes greatest integer function, is _____.

46. If a determinant of order 3 × 3 is formed by using the numbers 1 or – 1 and minimum value of the determinant is $-\lambda$, then the value of λ is _____.

47. The number of pair solution (x, y) of the equation $1 + x^2 + 2x \sin(\cos^{-1} y) = 0$ is _____.

48. If A is a square matrix of order 3 such that |A| = 2 then the value of $|(\text{adj } A^{-1})^{-1}|$ is _____.

SECTION-3 (MAXIMUM MARKS : 18)

- *This section contains **SIX** questions of matching type*
- *This section contains **TWO** tables (each having 3 columns and 4 rows)*
- *Based on each table, there are **THREE** questions*
- *Each question has **FOUR** options (A), (B), (C), and (D). **ONLY ONE** of these four options is correct*
- *For each question, darken the bubble corresponding to the correct option in the ORS*
- *For each question, marks will be awarded in <u>one of the following categories</u>:*

Full Marks : +3 If only the bubble corresponding to the correct option is darkened

Zero Marks : 0 If none of the bubbles is darkened

Negative Marks : –1 In all other cases

Space for Rough Work

Answer Q.49, Q. 50 and Q.51 by appropriately matching the information given in the three columns of the following table.

Column-1 contains definitions of various functions f(x) in terms of real parameter 'a'
Column-2 contains information about the coefficient of x^2 in the binomial expansion of f(x) for small numerical values of x
Column-3 contains the corresponding value of 'a'

	Column 1		**Column 2**		**Column 3**
(I)	$f(x)=\frac{a(2-3x)}{(1-2x)(2+x)}, \lvert x\rvert<\frac{1}{2}$	(i)	$\frac{1}{4}$	(P)	10
(II)	$f(x)=\sqrt{\frac{1+ax}{4-x}}, \lvert x\rvert<1$	(ii)	$\frac{1}{64}$	(Q)	4
(III)	$f(x)=\frac{1}{\sqrt{1-ax}}-\sqrt{1+ax}, \lvert x\rvert<\frac{1}{a}$	(iii)	10	(R)	$\frac{1}{4}$
(IV)	$f(x)=\frac{a(1-x)}{1+x+x^2+x^3}, \lvert x\rvert<1$	(iv)	4	(S)	$\sqrt{8}$

49. Which of the following options is the only INCORRECT combination?
(A) (IV) (i) (R) (B) (I) (iii) (P) (C) (IV) (ii) (S) (D) (IV) (iv) (Q)

50. Which of the following options is the only CORRECT combination?
(A) (I) (iv) (R) (B) (II) (ii) (S) (C) (III) (i) (Q) (D) (II) (ii) (R)

51. Which of the following options is the only CORRECT combination?
(A) (III) (iv) (S) (B) (I) (ii) (R) (C) (II) (iii) (P) (D) (I) (iv) (S)

Space for Rough Work

Answer Q.52, Q. 53 and Q.54 by appropriately matching the information given in the three columns of the following table.

	Column 1		Column 2		Column 3
(I)	If a, b, c $\in$ R – {0} such that $a \neq b \neq c \neq a$ and $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=0$ and $A=\begin{bmatrix}1+a & 1 & 1\\ 1 & 1+b & 1\\ 1 & 1 & 1+c\end{bmatrix}$, then	(i)	A is a symmetric matrix	(P)	$\lvert\text{adj } A\rvert = \lvert A\rvert^2$
(II)	If $\alpha, \beta, \gamma \in R$, and $A=\begin{bmatrix}1 & \cos(\alpha-\beta) & \cos(\alpha-\gamma)\\ \cos(\beta-\alpha) & 1 & \cos(\beta-\gamma)\\ \cos(\gamma-\alpha) & \cos(\gamma-\beta) & 1\end{bmatrix}$, then	(ii)	A is singular matrix	(Q)	$\text{adj}(\text{adj } A) = \lvert A\rvert A$
(III)	If $\omega \neq 1$ be cube root of unity and $A=\begin{bmatrix}1+2\omega^{100}+\omega^{200} & \omega^2 & 1\\ 1 & 1+\omega^{101}+2\omega^{202} & \omega\\ \omega & \omega^2 & 2+\omega^{100}+2\omega^{200}\end{bmatrix}$, then	(iii)	A is non-singular matrix	(R)	$\lvert A\rvert$ is equal to minimum value of $\cos^{-1}\left(x-\frac{1}{x}\right)+\cos^{-1}\left(\frac{y^2}{y+1}\right)+\cos^{-1}(z^2+z+1)$ (where x, y, z are real numbers)
(IV)	If a, b, c $\in$ R – {0} such that $a \neq b \neq c \neq a$, and $A=\begin{bmatrix}0 & (a-b)^3 & (a-c)^3\\ (b-a)^3 & 0 & (b-c)^3\\ (c-a)^3 & (c-b)^3 & 0\end{bmatrix}$, then	(iv)	Invertible	(S)	$\lvert A^{-1}\rvert = \frac{1}{\lvert A\rvert}$

52. Which of the following is only correct combination?
(A) (I) (i) (R) (B) (I) (ii) (R) (C) (I) (iii) (P) (D) (I) (ii) (S)

53. Which of the following is only correct combination?
(A) (II) (i) (S) (B) (II) (ii) (R) (C) (II) (iii) (Q) (D) (II) (iv) (S)

54. Which of the following is only incorrect combination?
(A) (I) (iv) (P) (B) (II) (i) (R) (C) (III) (ii) (R) (D) (IV) (iii) (Q)

Space for Rough Work