IIT – JEE (2011) PAPER II QUESTION & SOLUTIONS CODE 0

PART I : CHEMISTRY

PAPER – II

SECTION – I(TOTAL MARKS: 24)

(Single Correct Answer Type)

This section contains 8 multiple choice questions. Each question has four choices (A), (B), (C) and (D), out of which ONLY ONE is correct.

1. Among the following complexes (**K – P**),
$K_3[Fe(CN)_6]$ (**K**), $[Co(NH_3)_6]Cl_3$ (**L**), $Na_3[Co(oxalate)_3]$ (**M**), $[Ni(H_2O)_3]Cl_2$ (**N**), $K_2[Pt(CN)_4]$ (**O**) and $[Zn(H_2O)_6](NO_3)_2$ (**P**)
the diamagnetic complexes are

(A) **K, L, M, N** (B) **K, M, O, P**
(C) **L, M, O, P** (D) **L, M, N, O**

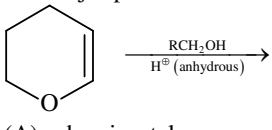
2. Consider the following cell reaction :

$2Fe_{(s)} + O_{2(g)} + 4H^+_{(aq)} \rightarrow 2Fe^{2+}_{(aq)} + 2H_2O_{(l)}$ $E^\circ = 1.67$ V

At $[Fe^{2+}] = 10^{-3}$M, $P(O_2) = 0.1$ atm and pH = 3, the cell potential at 25°C is

(A) 1.47 V (B) 1.77 V
(C) 1.87 V (D) 1.57 V

3. The major product of the following reaction is



(A) a hemiacetal (B) an acetal
(C) an ether (D) an ester

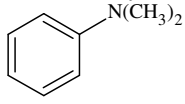
4. Passing H_2S gas into a mixture of Mn^{2+}, Ni^{2+}, Cu^{2+} and Hg^{2+} ions in an acidified aqueous solution precipitates

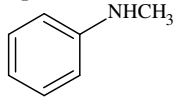
(A) CuS and HgS
(B) MnS and CuS
(C) MnS and NiS
(D) NiS and HgS

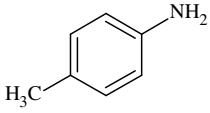
5. Oxidation states of the metal in the minerals haematite and magnetite, respectively are

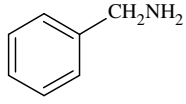
(A) II, III and haematite and III in magnetite
(B) II, III in haematite and II in magnetite
(C) II in haematite and II, III in magnetite
(D) III in haematite and II, III in magnetite

6. Amongst the compounds given, the one that would from a brilliant colored dye on treatment with $NaNO_2$ in dil. HCl followed by addition to an alkaline solution of β-naphthol is

(A) 

(B) 

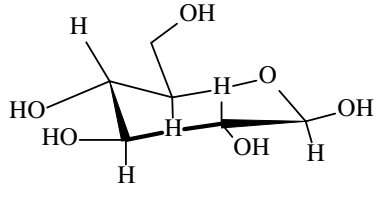
(C) 

(D) 

7. The freezing point (in °C) of a solution containing 0.1 g of $K_3[Fe(CN)_6]$ (Mol. Wt. 329) in 100 g of water (K_f = 1.86 K kg mol^{-1}) is

(A) -2.3×10^{-2}
(B) -5.7×10^{-2}
(C) -5.7×10^{-2}
(D) -1.2×10^{-2}

8. The following carbohydrate is



(A) a ketohexose
(B) an aldohexose
(C) an α-furanose
(D) an α - pyransose

SECTION – II (TOTAL MARKS: 16)
(Multiple Correct Answer(s) Type)

This section contains 4 multiple choice questions. Each question has four choices (A), (B), (C) and (D), out of which ONE OR MORE may be correct.

9. The equilibrium

$2Cu^{I} \rightleftharpoons Cu^{0} + Cu^{II}$

In aqueous medium at 25°C shifts towards the left in the presence of

(A) NO_3^-
(B) Cl^-
(C) SCN^-
(D) CN^-

10. The correct functional group X and the reagent / reaction condition Y in the following scheme are

$$X-(CH_2)_4-X \xrightarrow[\text{(ii) } HO-C(=O)-(CH_2)_4-C(=O)-OH]{\text{(i) Y}} \text{condensation polymer}$$

heat

(A) X = $COOCH_3$, Y = H_2 / Ni / heat
(B) X = $CONH_2$, Y = H_2/ Ni / heat
(C) X = $CONH_2$, Y = Br_2 / NaOH
(D) X = CN, Y = H_2 / Ni/ heat

11. For the first order reaction

$2N_2O_2\ (g) \longrightarrow 4NO_2\ (g) + O_2\ (g)$

(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 reactant.

(D) the reaction proceeds to 99.6% completion in eight half-life diration.

12. Reduction of the metal centre in aqueous permagnate ion involves

(A) 3 electrons in neutral medium

(B) 5 electrons in neutral medium

(C) 3 electrons in alkaline medium

(D) 5 electrons in acidic medium

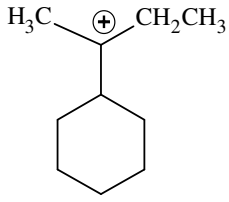
SECTION – III (TOTAL MARKS: 2 4)

(Integer Answer Type)

This Section contains 6 questions. The answer to each question is a Single-digit integer, ranging from 0 to 9. The bubble corresponding to the correct answer is to darkened in the ORS.

13. The number of hexagonal faces that are present in a truncated octahedron is

14. The total number of contributing structures showing hyperconjugation (involving C – H bonds) for the following carbocation is

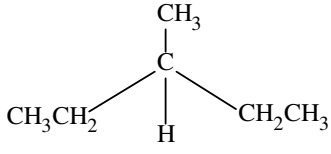


15. Among the following, the number of compounds than can react with PCl_5 to give $POCl_3$ is O_2, CO_2, SO_2, H_2O, H_2SO_4, P_4O_{10}

16. In 1 L saturated solution of AgCl [K_{sp} (AgCl) = 1.6×10^{-10}], 0.1 mole of CuCl [K_{sp} (CuCl) = 1.0×10^{-6}] is added. The resultant concentration of Ag^+ in the solution is 1.6×10^{-x}. The value of "x" is

17. The volume (in mL) of 0.1 M $AgNO_3$ required for complete precipitation of chloride ions present in 30 mL of 0.01 M solution of $[Cr(H_2O)_5Cl]Cl_2$, as silver chloride is close to

18. The maximum number of isomers (including stereoisomers) that are possible on mono-chlorination of the following compound, is



SECTION – IV (TOTAL MARKS: 16)

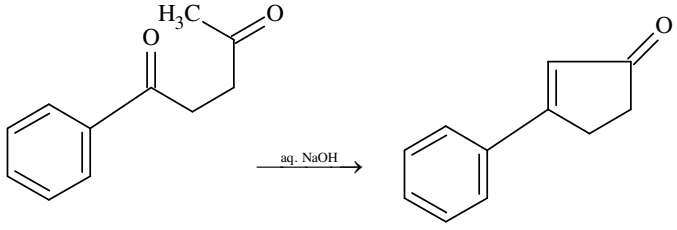
(Matrix-Match Type)

This section contains 2 questions. Each question four statements (A, B, C and D) given in Column I and five statements (p, q, r, s and t) in Column II. Any given statement in Column I can have correct matching with one or more statement(s) given in Column II. For example, if for a given question, statement B matches with the statements given in q and r, then for that particular question, against statement B, darken the bubbles corresponding to q and r in the ORS.

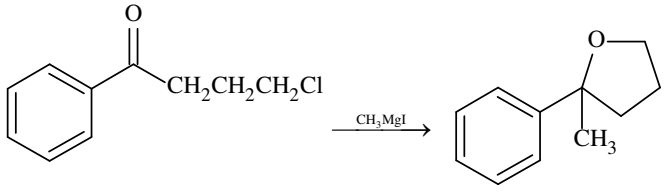
19. Match the reactions in Column I with appropriate types of steps / reactive intermediate involved in these reactions as given in Column II

Column I

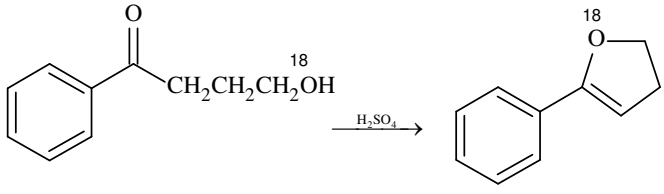
(A)



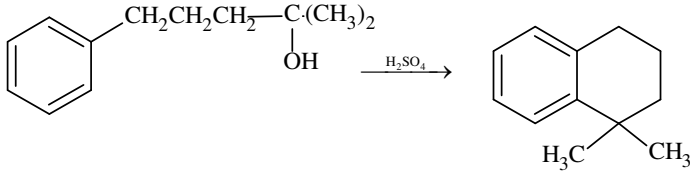
(B)



(C)



(D)



Column II

(p) Nucleophilic substitution

(q) Electrophilic substitution

(r) Dehydration

(s) Nucleophilic

(t) Carbanion

20. Match the transformations in Column I with appropriate options in column II

Column I		**Column II**	
(A)	CO_2 (s) $\rightarrow$ CO_2 (g)	(p)	Phase transition
(B)	$CaCO_3$ (s) $\rightarrow$ CaO (s) + CO_2 (g)	(q)	Allotropic change
(C)	$2H\bullet \rightarrow H_2$ (g)	(r)	ΔH is positive
(D)	$P_{(white, solid)} \rightarrow P_{(red, solid)}$	(s)	ΔS is positive
		(t)	ΔS is negative

PART II : PHYSICS

SECTION – I(TOTAL MARKS: 24)

(Single Correct Answer Type)

This section contains 8 multiple choice questions. Each question has four choices (A), (B), (C) and (D), out of which ONLY ONE is correct.

21. A satellite is moving with a constant speed V in a circular orbit about the earth. An object of mass m is ejected from the satellite such that it just escapes from the gravitational pull of the earth. At the time of its ejection, the kinetic energy of the object is

(A) $\frac{1}{2}mV^2$ (B) mV^2

(C) $\frac{3}{2}mV^2$ (D) $2mV^2$.

22. A point mass is subjected to two simultaneous sinusoidal displacements in x–direction, $x_1(t) = A\sin\omega t$ and $x_2(t) = A\sin\left(\omega t + \frac{2\pi}{3}\right)$. Adding a third sinusoidal displacement $x_3(t) = B\sin(\omega t + \phi)$ brings the mass to a complete rest. The value of B and ϕ are

(A) $\sqrt{2}A, \frac{3\pi}{4}$ (B) $A, \frac{4\pi}{3}$

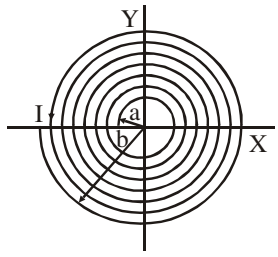
(C) $\sqrt{3}A, \frac{5\pi}{6}$ (D) $A, \frac{\pi}{3}$.

23. The density of a solid ball is to be determined in an experiment. The diameter of the ball is measured with a screw gauge, whose pitch is 0.5 mm and there are 50 divisions on the circular scale. The reading on the main scale is 2.5 mm and that on the circular scale is 20 divisions. If the measured mass of the ball has a relative error of 2%, the relative percentage error in the density is

(A) 0.9% (B) 2.4%

(C) 3.1% (D) 4.2%.

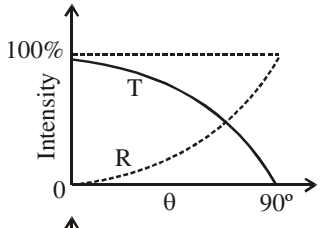
24. A long insulated copper wire is closely wound as a spiral of N turns. The spiral has inner radius a and outer radius b. The spiral lies in the X–Y plane and a steady current I flows through the wire. The Z–component of the magnetic field at the centre of the spiral is

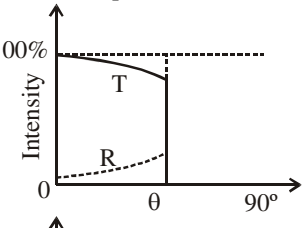


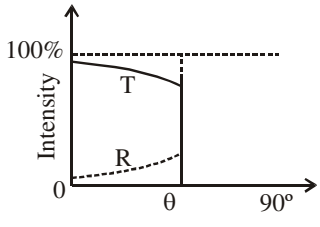
(A) $\frac{\mu_0 NI}{2(b-a)}\ell n\left(\frac{b}{a}\right)$ (B) $\frac{\mu_0 NI}{2(b-a)}\ell n\left(\frac{b+a}{b-a}\right)$

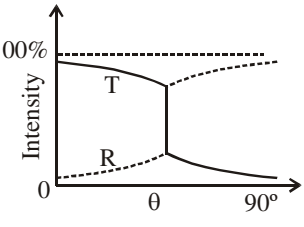
(C) $\frac{\mu_0 NI}{2b}\ell n\left(\frac{b}{a}\right)$ (D) $\frac{\mu_0 NI}{2b}\ell n\left(\frac{b+a}{b-a}\right)$.

25. A light ray traveling in glass medium is incident on glass air interface at an angle of incidence θ. The reflected (R) and transmitted (T) intensities, both as function of θ, are plotted. The correct sketch is

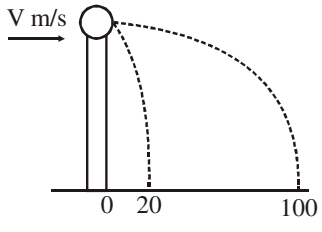
(A)


(B)


(C)


(D)


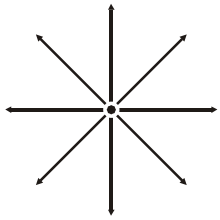
26. A ball of mass 0.2 kg rests on a vertical post of height 5 m. A bullet of mass 0.01 kg traveling with a velocity V m/s in a horizontal direction, hits the centre of the ball. After the collision, the ball and bullet travel independently. The ball hits the ground at a distance 20 m and the bullet at a distance of 100 m from the foot of the post. The initial velocity of the bullet is

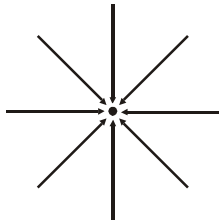


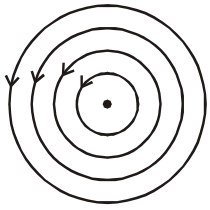
(A) 250 m/s (B) $250\sqrt{2}$ m/s

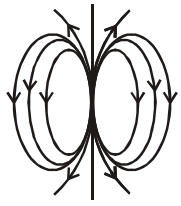
(C) 400 m/s (D) 500 m/s.

27. Which of the field patterns given below is valid for electric field as well as for magnetic field ?

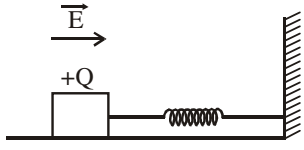
(A) 

(B) 

(C) 

(D) 

28. A wooden block performs SHM on a frictionless surface with frequency, v_0. The block carries a charge +Q on its surface. If now a uniform electrical field $\vec{E}$ is switched on as shown, then the SHM of the block will be



(A) of the same frequency and with shifted mean position
(B) of the same frequency and with the same mean position
(C) of changed frequency and with shifted mean position
(D) of changed frequency and with the same mean position.

SECTION – II (TOTAL MARKS: 16)
(Multiple Correct Answer(s) Type)

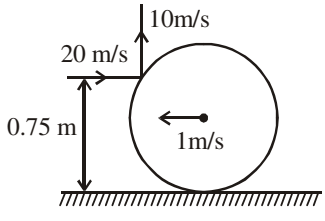
This section contains 4 multiple choice questions. Each question has four choices (A), (B), (C) and (D), out of which ONE OR MORE may be correct.

29. A series R–C circuit is connected to AC voltage source. Consider two cases; (A) when C is without a dielectric medium and (B) when C is filled with dielectric of constant 4. The current I_R through the resistor and voltage V_C across the capacitor are compared in the two cases. Which of the following is/are true ?

(A) $I_R^A > I_R^B$ (B) $I_R^A < I_R^B$

(C) $V_C^A > V_C^B$ (D) $V_C^A < V_C^B$.

30. A thin ring of mass 2 kg and radius 0.5 m is rolling without slipping on a horizontal plane with velocity 1 m/s. A small ball of mass 0.1 kg, moving with velocity 20 m/s in the opposite direction, hits the ring at a height of 0.75 m and goes vertically up with velocity 10 m/s. Immediately after the collision



(A) the ring has pure rotation about its stationary CM
(B) the ring comes to a complete stop
(C) friction between the ring and the ground is to the left
(D) there is no friction between the ring and the ground.

31. Which of the following statement(s) is/are correct ?

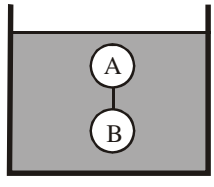
(A) if the electric field due to a point charge varies as $r^{-2/5}$ instead of r^{-2}, then the Gauss law will still be valid

(B) the Gauss law can be used to calculate the field distribution around an electric dipole

(C) if the electric field between two point charges is zero somewhere, then the sign of the two charges is the same

(D) the work done by the external force in moving a unit positive charge from point A at potential V_A to point B at the potential V_B ($V_B - V_A$).

32. Two solid spheres A and B of equal volumes but of different densities d_A and d_B are connected by a string. They are fully immersed in a fluid of density d_F. They get arranged into an equilibrium state as shown in the figure with a tension in the string. The arrangement is possible only if



(A) $d_A < d_F$ (B) $d_B > d_F$

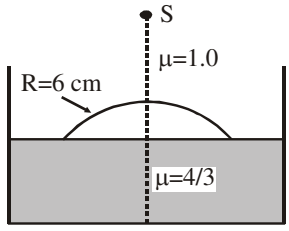
(C) $d_A > d_F$ (D) $d_A + d_B = 2\, d_F$.

SECTION – III (TOTAL MARKS: 2 4)

(Integer Answer Type)

This Section contains 6 questions. The answer to each question is a Single-digit integer, ranging from 0 to 9. The bubble corresponding to the correct answer is to darkened in the ORS.

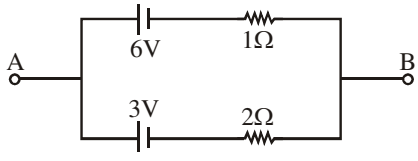
33. Water (with refractive index $=\frac{4}{3}$) in a tank is 18 cm deep. Oil of refractive index $\frac{7}{4}$ lies on water making a convex surface of radius of curvature R = 6 cm as shown. Consider oil to act as a thin lens. An object S is placed 24 cm above water surface. The location of its image is at x cm above the bottom of the tank. Then x is



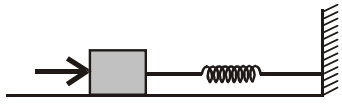
34. A silver sphere of radius 1 cm and work function 4.7 eV is suspended from an insulating thread in free–space. It is under continuous illumination of 200 nm wavelength light. As photoelectrons are emitted, the sphere gets charged and acquires a potential. The maximum number of photoelectrons emitted from the shphere is $A \times 10^Z$ (where $1 < A < 10$). The value of Z is

35. A train is moving along a straight line with a constant acceleration a. A boy standing in the train throws a ball forward with a speed of 10 m/s, at an angle of 60º to the horizontal. The boy has to move forward by 1.15 m inside the train to catch the ball back at the initial height. The acceleration of the train, in m/s^2 is

36. Two batteries of different emfs and different internal resistances are connected as shown. The voltage across AB in volts is



37. A block of mass 0.18 kg is attached to a spring of force–constant 2 N/m. The coefficient of friction between the block and the floor is 0.1. Initially the block is at rest and the spring is un–stretched. An impulse is given to the block as shown in the figure. The block slides a distance of 0.06 m and comes to rest for the first time. The initial velocity of the block in m/s is V = N/10. Then N is



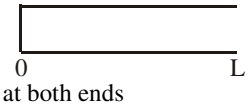
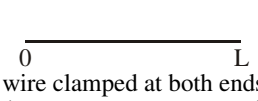
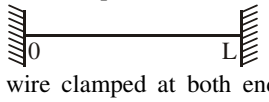
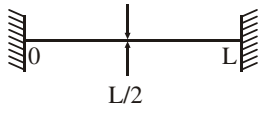
38. A series R–C combination is connected to an AC voltage of angular frequency ω = 500 radian/s. If the impedance of the R–C circuit is $R\sqrt{1.25}$, the time constant (in millisecond) of the circuit is

SECTION – IV (TOT AL MARKS: 16)

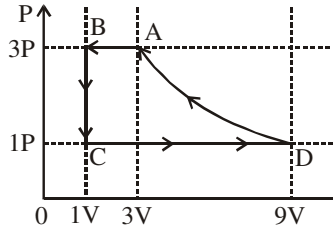
(Matrix-Match Type)

This section contains 2 questions. Each question four statements (A, B, C and D) given in Column I and five statements (p, q, r, s and t) in Column II. Any given statement in Column I can have correct matching with one or more statement(s) given in Column II. For example, if for a given question, statement B matches with the statements given in q and r, then for that particular question, against statement B, darken the bubbles corresponding to q and r in the ORS.

39. Column I shows four systems, each of the same length L, for producing standing waves. The lowest possible natural frequency of a system is called its fundamental frequency whose wavelength is denoted as λ_1. Match each system with statements given in Column II describing the nature and wavelength of the standing waves.

Column I		**Column II**	
(A)	Pipe closed at one end 	(p)	Longitudinal waves
(B)	Pipe open at both ends 	(q)	Transverse waves
(C)	Stretched wire clamped at both ends 	(r)	$\lambda_f = L$
(D)	Stretched wire clamped at both ends and at mid–point 	(s)	$\lambda_f = 2L$
		(t)	$\lambda_f = 4L$

40. One mole of a monatomic ideal gas is taken through a cycle ABCDA as shown in the P–V diagram. Column II gives the characteristics involved in the cycle. Match them with each of the processes given in Column I.



Column I		Column II	
(A)	Process A – B	(p)	Internal energy decreases
(B)	Process B – C	(q)	Internal energy increases
(C)	Process C – D	(r)	Heat is lost
(D)	Process D – A	(s)	Heat is gained
		(t)	Work is done on the gas.

PART I : MATHEMATICS

SECTION – I(TOTAL MARKS: 24)

(Single Correct Answer Type)

This section contains 8 multiple choice questions. Each question has four choices (A), (B), (C) and (D), out of which ONLY ONE is correct.

41. A value of b for which the equations

$x^2 + bx - 1 = 0$

$x^2 + x + b = 0$

have one root in common is

(A) $-\sqrt{2}$ (B) $-i\sqrt{3}$

(C) $i\sqrt{5}$ (D) $\sqrt{2}$

42. The circle passing through the point (-1, 0) and touching the y-axis at (0, 2) also passes through the point

(A) $\left(-\frac{3}{2},0\right)$ (B) $\left(-\frac{5}{2},2\right)$

(C) $\left(-\frac{3}{2},\frac{5}{2}\right)$ (D) (-4, 0)

43. Let $f(x) = x^2$ and $g(x) = \sin x$ for all $x \in R$. Then the set of all x satisfying $(f \circ g \circ g \circ f)(x) = (g \circ g \circ f)(x)$, where $(f \circ g)(x) = f(g(x))$, is

(A) $\pm\sqrt{n\pi}$, $n \in \{0, 1, 2, \ldots\}$ (B) $\pm\sqrt{n\pi}$, $n \in \{1, 2, \ldots\}$

(C) $\frac{\pi}{2} + 2n\pi$, $n \in \{\ldots, -2, -1, 0, 1, 2, \ldots\}$ (D) $2n\pi$, $n \in \{\ldots, -2, -1, 0, 1, 2, \ldots.\}$

44. Let $\omega \neq 1$ be a cube root of unity and S be the set of all non-singular matrices of the form $\begin{bmatrix} 1 & a & b \\ \omega & 1 & c \\ \omega^2 & \omega & 1 \end{bmatrix}$, where each of a, b, and c is either ω or ω^2. Then the number of distinct matrices in the set S is

(A) 2 (B) 6

(C) 4 (D) 8

45. Let P (6, 3) be a point on the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$. If the normal at the point P intersects the x-axis at (9, 0), then the eccentricity of the hyperbola is

(A) $\sqrt{\frac{5}{2}}$ (B) $\sqrt{\frac{3}{2}}$

(C) $\sqrt{2}$ (D) $\sqrt{3}$

46. Let f : [-1, 2] $\rightarrow$ [0, ∞) be a continuous function such that f(x) = f(1-x) for all x$\in$ [-1, 2]. Let $R_1 = \int_{-1}^{2} xf(x)\,dx$, and R_2 be the area of the region bounded by y = f(x), x = -1, x = 2, and the x-axis. Then

(A) $R_1 = 2R_2$ (B) $R_1 = 3R_2$

(C) $2R_1 = R_2$ (D) $3R_1 = R_2$

47. If $\lim_{x\to 0}\left[1+x\ln(1+b^2)\right]^{\frac{1}{x}} = 2b\sin^2\theta$, b > 0 and $\theta\in(-\pi, \pi]$, then the value of θ is

(A) $\pm\frac{\pi}{4}$ (B) $\pm\frac{\pi}{3}$

(C) $\pm\frac{\pi}{6}$ (D) $\pm\frac{\pi}{2}$

48. Let (x, y) be any point on the parabola $y^2 = 4x$. Let P be the point that divides the line segment from (0, 0) to (x, y) in the ratio 1 : 3. Then the locus of P is

(A) $x^2 = y$ (B) $y^2 = 2x$

(C) $y^2 = x$ (D) $x^2 = 2y$

SECTION – II (TOTAL MARKS: 16)

(Multiple Correct Answer(s) Type)

This section contains 4 multiple choice questions. Each question has four choices (A), (B), (C) and (D), out of which ONE OR MORE may be correct.

49. Let E and F be two independent events. The probability that exactly one of them occurs is $\frac{11}{25}$ and the probability of none of them occurring is $\frac{2}{25}$. If P(T) denotes the probability of occurrence of the event T, then

(A) $P(E) = \frac{4}{5}, P(F) = \frac{3}{5}$ (B) $P(E) = \frac{1}{5}, P(F) = \frac{2}{5}$

(C) $P(E) = \frac{2}{5}. P(F) = \frac{1}{5}$ (D) $P(E) = \frac{3}{5}, P(F) = \frac{4}{5}$

50. Let $f : (0, 1) \to R$ be defined by $f(x) = \frac{b - x}{1 - b\,x}$, where b is a constant such that $0 < b < 1$. Then

(A) f is not invertible on (0, 1) (B) $f \neq f^{-1}$ on (0, 1) and $f'(b) = \frac{1}{f'(0)}$

(C) $f = f^{-1}$ on (0, 1) and $f'(b) = \frac{1}{f'(0)}$ (D) f^{-1} is differentiable on (0, 1)

51. Let L be a normal to the parabola $y^2 = 4x$. If L passes through the point (9, 6), then L is given by

(A) y - x + 3 = 0 (B) y + 3x - 33 = 0

(C) y + x - 15 = 0 (D) y - 2x + 12 = 0

52. If $f(x) = \begin{cases} -x - \frac{\pi}{2}, & x \le -\frac{\pi}{2} \\ -\cos x, & -\frac{\pi}{2} < x \le 0 \\ x - 1, & 0 < x \le 1 \\ \ln x, & x > 1, \end{cases}$

then

(A) f(x) is continuous at $x = -\frac{\pi}{2}$

(B) f(x) is not differentiable at x = 0

(C) f(x) is differentiable at x = 1

(D) f(x) is differentiable at $x = -\frac{3}{2}$

SECTION – III (TOTAL MARKS: 24)

(Integer Answer Type)

This Section contains 6 questions. The answer to each question is a Single-digit integer, ranging from 0 to 9. The bubble corresponding to the correct answer is to darkened in the ORS.

53. Let M be a 3 × 3 matrix satisfying $M\begin{bmatrix}0\\1\\0\end{bmatrix} = \begin{bmatrix}-1\\2\\3\end{bmatrix}, M\begin{bmatrix}1\\-1\\0\end{bmatrix} = \begin{bmatrix}1\\1\\-1\end{bmatrix}$, and $M\begin{bmatrix}1\\1\\1\end{bmatrix} = \begin{bmatrix}0\\0\\12\end{bmatrix}$. Then the sum of the diagonal entries of M is

54. The straight line $2x - 3y = 1$ divides the circular region $x^2 + y^2 \leq 6$ into two parts. If $S = \left\{\left(2, \frac{3}{4}\right), \left(\frac{5}{2}, \frac{3}{4}\right), \left(\frac{1}{4}, -\frac{1}{4}\right), \left(\frac{1}{8}, \frac{1}{4}\right)\right\}$, then the number of point(s) in S lying inside the smaller part is

55. Let $\omega = e^{i\pi/3}$, and a, b, c, x, y, z be non-zero complex numbers such that
$a + b + c = x$
$a + b\omega + c\omega^2 = y$
$a + b\omega^2 + c\omega = z$. Then the value of $\frac{|x|^2 + |y|^2 + |z|^2}{|a|^2 + |b|^2 + |C|^2}$ is

56. Let $y'(x) + y(x)\, g'(x) = g(x)\, g'(x)$, $y(0) = 0$, $x \in R$, where $f'(x)$ denotes $\frac{df(x)}{dx}$ and g(x) is a given non-constant differentiable function on R with $g(0) = g(2) = 0$. Then the value of y(2) is

57. The number of distinct real roots of $x^4 - 4x^3 + 12x^2 + x - 1 = 0$ is

58. Let $a = -\hat{i} - \hat{k}$, $\vec{b} = -\hat{i} + \hat{j}$ and $\vec{c} = \hat{i} + 2\hat{j} + 3\hat{k}$ be three given vectors. If $\vec{r}$ is a vector such that $\vec{r} \times \vec{b} = \vec{c} \times \vec{b}$ and $\vec{r}.\vec{a} = 0$, then the value of $\vec{r}.\vec{b}$ is

SECTION – IV (TOTAL MARKS: 16)

(Matrix-Match Type)

This section contains 2 questions. Each question four statements (A, B, C and D) given in Column I and five statements (p, q, r, s and t) in Column II. Any given statement in Column I can have correct matching with one or more statement(s) given in Column II. For example, if for a given question, statement B matches with the statements given in q and r, then for that particular question, against statement B, darken the bubbles corresponding to q and r in the ORS.

59. Match the statement given in Column I with the intervals/union of intervals given in Column II

	• Column I	• • Column II
(A)	The set $\{\text{Re}\left(\frac{2iz}{1-z^2}\right)$: z is a complex number, $\lvert z\rvert = 1, z \neq \pm 1\}$	(p) $(-\infty, -1) \cup (1, \infty)$
(B)	The domain of the function $f(x) = \sin^{-1}\left(\frac{8(3)^{x-2}}{1-3^{2(x-1)}}\right)$ is	(q) $(-\infty, 0) \cup (0, \infty)$

(C) If $f(\theta) = \begin{vmatrix} 1 & \tan\theta & 1 \\ -\tan\theta & 1 & \tan\theta \\ -1 & -\tan\theta & 1 \end{vmatrix}$, then the set $\{f(\theta) : 0 \le \theta < \frac{\pi}{2}\}$ is

(r) $(-\infty, -1] \cup [1, \infty)$

(D) If $f(x) = x^{3/2}(3x - 10)$, $x \ge 0$, then $f(x)$ is increasing in

(s) $(-\infty, 0] \cup [2, \infty)$

(t) $(-\infty, 0] \cup [2, \infty)$

60. Match the statement given in Column I with the values given in Column II

	• Column I	•	• Column II
(A)	If $\vec{a} = \hat{j} + \sqrt{3}\hat{k}$, $\vec{b} = -\hat{j} + \sqrt{3}\hat{k}$ and $\vec{c} = 2\sqrt{3}\ \hat{k}$ form a triangle, then the internal angle of the triangle between $\vec{a}$ and $\vec{b}$ is	(p)	$\frac{\pi}{6}$
(B)	If $\int_a^b (f(x) - 3x)\,dx = a^2 - b^2$, then the value of $f\left(\frac{\pi}{6}\right)$ is	(q)	$\frac{2\pi}{3}$
(C)	The value of $\frac{\pi^2}{\ln 3}\int_{7/6}^{5/6} \sec \pi x)\,dx$ is	(r)	$\frac{\pi}{3}$
(D)	The maximum value of $\left\lvert \text{Arg}\left(\frac{1}{1-z}\right)\right\rvert$ for $\lvert z\rvert = 1, z \neq 1$ is given by	(s)	π
		(t)	$\frac{\pi}{2}$