ALLEN CAREER INSTITUTE KOTA (RAJASTHAN)

DISTANCE LEARNING PROGRAMME
(Academic Session : 2024 - 2025)

JEE (Main)
TEST # 14
29-12-2024

JEE(Main+Advanced) : LEADER TEST SERIES / JOINT PACKAGE COURSE

Test Type : Review (Unit Test # 06, 07, 08, 09 & 10)

ANSWER KEY

PART-1 : PHYSICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	A	C	A	B	D	A	B	D	A	A
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	C	D	C	C	C	A	B	C	C	A
SECTION-II	Q.	1	2	3	4	5					
	A.	6	5	9	1	27					

PART-2 : CHEMISTRY

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	A	D	A	D	A	C	D	A	D	B
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	B	C	B	B	D	D	D	D	A	B
SECTION-II	Q.	1	2	3	4	5					
	A.	5	9	9	0	147					

PART-3 : MATHEMATICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	A	B	A	A	B	C	B	B	C	A
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	D	C	C	B	C	A	D	B	B	D
SECTION-II	Q.	1	2	3	4	5					
	A.	1	18	1	4	99					

HINT – SHEET

PART-1 : PHYSICS

SECTION-I

1. Ans (A)

$I = 2 \times 0.01 \times 5 = F_0 t$

$\Rightarrow F = \dfrac{2 \times 0.01 \times 5}{0.01} = 10\ N$

2. Ans (C)

$f = mg$

$= 20 \times 10^{-3} \times 10$

$= 10^{-1} \times 2$

$= 2 \times 10^{-1}\ N$

$F_{photon} = fg$

$\dfrac{P}{C} = 2 \times 10^{-1}$

$P = 2 \times 10^{-1} \times 3 \times 10^{8}$

$P = 6 \times 10^{7} W$

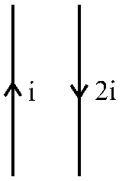
3. Ans (A)

$I = \dfrac{Mr^2}{2} + \dfrac{mr^2}{4} = \dfrac{3}{4}mr^2$

4. Ans (B)

$m_1 v \ell = \left(\dfrac{m_2 \ell^2}{3}\omega\right) + m_1(\ell\omega)\,\ell$

5. Ans (D)



$B = \dfrac{\mu_0 i}{2\pi\frac{d}{2}} + \dfrac{\mu_0 xzi}{2\pi\frac{d}{2}} = \dfrac{3\mu_0 i}{\pi d}$

$F = q\vec{v} \times \vec{B} = 0$

6. Ans (A)

The work done by the external agent = change in potential enrgy

$= -(MB\cos\theta_2) - (-MB\cos\theta_1)$

$= -MB(\cos 60° - \cos 0°) = \frac{1}{2}MB$

$= \frac{1}{2}(1.0\times10^4 J/T)(4\times10^{-5}T) = 0.2J$

7. Ans (B)

$T_S = 3mg$

$\frac{3mg}{A_s} = y_S \times \frac{\Delta\ell_S}{\ell_S}$

$\frac{2mg}{A_b} = y_b \times \frac{\Delta\ell_b}{\ell_b}\frac{\Delta\ell_b}{\ell_b}$

$\frac{\Delta\ell_s}{\Delta\ell_b} = \frac{3}{2}\times\frac{\ell_s}{\ell_b}\times\frac{A_b}{A_S}\times\frac{y_b}{y_S} = \frac{3}{2}\times\frac{a}{b^2c}$

8. Ans (D)

$\vec{S} = \frac{\vec{E}\times\vec{B}}{\mu_0}$

is called the Poynting vector after its discoverer, John Poynting. The average magnitude of $\vec{S}$ is the intensity of the wave, and the direction of $\vec{S}$ is the direction of propagation of the wave.

9. Ans (A)

As ratio of slit widths = Ratio of intensities

$\therefore \frac{I_1}{I_2} = \frac{9}{4}$ or $\frac{a_1^2}{a_2^2} = \frac{9}{4} \Rightarrow \frac{a_1}{a_2} = \frac{3}{2}$

$a_{max} = a_1 + a_2 = 3 + 2 = 5$; $a_{min} = 3 - 2 = 1$

$\frac{I_{max}}{I_{min}} = \frac{(a_1+a_2)^2}{(a_1-a_2)^2} = \frac{(3+2)^2}{(3-2)^2} = \frac{25}{1}$

10. Ans (A)

$f = \frac{4}{2\times0.4}\times\sqrt{\frac{90}{0.1}}$

$= \frac{2\times5}{2}\times30 = 150Hz$

11. Ans (C)

$\frac{A_R}{A_i} = \frac{\sqrt{\mu_1}-\sqrt{\mu_2}}{\sqrt{\mu_1}+\sqrt{\mu_2}}$

12. Ans (D)

$\omega = 2\pi f$

$= 1.5\times10^3$

$A = \frac{6}{2} = 3\text{ cm} = 0.03\text{ m}$

13. Ans (C)

Loudness of sound is given by

$dB = 10\log\frac{I}{I_0}$

$\begin{pmatrix} I \text{ is intensity of sound} \\ I_0 \text{ is reference intensity of sound}\end{pmatrix}$

$\therefore \quad 120 = 10\log\left(\frac{I}{I_0}\right)$

$\Rightarrow \quad I = 1\ W/m^2$

Also $I = \frac{P}{4\pi r^2} = \frac{2}{4\pi r^2}$

$\therefore \quad r = \sqrt{\frac{2}{4\pi}} = \sqrt{\frac{1}{2\pi}}\ m = 0.399\ m \approx 40\ cm$

14. Ans (C)

When KE = PE then total energy is half kinetic and half potential.

So, KE = PE

$= \frac{1}{2}m\omega^2(a^2-x^2) = \frac{1}{2}m\omega^2x^2$

$= \frac{1}{2}m\omega^2a^2 = m\omega^2x^2$

$x^2 = \frac{a^2}{2} \Rightarrow x = \frac{a}{\sqrt{2}}$

15. Ans (C)

$P = \left(\frac{N}{t}\right)250\,MeV$

$\left(\frac{N}{t}\right) = \frac{100\times10^6}{250\times1.6\times10^{-13}}$

$= 2.5\times10^{18}$

$\therefore$ Number of neutron per second

$= 2.5\times2.5\times10^{18}$

$= 6.25\times10^{18}$

19. Ans (C)

Theory based

20. Ans (A)

Conceptual.

PART-1 : PHYSICS

SECTION-II

1. **Ans (6)**

$C = 2mF$

$\omega = \frac{1}{\sqrt{LC}} = \frac{1000}{\sqrt{1.2 \times 10^{-3}}}$

$q_0 = 24nC$, $q = 12$ mC

$i = \omega\sqrt{q_0^2 - q^2}$

$i = \frac{1000}{\sqrt{1.2 \times 10^{-3}}}\sqrt{144 \times 3 \times 10^{-12}} = 0.60$

2. **Ans (5)**

$\Delta l = \alpha \ell \Delta T$

$\frac{\Delta \ell}{\ell} = \alpha \Delta T$

$\sigma_b = \frac{T}{A} = \frac{y\Delta \ell}{\ell} = y\alpha \Delta T$

$\Rightarrow \Delta T = \frac{\sigma_b}{y\alpha} = \frac{4 \times 10^8}{2 \times 10^{11} \times 10^{-5}} = 200°C$

3. **Ans (9)**

Heat developed in 1 sec $= \frac{20}{100} \times 4200J$

$\therefore \quad Q = ms\Delta T$

$\Rightarrow \frac{4200 \times 20}{100} = 2 \times 5 \times 4.2 \times 1.8 \times \Delta T$

(ΔT is in °C)

$\Rightarrow \Delta T = 11.11 = \frac{100}{9}^{\circ}C$

$\therefore \Delta T$ in 10s $= \frac{100}{9}^{\circ}C$

4. **Ans (1)**

The change in internal energy of the gas is

$\Delta U = 1.5\ nR\ (\Delta T) = 1.5\ (1\ mol)\ (\frac{25}{3}\ J/mol\text{-}K)\ (2K)$

$= 25\ J$

The heat given to the gas = 42 J

The work done by the gas is

$\Delta W = \Delta Q - \Delta U = 42\ J - 25\ J = 17\ J$

If the distance moved by the piston is x, the work done is

$\Delta W = (100\ kPa)\ (8.5\ cm^2)\ x$

Thus, $(10^5\ N/m^2)\ (8.5 \times 10^{-4}\ m^2)\ x = 17\ J$ or,

$x = 0.2m = 20\ cm$

5. **Ans (27)**

$Q_{absorbed} = Q_{emitted}$

$e(I\ A_{projected}) = e\sigma AT^4$

$1944 \times \pi R^2 = 6 \times 10^{-8} \times 4\pi R^2 T^4$

$T = 300\ K = 27°C$

PART-2 : CHEMISTRY

SECTION-I

1. **Ans (A)**

Glucose is soluble in water due to presence of alcohol functional group and extensive hydrogen bonding.

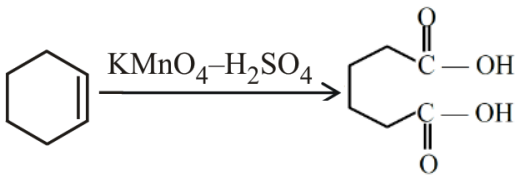
Glucose exist is open chain as well as cyclic forms in its aqueous solution.

Glucose having 6C atoms so it is hexose and having aldehyde functional group so it is aldose.

Thus, aldohexose.

Glucose is monomer unit in sucrose with fructose.

2. **Ans (D)**



3. **Ans (A)**

Stability : $Cu^{2+}_{(aq.)} > Cu^{+}_{(aq.)}$.

Electrode potential is more important than electronic configuration for determining stable oxidation state.

4. **Ans (D)**

(i) In $VOSO_4$, 'V' is in +4 oxidation state. So it act as oxidising agent.

(ii) Cr_2O_3 is an amphoteric oxide.

(iii) In RuO_4, 'Ru' is in +8 oxidation state. So it act as oxidising agent.

(iv) Red colour of ruby is due to the presence of Cr^{+3} ions in Al_2O_3.

5. Ans (A)

$$CO(g) + H_2O(g) \rightleftharpoons CO_2(g) + H_2(g)$$

Initial	1	5	0	1
Equilibrium	$1-x$	$5-x$	x	$1+x$

$$Keq = \frac{1}{3} = \frac{x(1+x)}{(1-x)(5-x)}$$

$$x = \frac{1}{2}$$

6. Ans (C)

$M \mid M^{+2} \parallel X / X^{2-}$

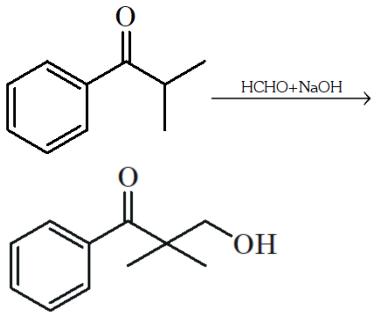
$E^o_{cell} = E^o_{M/M^{+2}} + E^o_{X/X^{-2}}$

$= -0.46 + 0.34 = -0.12V$

As E^o_{cell} is negative so anode becomes cathode and cathode become anode. Spontaneous reaction will be

$M^{+2} + X^{2-} \longrightarrow M + X$

7. Ans (D)



9. Ans (D)

$PbS + HNO_3 \longrightarrow Pb(NO_3)_2 + NO + S + H_2O$

Nitrous oxide (N_2O) is not formed during the reaction.

10. Ans (B)

(A) Pb_3O_4 is insoluble in water or do not react with water.

(B) $2KO_2 + 2H_2O \quad 2KOH + H_2O_2 + O_2(g) \uparrow$

(C) $Na_2O_2 + 2H_2O \quad 2NaOH + H_2O_2$

(D) $Li_2O_2 + 2H_2O \quad 2LiOH + H_2O_2$

11. Ans (B)

$AB_{2(s)} \rightleftharpoons A^{+2}_{(aq)} + 2B^-_{(aq)}$

$K_{sp} = [A^{+2}][B^-]^2$

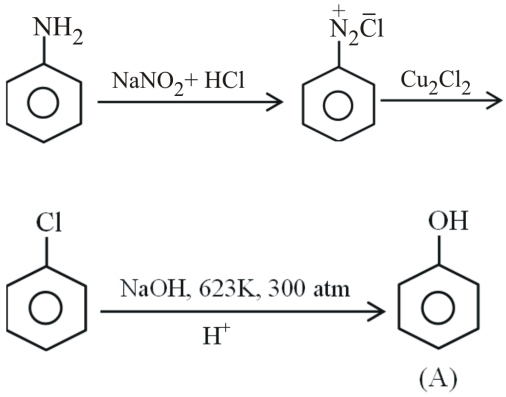
$= 1.2 \times 10^{-4} \times (2.4 \times 10^{-4})^2$

$= 6.91 \times 10^{-12} M^3$

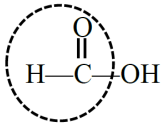
12. Ans (C)

For endothermic reaction $Keq. \propto \left(\frac{1}{\text{temperature}}\right)^{-1}$

13. Ans (B)



14. Ans (B)

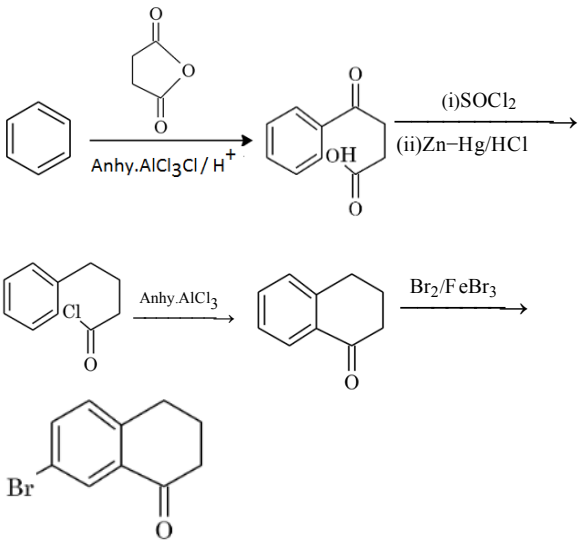
Apart from aldehyde, Formic acid 

also gives silver mirror test with ammonical silver nitrate.

15. Ans (D)

Hydrazine (NH_2-NH_2) have no carbon so does not show Lassaigne's test.

16. Ans (D)



17. Ans (D)

The E° value for Ce^{4+}/Ce^{3+} is +1.74 V because the most stable oxidation state of lanthanide series elements is +3. It means Ce^{3+} is more stable than Ce^{4+}.

20. Ans (B)

$$E = E^0 - \frac{2.303RT}{2F}\log\frac{[Q][H^+]^2}{[H_2Q]}$$

$$E = 1.30 - \frac{0.06}{2}\log\frac{0.01\times(10^{-4})^2}{0.1}$$

$= 1.30 + 0.27 = 1.57$ V

PART-2 : CHEMISTRY

SECTION-II

1. Ans (5)

$$[Ba^{+2}] = \frac{25\times0.05}{50} = 0.025M$$

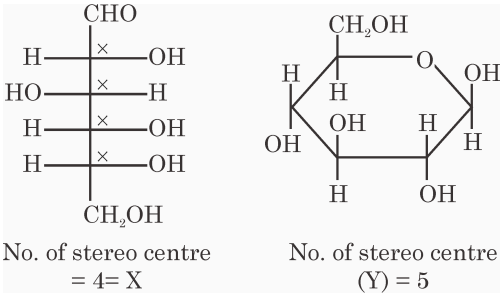
$$[F^-] = \frac{25\times0.02}{50} = 0.01M$$

$$[Ba^{+2}][F^-]^2 = 25\times10^{-7}$$

$K_{sp} = 5\times10^{-7}$ (given)

$$\text{Ratio} = \frac{[Ba^{+2}][F^-]^2}{K_{sp}} = 5$$

3. Ans (9)



No. of stereo centre = 4= X

No. of stereo centre (Y) = 5

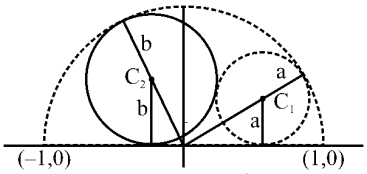
4. Ans (0)

$X \equiv \overset{VI}{Cr}O_2Cl_2$ "sp^3"

PART-3 : MATHEMATICS

SECTION-I

1. Ans (A)



$C_1C_2 = a + b = a + \frac{1}{2}$

C_1 is $\left(\sqrt{1-2a},\ a\right)$

C_2 is $\left(\sqrt{1-2b},\ b\right)$ now calculate.

2. Ans (B)

Point of intersection of normals $3x - 4y - 7 = 0$ and $2x - 3y - 5 = 0$ is $(1, -1)$

Radius is $\sqrt{(2-1)^2+(0+1)^2} = \sqrt{2}$

Equation of circle is $(x-1)^2 + (y+1)^2 = 2$

3. Ans (A)

Centre = $(1, -2)$ radius = 3

Image of centre $(1, -2)$ about line

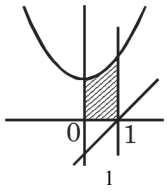
$x - y + 5 = 0$ is $(-7, 6)$

$\therefore$ Equation of circle

$(x+7)^2 + (y-6)^2 = (3)^2$

$x^2 + y^2 + 14x - 12y + 76 = 0$

4. Ans (A)



$$\text{Area} = \int_0^1 (x^2+1)\,dx + \frac{1}{2} = \frac{11}{6}$$

5. Ans (B)

$$\frac{dP(t)}{dt} = \frac{1}{2}P(t) - 450$$

integrate

$$\int\frac{dP}{P-900} = \int\frac{1}{2}dt$$

$$\ell n|(P-900)| = \frac{1}{2}t + C \quad ....(1)$$

given $t = 0 \longrightarrow P = 850$

$\therefore$ $C = \ell n\ 50$

from (1)

$$\ln|(P-900)| = \frac{1}{2}t + \ell n50$$

$$\frac{1}{2}t = \ell n\left|\left(\frac{P-900}{50}\right)\right|; \qquad t = 2\ell n\left|\left(\frac{P-900}{50}\right)\right|$$

$$t = 2\ell n\frac{900}{50}; \qquad t = 2\ell n18$$

6. Ans (C)

$$\left(\frac{2+\sin x}{1+y}\right)\frac{dy}{dx} = \cos x$$

$$\frac{dy}{dx} = \frac{(\cos x)(1+y)}{(2+\sin x)}$$

$$\frac{dy}{dx} \sim \left(\frac{\cos x}{2+\sin x}\right) y = \left(\frac{\cos x}{2+\sin x}\right)$$

$$IF = e^{\int \left(\frac{-\cos x}{2+\sin x}\right) dx}$$

$2 + \sin x = t$

$\cos x\, dx = dt$

$$= e^{-\int \frac{dt}{t}}$$

$$= e - \ln t$$

$$= \frac{1}{t} = \frac{1}{2+\sin x}$$

$$\frac{y}{2+\sin x} = \int \frac{\cos x}{(2+\sin x)^2} dx$$

$$= \int \frac{\cot x \operatorname{cosec} x}{(2\operatorname{cosec} x + 1)^2} dx + C$$

$2 \operatorname{cosec} x + 1 = t$

$-2 \operatorname{cosec} x \cot x\, dx = dt$

$$= -\int \frac{dt}{2t^2} + C = \frac{1}{2t} + C$$

$$\frac{y}{2+\sin x} = \frac{1}{2(2\operatorname{cosec} x + 1)} + C$$

$$= \frac{\sin x}{2(2+\sin x)} + C$$

$$y = \frac{\sin x}{2} + C(2+\sin x)$$

$y(0) = 2$

$\Rightarrow \quad c = 1$

$$y = \frac{3\sin x}{2} + 2$$

$$y\left(\frac{x}{2}\right) = \frac{7}{2}$$

7. Ans (B)

Centre = (3, 4)

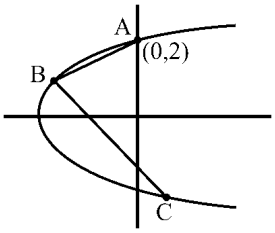
$PS + PS' = 2a$

Here P = (1, 1), S(4, 5), S'(2, 3)

$$2a = 5 + \sqrt{5} \Rightarrow a = \frac{5+\sqrt{5}}{2}$$

$$(x-3)^2 + (y-4)^2 = \left(\frac{5+\sqrt{5}}{2}\right)^2$$

8. Ans (B)



$B \equiv (t_1^2 - 4, t_1)$

$C \equiv (t_2^2 - 4, t_2)$

$$\left(\frac{t_2 - t_1}{t_2^2 - t_1^2}\right) \times \left(\frac{t_1 - 2}{t_1^2 - 4}\right) = -1$$

$\Rightarrow \quad t_1^2 + t_1 t_2 + 2t_1 + 2t_2 + 1 = 0$

$\Rightarrow \quad (t^2+2)^2 - 4(2t_2 + 1) \geq 0 \quad (\because t_1 \text{ is real})$

$\Rightarrow \quad t_2 \in (-\infty, 0] \cup [4, \infty)$

least positive value of t_2 is 4.

9. Ans (C)

$3x^2 - 10x - 5y - 20 = 0$

$$3\left(x^2 - \frac{10x}{3}\right) = 5(y+4)$$

$$\left(x - \frac{5}{3}\right)^2 = \frac{5}{3}\left(y + \frac{17}{3}\right)$$

$$L(LR) = \frac{5}{3}$$

10. Ans (A)

$M^2 = I - M$, $M^3 = M(I - M) = M - M^2 = 2M - I$

$M^4 = M^3 M = 2I - 3M$

$\therefore n = 4$

11. Ans (D)

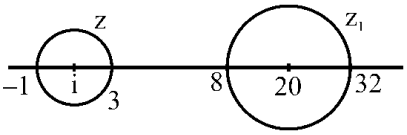
$C = \text{adj}(\text{adj}(A)) = |A|A$

$\Rightarrow \text{tr}(C) = |A|\, \text{tr}(A) = 60$

12. Ans (C)

$|4w - 20| = 12$ let $z_1 = 4w$

$\Rightarrow |z_1 - 20| = 12$



so max value of $|z - z_1|$ is 33.

13. Ans (C)

$x^3 + y^2 = 5$ & $x^3y^2 = -6$

$\Rightarrow$ $t^2 - 5t - 6 = 0$ has roots given by x^3 & y^2.

or $t = 6, -1$

$\Rightarrow$ $x^3 = -1$ & $y^2 = 6$

$\therefore$ $\arg(x + iy) = \tan^{-1}(\pm\sqrt{6})$ or $\tan^2\theta = 6$

14. Ans (B)

$(x, y, z) = (9\lambda + 1, -\lambda + 2, -3\lambda - 3)$

$$\frac{x-(9\lambda+1)}{3} = \frac{y-(-\lambda+2)}{-3} = \frac{z-(-3\lambda-3)}{10}$$

$$= -2\left[\frac{3(9\lambda+1)-3(-\lambda+2)+10(-3\lambda-3)}{3^2+3^2+10^2}\right]$$

$$\frac{x-(9\lambda+1)}{3} = \frac{y-(-\lambda+2)}{-3} = \frac{z+(3\lambda+3)}{10}$$

$$= -2\left[\frac{-59}{118}\right] = 1$$

$(x, y, z) = (9\lambda + 4, -\lambda - 1, 7 - 3\lambda)$

$$\frac{x-4}{9} = \frac{y+1}{-1} = \frac{z-7}{-3}$$

15. Ans (C)

dr of line $= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & -1 & 2 \\ 1 & 2 & 2 \end{vmatrix}$

$= -6\hat{i} + \hat{k}(3) = 3(-2\hat{i} + \hat{k})$

Hence vector equation of line is

$\vec{r} = \left(-\hat{i} + \hat{j} + 3\hat{k}\right) + \lambda(2\hat{i} - \hat{k})$

16. Ans (A)

Here solution R is reflexive since $1 + a \times a > 0$ $\forall$ real numbers a. It is symmetric since $1 + ab > 0$ $\Rightarrow 1 + ba > 0$. However R is not transitive :

consider three real numbers $2, -\frac{1}{6}$ and -2.

We have $1 + 2 \times \left(-\frac{1}{6}\right) = \frac{2}{3} > 0$ and

$1 + \left(-\frac{1}{6}\right)(-2) = \frac{4}{3} > 0$ Hence,

$2R\left(-\frac{1}{6}\right)$ and $\left(-\frac{1}{6}\right)R(-2)$ But $2\not{R}-2$

since $1 + 2(-2) = -3 \not> 0$

17. Ans (D)

$$\frac{\sum_{i=1}^{n} a_i + 2i}{n} = \frac{n.\bar{a} + 2.\frac{n(n+1)}{2}}{n} = \bar{a} + (n+1)$$

18. Ans (B)

$$\bar{x} = \frac{8+12+13+15+22}{5} = \frac{70}{5} = 14$$

$$\sigma_x^2 = \frac{\sum(x_i - \bar{x})^2}{n}$$

$$= \frac{(-6)^2 + (-2)^2 + (-1)^2 + (1)^2 + (8)^2}{5}$$

$$= \frac{36+4+1+1+64}{5} = \frac{106}{5} = 21.2$$

19. Ans (B)

$${}^5C_2\left(\frac{1}{4}\right)^2\left(\frac{3}{4}\right)^3\frac{1}{4} = \frac{10.27}{4^6} = \frac{135}{2^{11}}$$

20. Ans (D)

Given $P(A) = \frac{3}{5}$, $P(\bar{B}) = P(B) = \frac{1}{2}$, $P(A \cap \bar{B}) = \frac{1}{5}$

$\because P(A \cap \bar{B}) = P(A) - P(A \cap B)$

$\frac{1}{5} = \frac{3}{5} - P(A \cap B)$ $\Rightarrow P(A \cap B) = \frac{2}{5}$

$\therefore$ $P(\text{only A}) = \frac{1}{5}$, $P(\text{only B}) = \frac{1}{10}$.

$\therefore$ $P(A \cup B) = \frac{1}{5} + \frac{1}{10} + \frac{2}{5} = \frac{7}{10}$

$\Rightarrow P(\bar{A} \cap \bar{B}) = \frac{3}{10}$

Now, $P\left(\frac{\bar{A}}{A \cup \bar{B}}\right) = \frac{P(\bar{A} \cap (A \cup \bar{B}))}{P(A \cup \bar{B})} = \frac{P(\bar{A} \cap \bar{B})}{P(A \cup \bar{B})}$

$$= \frac{\frac{3}{10}}{1 - \frac{1}{10}} = \frac{1}{3}$$

PART-3 : MATHEMATICS

SECTION-II

1. Ans (1)

$y = mx + \frac{4}{m}$

$y = mx \pm 2\sqrt{2}\sqrt{1+m^2}$

$\left(\frac{4}{m}\right)^2 = 8(1+m^2)$

$\frac{2}{m^2} = 1 + m^2$

$m^2 = t$

$2 = t + t^2$

$t^2 + t - 2 = 0$

$t = -2, 1$

$m^2 = 1$

2. Ans (18)

$\det\{\text{adj}(A\ \text{adj}(2A))\} = |A\ \text{adj}(2A)|^2$

$= |A|^2|2A|^4$

$= |A|^6 2^{12} = 2^{12} \times 3^6$

$\Rightarrow a + b = 18$

3. Ans (1)

$|a| = 1 \Rightarrow a\bar{a} = 1$

$|b| = 1 \Rightarrow b\bar{b} = 1$

$|c| = 1 \Rightarrow c\bar{c} = 1$

$a + b + c = abc$

$\Rightarrow \frac{1}{ab} + \frac{1}{bc} + \frac{1}{ca} = 1$

$\bar{a}\bar{b} + \bar{b}\bar{c} + \bar{c}\bar{a} = 1$

$\Rightarrow ab + bc + ca = 1$

$|ab + bc + ca| = 1$

4. Ans (4)

$L_1 : \vec{r} = \left(\hat{i} + \hat{j}\right) + \lambda\left(\hat{i} - 2\hat{j} + \hat{k}\right)$

$L_2 : \vec{r} = 2\mu\hat{i} + (1-\mu)\hat{j} + (1+\mu)\hat{k}$

S.D. between $\vec{r} = \vec{a} + \lambda\vec{b}$ & $\vec{r} = \vec{c} + \mu\vec{d}$ is

$\text{S.D.} = \frac{(\vec{a} - \vec{c}) \cdot \left(\vec{b} \times \vec{d}\right)}{\left|\vec{b} \times \vec{d}\right|}$

$d = \frac{4}{\sqrt{11}} \Rightarrow \left(\frac{11}{4}d^2\right) = 4$

5. Ans (99)

That total number of ways of choosing 4 shoes (in order) out of 10 pairs (or 20 shoes) is $20 \times 19 \times 18 \times 17$. The number of ways in which no pair is selected is $20 \times 18 \times 16 \times 14$. Thus, the probability of not getting a pair is:

$\frac{20 \times 18 \times 16 \times 14}{20 \times 19 \times 18 \times 17} = \frac{224}{323}$

Hence, the probability of getting at least one pair is :