Test Pattern

ALLEN CAREER INSTITUTE KOTA (RAJASTHAN)

DISTANCE LEARNING PROGRAMME

(Academic Session : 2024 - 2025)

JEE (Main)
MAJOR TEST # 04
02-02-2025

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

ANSWER KEY

PART-1 : PHYSICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	B	B	B	D	B	A	D	B	B	B
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	D	C	C	D	B	B	C	B	C	A
SECTION-II	Q.	1	2	3	4	5					
	A.	5	18	12	600	2					

PART-2 : CHEMISTRY

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	A	D	D	A	B	D	D	B	B	A
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	C	C	B	B	A	B	B	D	A	A
SECTION-II	Q.	1	2	3	4	5					
	A.	2	11	20	76	24					

PART-3 : MATHEMATICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	D	D	B	B	D	A	B	C	D	C
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	D	A	B	A	B	D	C	D	B	A
SECTION-II	Q.	1	2	3	4	5					
	A.	96	6	12	0	5					

HINT – SHEET

PART-1 : PHYSICS

SECTION-I

1. Ans (B)

$$KE_{max} = \frac{hc}{\lambda} - \frac{hc}{\lambda_0} = (eE)d$$

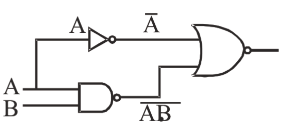
$$\Rightarrow \lambda_0 = \left(\frac{1}{\lambda} - \frac{eEd}{hc}\right)^{-1}$$

2. Ans (B)

$$F = \frac{\Delta p}{\Delta t} = \frac{nh}{\lambda}$$

$$n = \frac{F\lambda}{h} = \frac{6.62 \times 10^{-5} \times 5 \times 10^{-7}}{6.62 \times 10^{-34}} = 5 \times 10^{22}$$

3. Ans (B)

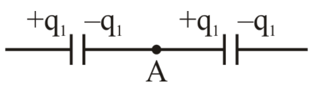


$Y = \overline{\bar{A} + \overline{AB}}$

$Y = A\,AB$

$Y = AB$

4. Ans (D)

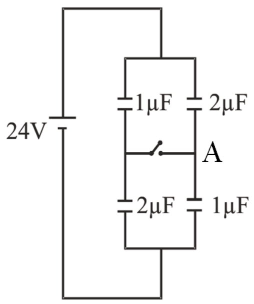


S ⟶ open

$q_1 = C_{eq}V = \left(\frac{2\times 1}{2+1}\right)$ μF ×24V = 16 μC

Net charge on plate connected with A = 0

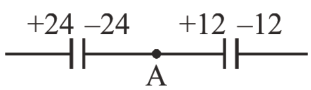
S ⟶ closed :



$q = C_{eq}V = 1.5\ \mu F \times 24 = 36\ \mu C$

At 2μF, $q_1' = \frac{2}{2+1} \times 36 = 24\ \mu C$

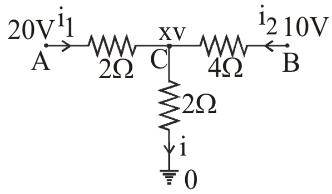
At 1 μF, $q_2' = 12\ \mu C$



Net charge connected with

A = –24 + 12 = – 12 μC

5. Ans (B)



Let voltage at C = xv

KCL : $i_1 + i_2 = i$

$$\frac{20-x}{2} + \frac{10-x}{4} = \frac{x-0}{2}$$

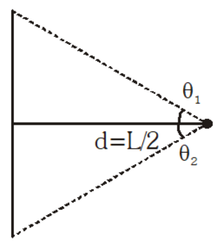
⇒ x = 10

and i = 5 amp.

6. Ans (A)

For one side

$\theta_1 = \theta_2 = 45°$



$$B_S = \frac{\mu_0 I}{4\pi\left(\frac{L}{2}\right)}(\sin 45° + \sin 45°) = \frac{\mu_0 I}{\sqrt{2}\pi L}$$

For square $B = 4B_S = 2\sqrt{2}\frac{\mu_0 I}{\pi L}$

7. Ans (D)

At t = 0, L will acts as a open circuit and at t = ∞,

C will not allow to pass the current.

8. **Ans (B)**

$\vec{B} = 3 \times 10^{-8} \sin[200\pi(y+ct)]\hat{i}$ T

$E_0 = CB_0 \Rightarrow E_0 = 3 \times 10^8 \times 3 \times 10^{-8} = 9$ V/m

and direction of wave propagation is given as

$\left(\vec{E} \times \vec{B}\right) \parallel \vec{C}$

$\hat{B} = \hat{i}$ & $\hat{C} = -\hat{j}$

so $\hat{E} = -\hat{k}$

$\therefore \vec{E} = E_0 \sin[200\pi(y+ct)](-\hat{k})$ V/m

9. **Ans (B)**

$\frac{\lambda}{2} = \frac{46-16}{100} \Rightarrow \lambda = \frac{2 \times 30}{100}$

$v = n\lambda = 500 \times \frac{2 \times 30}{100} = 300$ m/s

10. **Ans (B)**

$(y_8)_{\text{Bright, medium}} = (y_5)_{\text{Bright, air}}$

$\frac{8\lambda_m \Delta}{d} = \frac{5\lambda_a D}{d}$

$\mu = \frac{\lambda_a}{\lambda_m} = \frac{8}{5} = 1.6$

11. **Ans (D)**

$\frac{1}{f_{air}} = (\mu - 1)\left(\frac{1}{R} - \frac{1}{-R}\right)$

$\frac{1}{20} = (1.5-1)\left(\frac{2}{R}\right)$

R = 20 cm

focal length of liquid lens in air

$\frac{1}{f} = (1.6-1)\left(\frac{1}{-20} - \frac{1}{\infty}\right)$

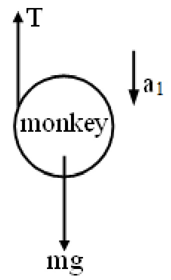
$f = \frac{-200}{6} = \frac{-100}{3}$ cm

$\therefore \frac{1}{f_{comb}} = \frac{-3}{100} \times 2 + \frac{1}{20}$

$f_{comb} = -100$ cm

12. **Ans (C)**

F.B.D of monkey while moving downward

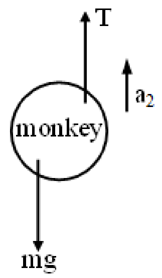


Using Newton's second law

$mg - T = ma_1$

$\therefore 500 - T = 50 \times 4 \Rightarrow T = 300$ N

F.B.D of monkey while moving up



Using Newton's second law of motion

$T - mg = ma_2$

$\Rightarrow T - 500 = 50 \times 5$

$\Rightarrow T = 750$ N

Breaking strength of string = 350 N

$\therefore$ String will break while monkey is moving upward

13. Ans (C)

L_0 = angular momentum of shell about O.

As shell is rolling

so $V_{cm} = \omega R$

$L_0 = mV_{cm} R + I\omega$

$= 1 \times wR \times R + \frac{2}{3}R^2\omega$

$= \frac{5}{3}R^2\omega$

so a = 5

14. Ans (D)

$X_P(t) = \alpha t + \beta t^2 \quad X_Q = ft - t^2$

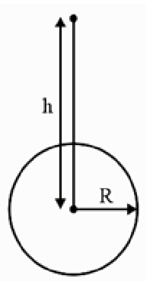
$V_P(t) = \alpha + 2\beta t \quad V_Q = f - 2t$

$V_P = V_Q$

$\alpha + 2\beta t = f - 2t$

$t = \frac{f-\alpha}{2\beta + 2}$

15. Ans (B)



$-\frac{GMm}{R} + \frac{1}{2}m\lambda^2 V_e^2 = -\frac{GMm}{h}$

$-\frac{GMm}{R} + \frac{1}{2}\lambda^2 \frac{2GMm}{R} = -\frac{GMm}{h}$

$\frac{\lambda^2}{R} - \frac{1}{R} = \frac{-1}{h}$

$\frac{1}{h} = \frac{1-\lambda^2}{R}$

$h = \frac{R}{1-\lambda^2}$

16. Ans (B)

$\frac{dw}{dt} = 6t^2 - 2t$

$\int_{10}^{w} dw = 2t^3 - t^2$

$w = 10 + 2t^3 - t^2$

$\frac{d\theta}{dt} = 10 + 2t^3 - t^2$

$\int_4^{\theta} d\theta = 10 + 2t^3 - t^2$

$\int_4^{\theta} d\theta = 10t + \frac{t^4}{2} - \frac{t^3}{3}$

$\theta = 4 + 10t + \frac{t^4}{2} - \frac{t^3}{3}$

17. Ans (C)

let the wrong scale has total n number of parts between lower fixed point θ_0 and upper fixed point, then we have

$\frac{C-0}{100} = \frac{\theta - \theta_0}{n}$

where θ is any unknown temperature.

For $C = 0°C$, $\theta = -10°C$ (given)

$\frac{0}{100} = \frac{-10-\theta_0}{n}$ or $q_0 = -10°C$

For $C = 50°C$; $\theta = 60°C$ (given)

$\frac{50-0}{100} = \frac{60-\theta_0}{n}$

$\frac{50}{100} = \frac{60-(-10)}{n} = \frac{70}{n}$

$n = \frac{70 \times 100}{50} = 140$

18. **Ans (B)**

Power radiated, $P = e\,As\,T^{-4}$

i.e., $P \propto AT^{-4}$

Using Wien's displacement law,

$T \propto \frac{1}{\lambda_m}$

$\therefore\ P \propto \frac{A}{\lambda_m^4} \propto \frac{r^2}{\lambda_m^4}$

$Q_a : Q_b : Q_c = \frac{(2)^2}{(300)^4} : \frac{(4)^2}{(400)^4} : \frac{(6)^2}{(500)^4}$

Hence, Q_b is maximum

19. **Ans (C)**

$\Delta E = eA\,s\,(T^4 - T_0^4)$

$\frac{(\Delta E)_{sphere}}{(\Delta E)_{cube}} = \frac{\text{Surface area of sphere}}{\text{Surface area of cube}} = \frac{4\pi R^2}{6\alpha^2}$

where R is the radius of sphere and a is the side of the cube.

Given $\frac{4}{3}\pi R^3 = a^3 \Rightarrow a = \left(\frac{4}{3}\pi\right)^{1/3}.R$

$\therefore\ \frac{(\Delta E)_{sphere}}{(\Delta E)_{cube}} = \frac{4\pi R^2}{6\left\{\left(\frac{4}{3}\pi\right)^{1/3}.R\right\}^2}\left(\frac{\pi}{6}\right)^{1/3}$

20. **Ans (A)**

$ms\Delta\theta = m_{ice}L$

$80 \times 1 \times (30 - 0) = m_{ice} \times 80$

$m_{ice} = 30$ g

PART-1 : PHYSICS

SECTION-II

1. **Ans (5)**

For diode $P_{max} = VI_{max}$

$100 \times 10^{-3} = (0.5)\,I_{max}.$

$I_{max} = 200 \times 10^{-3}$

In the circuit

$V_R = 1.5 - 0.5 = 1.0$

$(I_{max})R = 1.0V$

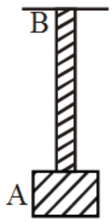
$R = \frac{1}{200 \times 10^{-3}} = 5\Omega$

2. **Ans (18)**

$v = \frac{kq}{r}$

$r = \sqrt{(4-1)^2 + (7-3)^2 + (2-2)^2} = 5$ m

3. **Ans (12)**



$v = n\,.\,\lambda = \sqrt{\frac{T}{m}}$

$v \propto \lambda \propto \sqrt{T}$

$\frac{0.06}{\lambda} = \sqrt{\frac{2 \times g}{(2+6) \times g}}$

$\lambda = 0.12$ m

4. **Ans (600)**

$U_i + K_i = U_f + K_f$

$\Rightarrow 0 + \frac{1}{2}m(12)^2 = \frac{1}{2}K(0.3)^2 + \frac{1}{2}m(6)^2$

$\Rightarrow 0.5\left(12^2 - 6^2\right) = K(0.3)^2$

K = 600 N/m

PART-2 : CHEMISTRY

SECTION-I

1. **Ans (A)**

$Pb(NO_3)_2 \xrightarrow{\Delta} PbO_2 + NO_2 + O_2$

5. **Ans (B)**

The biggest jump occurs from IE_3 to IE_4

$IE_3 << IE_4$

$(IE_n) \quad (IE_{n+1})$

n(Valence e^-) = 3

Hence, the electronic configuration of the atom will be $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$

7. **Ans (D)**

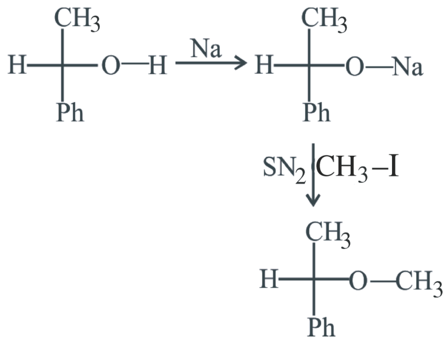
Proton $({}_1P^1)$, Deuteron $({}_1D^2)$, Alpha $({}_2He^4)$

$\lambda = \frac{h}{\sqrt{2m(KE)}}$

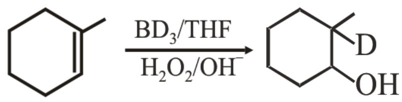
If, they have similar value of λ then particle having greater mass has lower KE.

Order of KE : $E_\alpha < E_d < E_p$

8. **Ans (B)**

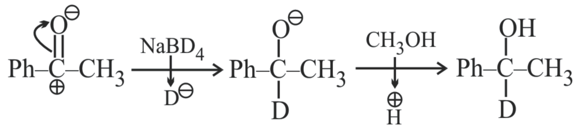


9. **Ans (B)**

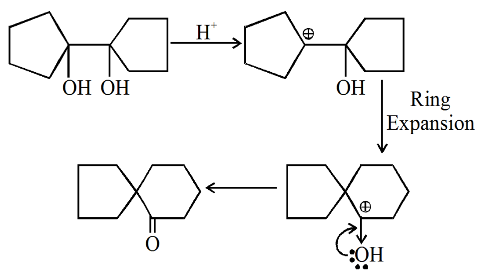


It is HBO reaction. The product of this reaction is similar of addition of H_2O according antimarkonikoff rule

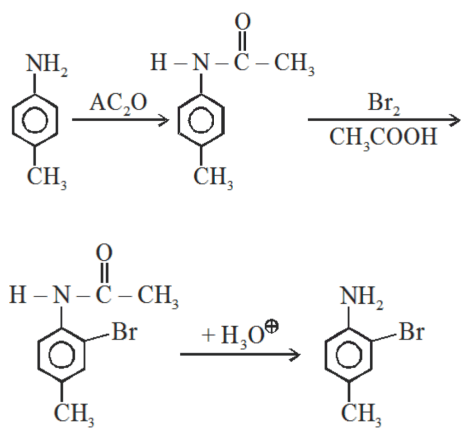
10. **Ans (A)**



11. **Ans (C)**



12. **Ans (C)**



13. **Ans (B)**

Position of –OH GP & – CH_2OH are on same side on C_1 & C_4 carbon

14. Ans (B)

$$x\text{Å} = \frac{1}{R(2)^2} = \frac{1}{R \times 4}$$

$$y = \frac{2^2}{R(3)^2} = \frac{4}{R \times 9}$$

$$\frac{x}{y} = \frac{1}{4} \times \frac{9}{4} = \frac{9}{16}$$

$$y = \frac{16}{9} x\text{Å}$$

17. Ans (B)

$$N_1V_1 + N_2V_2 = NV$$

$$4 + 1 = W \times 300$$

$$[H^+] = \frac{5}{300} = 1.6 \times 10^{-2}$$

$$P^H = 2 - \log 1.6 = 1.78$$

18. Ans (D)

$$\text{mol} \times 5 = 1 \times 8$$

$$\text{moles of } KMnO_4 = \frac{8}{5} = 1.6$$

PART-2 : CHEMISTRY

SECTION-II

2. Ans (11)

$X = KMnO_4$

$Y = MnO_2$

3. Ans (20)

$x = 5$

2, 3, 7, 11, 12 (Aromatic compound)

$y = 4$

1, 2, 5, 6 (Anti Aromatic compound)

Thus $\Rightarrow x \times y = 5 \times 4 = 20$

5. Ans (24)

$$n_{CO_2} = 6n \times \frac{1}{180n} = \frac{1}{30}$$

$$t = \frac{3600}{5 \times 30} = 24$$

PART-3 : MATHEMATICS

SECTION-I

1. Ans (D)

$$T_{r+1} = {}^{711}C_r \, 7^{\frac{711-r}{7}} \, 11^{\frac{r}{11}}$$

r = 11, 88, 165, 232, 319, 396, 473, 550, 627, 704

10 terms are rational

2. Ans (D)

Put $Z = x + iy$

$$(x-3)^2 + (y-4)^2 + (x+2)^2 + (y-7)^2$$

$$+ (x-5)^2 + (y+2)^2$$

$$= 3x^2 + 3y^2 - 12x - 18y + 107$$

$$= 3\,[(x-2)^2 + (y-3)^2] + 68$$

The least value occurs at $x = 2, y = 3$

4. Ans (B)

$$f\left(x + \frac{7}{4}\right) = f\left(\frac{7}{4} - 4\right) \ \forall\ x \in R$$

$\Rightarrow$ f(x) is symmetric about $x = \frac{7}{4}$

$$-\frac{b}{2a} = \frac{7}{4} \Rightarrow -\frac{b}{a} = \frac{7}{4}$$

$ax^2 + bx + a = 7x + a$ has one real solution. So D =

0

$$(b-7)^2 = 0 \Rightarrow b = 7$$

$a = -2 \qquad a + b = 5$

5. **Ans (D)**

$|B| = 27$

$|\text{adj } A| = 27$

$|A|^3 = 27 \quad |A| = 3$

$|A^{-1} \text{ adj}(3AB)| = |A|^{-1} |\text{adj}(AB)|$

$= \frac{1}{3} \times 3^{12}|\text{adj}AB|$

$3^{11} \times |AB|^3$

$3^{11} \times |A|^3 |B|^3$

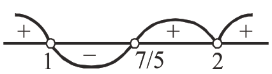
$3^{11} \times 3^3 \times (3^3)^3 = 3^{23}$

6. **Ans (A)**

$f'(x) = 2(x-1)(x-2)^3 + 3(x-1)^2(x-2)^2$

$= (x-1)(x-2)^2\{2(x-2) + 3(x-1)\}$

$= (x-1)(x-2)^2(5x-7)$



sign change of $f'(x)$ from +ve to −ve at $x = 1$

$\therefore$ Maximum at $x = 1$

7. **Ans (B)**

$v = \frac{4}{3}\pi r^3$

$\Rightarrow 16 = 4\pi r^2 \Rightarrow r = \frac{2}{\sqrt{\pi}}$

8. **Ans (C)**

$f'(x) = 2^2x + 4^2x^3 + 6^2x^5 + \dots + (100)^2x^{99}$

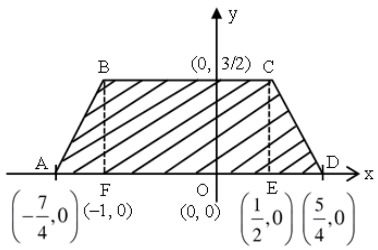
$= x(2^2 + 4^2x^2 + 6^2x^4 + \dots + (100)^2x^{98})$

$\therefore$ only one minimum

10. **Ans (C)**

$$y = \begin{cases} 3 + (x+1) + \left(x - \frac{1}{2}\right), & x < -1 \\ 3 - (x+1) + \left(x - \frac{1}{2}\right), & -1 \le x < \frac{1}{2} \\ 3 - (x+1) - \left(x - \frac{1}{2}\right), & \frac{1}{2} \le x \end{cases}$$

$$y = \begin{cases} \frac{7}{2} + 2x, & x < -1 \\ \frac{3}{2}, & -1 \le x < \frac{1}{2} \\ \frac{5}{2} - 2x, & \frac{1}{2} \le x \end{cases}$$



Area bounded = ar ABF + ar BCEF + ar CDE

$= \frac{1}{2}\left(\frac{3}{4}\right)\left(\frac{3}{2}\right) + \left(\frac{3}{2}\right)\left(\frac{3}{2}\right) + \frac{1}{2}\left(\frac{3}{4}\right)\left(\frac{3}{2}\right)$

$= \frac{27}{8}$ sq. units.

11. **Ans (D)**

$$I = \int_0^5 \cos\left(\pi x - \pi\left[\frac{x}{2}\right]\right)dx$$

$$\Rightarrow I = \int_0^2 \cos(\pi x)dx + \int_2^4 \cos(\pi x - \pi)dx + \int_4^5 \cos(\pi x - 2\pi)dx$$

$$\Rightarrow I = \left[\frac{\sin \pi x}{\pi}\right]_0^2 + \left[\frac{\sin(\pi x - \pi)}{\pi}\right]_2^4 + \left[\frac{\sin(\pi x - 2\pi)}{\pi}\right]_4^5$$

$\Rightarrow I = 0$

12. **Ans (A)**

$$\left(\frac{x}{\sqrt{x^2-y^2}}+e^{\frac{y}{x}}\right)x\frac{dy}{dx}=x+\left(\frac{x}{\sqrt{x^2y^2}}+e^{\frac{y}{x}}\right)y$$

$$\Rightarrow e^{\frac{y}{x}}(x\,dy-y\,dx)+\frac{x}{\sqrt{x^2-y^2}}(xdy-ydx)=xdx$$

Dividing both side by x^2

$$\Rightarrow e^{\frac{y}{x}}\left(\frac{xdy-y\,dx}{x^2}\right)+\frac{1}{\sqrt{1-\left(\frac{y}{x}\right)^2}}\left(\frac{xdy-ydx}{x^2}\right)=\frac{dx}{x}$$

$$\Rightarrow e^{\frac{y}{x}}\,|\,d\left(\frac{t}{x}\right)+\frac{1}{\sqrt{1-\left(\frac{y}{x}\right)^2}}d\left(\frac{y}{x}\right)=\frac{dy}{x}$$

Integrate both side.

$$\int e^{\frac{y}{x}}d\left(\frac{y}{x}\right)+\int\frac{1}{\sqrt{1-\left(\frac{y}{x}\right)^2}}d\left(\frac{y}{x}\right)=\int\frac{dx}{x}$$

$$\Rightarrow e^{\frac{y}{x}}+\sin^{-1}\left(\frac{y}{x}\right)=\ln x+c$$

It passes through (1, 0)

$1+0=0+c \Rightarrow c=1$

It passes through (2a, a)

$$e^{\frac{1}{2}}+\sin^{-1}\frac{1}{2}=\ln 2\alpha+1$$

$$\Rightarrow \ln 2\alpha=\sqrt{e}+\frac{\pi}{6}-1$$

$$\Rightarrow 2\alpha=e^{\left(\sqrt{e}+\frac{\pi}{6}-1\right)}$$

$$\Rightarrow \alpha=\frac{1}{2}e^{\left(\frac{\pi}{6}+\sqrt{e}-1\right)}$$

13. **Ans (B)**

$$\int\left(\frac{x^2+1}{(x+1)^2}\right)e^x.dx=\int\left(\frac{x^2-1+2}{(x+1)^2}\right)e^x\,dx$$

$$=\int\left(\frac{x-1}{x+1}+\frac{2}{(x+1)^2}\right)e^x\,dx$$

$$=\int\left(f(x)+f'(x)\right)e^x\,dx=f(x)\,e^x+c$$

Where $f(x)=\dfrac{x-1}{x+1}$

$$f'(x)=\frac{2}{(x+1)^2}$$

$$f''(x)=\frac{-4}{(x+1)^3}=\frac{12}{(x+1)^4}$$

$$f''(1)=\frac{12}{16}=\frac{3}{4}$$

14. **Ans (A)**

$\cot\alpha=1$, $\sec\beta=\dfrac{-5}{3}$, $\cos\beta=\dfrac{-3}{5}$, $\tan\beta=\dfrac{-4}{3}$

$$\tan(\alpha+\beta)=\frac{1-\frac{4}{3}}{1+\frac{4}{3}\times 1}=\frac{-1}{7}$$

15. **Ans (B)**

$$\cos\frac{2\pi}{7}+\cos\frac{4\pi}{7}+\cos\frac{6\pi}{7}$$

$$=\frac{\sin\left(3\times\frac{\pi}{7}\right)}{\sin\frac{\pi}{7}}\times\cos\left(\frac{\frac{2\pi}{7}+\frac{6\pi}{7}}{2}\right)$$

$$=\frac{2\sin\left(\frac{3\pi}{7}\right)}{2\sin\frac{\pi}{7}}\times\cos\left(\frac{4\pi}{7}\right)=\frac{-\sin\frac{\pi}{7}}{2\sin\frac{\pi}{7}}=-\frac{1}{2}$$

17. **Ans (C)**

Let $P(r, \theta)$ be the point which is maximum distance from origin.

$x = r\cos\theta,\ y = r\sin\theta$

$p(r\cos\theta, r\sin\theta)$ lies on curve

$r^2\cos^2\theta + 2r^2\sin^2\theta + 2r^2\cos\theta\sin\theta = 1$

$$r^2 = \frac{1}{\cos^2\theta + 2\sin^2\theta + \sin 2\theta}$$

$$r^2 = \frac{1}{1+\sin^2\theta + \sin 2\theta} = \frac{2}{3-\cos 2\theta + 2\sin 2\theta}$$

$(3 - \cos 2\theta + 2\sin 2\theta)_{min} = 3 - \sqrt{5}$

$$r_{max} = \sqrt{\frac{2}{3-\sqrt{5}}}$$

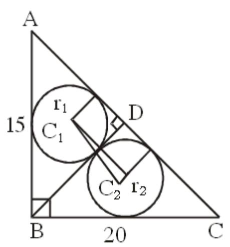
18. **Ans (D)**

$AC = \sqrt{15^2 + 20^2} = 25$

$BD = 12$

$AD = 9$

$CD = 16$



$$r_1 = \frac{\Delta}{S} = \frac{\frac{1}{2}\times 12 \times 9}{\frac{12+9+15}{2}} \Rightarrow \frac{9\times 12}{36} = 3$$

$$r_2 = \frac{\Delta}{S} = \frac{\frac{1}{2}\times 16 \times 12}{\frac{20+16+12}{2}} \Rightarrow \frac{16\times 12}{48} = 4$$

distance C_1C_2

$$= \sqrt{(r_2 - r_1)^2 + (r_1 + r_2)^2} = \sqrt{1+49} = \sqrt{50}$$

19. **Ans (B)**

$a_1e_1 = a_2e_2$ or $a_1^2e_1^2 = a_2^2e_2^2$

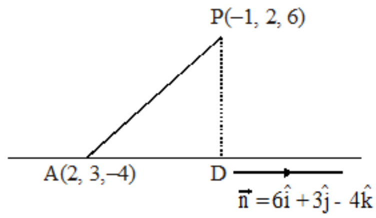
or $\quad a_1^2\left(1 - \frac{b_1^2}{a_1^2}\right) = a_2^2\left(1 + \frac{b_2^2}{a_2^2}\right)$

or $\quad a_1^2 - b_1^2 = a_2^2 + b_2^2$

$$16 - a = \left(\frac{12}{5}\right)^2 + \left(\frac{9}{5}\right)^2 = \frac{225}{25} = 9$$

$\therefore \quad a = 7$

20. **Ans (A)**



$$AD = \left|\frac{\overrightarrow{AP}\cdot\vec{n}}{|\vec{n}|}\right| = \sqrt{61}$$

$$\Rightarrow PD = \sqrt{AP^2 - AD^2} = \sqrt{110 - 61} = 7$$

PART-3 : MATHEMATICS

SECTION-II

1. **Ans (96)**

$A \geq G$

$$\frac{x^2 + 2xy + 2xy + 4y^2 + z^2 + z^2}{6} \geqslant (x^4y^4z^4 \cdot 16)^{1/6}$$

$x^2 + 4xy + 4y^2 + 2z^2 \geq 6 \times 2^4 \geq 96$

2. Ans (6)

The given limit has $\frac{0}{0}$ form.

Using L' Hospital's rule, we have

Limit$= \lim_{x\to 0} \frac{2f'(x) - 6f'(2x) + 4f'(4x)}{2x} \left(\frac{0}{0}\text{form}\right)$

$= \lim_{x\to 0} \frac{2f''(x) - 12f''(2x) + 16f''(4x)}{2}$

(Using L' Hospital's rule)

$= \frac{6f''(0)}{2} = 6$

3. Ans (12)

Given $\pi a^2 - \pi ab = 30\pi$ and $\pi ab - \pi b^2 = 18\pi$

on subtracting, we get $(a-b)^2 = a^2 - 2ab + b^2 = 12$

4. Ans (0)

$20 = \frac{\sum_{i=1}^{7} |x_i - 62|^2}{7}$

$\Rightarrow |x_1 - 62|^2 + |x_2 - 62|^2 + ... + |x_7 - 62|^2 = 140$

If $x_1 = 49$

$|49 - 62|^2 = 169$

then, $|x_2 - 62|^2 + ... + |x_7 - 62|^2 = \text{Negative Number}$

which is not possible, therefore, no student can fail.

5. Ans (5)

Let $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ are (1, 1, 1), (–1, 1, 1)

(1, –1, 1), (–1, –1, 1) and rest of the vector are

$-\vec{a}, -\vec{b}, -\vec{c}, -\vec{d}$

Here 3 vectors will be coplanar if two will be collinear (anti parallel)

Number of ways of selecting two anti parallel pair = 4

Number of ways of selecting third vector = 6

Total number of ways = 24

Total number of ways of non coplaner selection

$= {}^8C_3 - 24 = 32 = 25$