Paper Code : 1001CT102116001

ALLEN CAREER INSTITUTE KOTA (RAJASTHAN) path to success

CLASSROOM CONTACT PROGRAMME

(Academic Session : 2016 - 2017)

JEE (Main + Advanced) : ENTHUSIAST COURSE (PHASE : I)

ANSWER KEY : PAPER-1 **TEST DATE : 01-05-2016**

Test Type : MINOR Test Pattern : JEE-Advanced

PART-1 : PHYSICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	B,C	A,D	A,B,D	A,C,D	A,B,C,D	B,D	B,C	C,D	A	C
	Q.	11	12								
	A.	A	A								
SECTION-IV	Q.	1	2	3	4	5	6	7	8		
	A.	3	4	2	3	3	8	3	5		

PART-2 : CHEMISTRY

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	A,B,D	A,C,D	A,B,C,D	B,D	A,C,D	A,C,D	A,B,C,D	A,B,D	B	B
	Q.	11	12								
	A.	D	A								
SECTION-IV	Q.	1	2	3	4	5	6	7	8		
	A.	2	3	2	5	7	6	4	4		

PART-3 : MATHEMATICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	A,C	Bonus	A,B	A,B,C	A	B,D	A,C or A,C,D	A,B,D	C	C
	Q.	11	12								
	A.	A	D								
SECTION-IV	Q.	1	2	3	4	5	6	7	8		
	A.	2	5	0	4	6	2	1	2		

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ANSWER KEY : PAPER-2 **TEST DATE : 01-05-2016**

Test Type : MINOR Test Pattern : JEE-Advanced

PART-1 : PHYSICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	D	B	A	C	D	C	A	D	C	D
	Q.	11	12								
	A.	B	C								
SECTION-II	Q.1	A	B	C	D	Q.2	A	B	C	D	
		P,Q,R	S	P,T	S		S	S	Q	R	
SECTION-IV	Q.	1	2	3	4	5	6				
	A.	5	1	9	8	5	3				

PART-2 : CHEMISTRY

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	D	B	C	C	C	D	A	B	B	D
	Q.	11	12								
	A.	C	B								
SECTION-II	Q.1	A	B	C	D	Q.2	A	B	C	D	
		Q,R,T	P,S	P,Q,T	P		P,R,S,T	P,Q,R,S,T	P,R,S,T	P,R,S,T	
SECTION-IV	Q.	1	2	3	4	5	6				
	A.	9	5	0	4	4	6				

PART-3 : MATHEMATICS

SECTION-I	Q.	1	2	3	4	5	6	7	8	9	10
	A.	B	C	B	D	C	C	D	A	A	D
	Q.	11	12								
	A.	B	D								
SECTION-II	Q.1	A	B	C	D	Q.2	A	B	C	D	
		R	Q	S	R		Q	P	R	Q	
SECTION-IV	Q.	1	2	3	4	5	6				
	A.	6	0	4	1	3	2				

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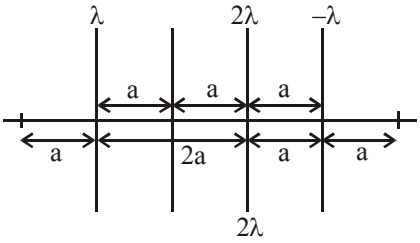
PAPER-1

PART-1 : PHYSICS SOLUTION

SECTION-I

1. Ans. (B,C)

Sol.



at $x = -2a$

$$-\frac{2k\lambda}{a}\hat{i}-\frac{2k\times 2\lambda}{3a}\hat{i}+\frac{2k\lambda}{4a}\hat{i}$$

$$2k\lambda\left[\frac{-12-16+3}{12a}\right]\hat{i}$$

$$-\frac{25k\lambda}{6a}\hat{i}$$

At $x = 0$

$$\frac{2k\lambda}{a}\hat{i}-\frac{2k\times 2\lambda}{a}\hat{i}+\frac{2k\lambda}{3a}\hat{i}$$

$$\frac{3k\lambda}{a}\hat{i}-\frac{4k}{a}\hat{i}$$

$$=-\frac{k\lambda}{a}\hat{i}$$

At $x = \frac{3a}{2}$

$$\frac{4k\lambda}{5a}\hat{i}+\frac{2k\times 2\lambda}{\frac{a}{2}}\hat{i}+\frac{k\lambda}{a}\hat{i}$$

$$\frac{4+40+20}{5a}$$

2. Ans. (A,D)

3. Ans. (A,B,D)

Sol.

$$E\times 4\pi x^2=\frac{\int_0^x \frac{Q}{ar^2}\times 4\pi r^2\times dr}{\epsilon_0}$$

$$E=\frac{Q}{ax\,\epsilon_0}$$

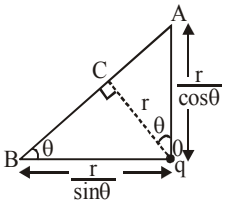
4. Ans. (A,C,D)

5. Ans. (A,B,C,D)

Sol. $\phi_{net}=\frac{q_{in}}{\epsilon_0}$

6. Ans. (B,D)

Sol.



$$\vec{E}_A=\frac{kq^2\cos^2\theta}{r^2}$$

$$\vec{E}_B=\frac{kq^2\sin^2\theta}{r^2}$$

$$\vec{E}_C=\frac{kq^2}{r^2}$$

7. Ans. (B,C)

Sol. Stress = y × strain

$$\frac{F}{A}=Y\times\frac{\Delta\ell}{\ell}\Rightarrow(\Delta\ell)\propto\frac{F}{A}=\text{Stress}$$

$$\left[\text{Energy stored}=\frac{1}{2}\times F\times\Delta\ell\right]$$

8. Ans. (C,D)

9. Ans. (A)

10. Ans. (C)

11. Ans. (A)

Sol. $mC_A \times (150 - 0)$

$= mC_B (T_B - 150)$

$m \times C_A (500 - 350)$

$= mC_B (350 - T_B)$

$T_B - 150 = 350 - T_B$

$2T_B = 500$

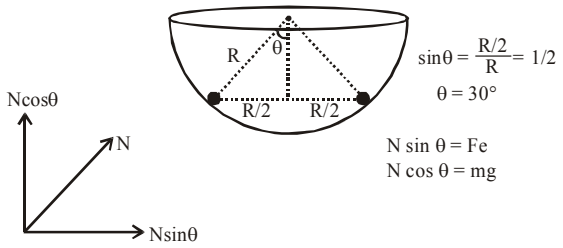
$T_B = 250$

12. Ans. (A)

SECTION-IV

1. Ans. 3

Sol.



$$\tan\theta = \frac{Fe}{mg} = \frac{kq^2}{R^2 \times mg} = \tan 30°$$

$$\frac{1}{\sqrt{3}} = \frac{9\times10^9 \times q^2}{(1)^2 \times (\sqrt{3}) \times 10}$$

$$q^2 = \frac{1}{9\times10^8} \Rightarrow q = \frac{1}{3}\times10^{-4}\,C$$

$n = 3$

2. Ans. 4

Sol. $$\frac{\sigma}{2\epsilon_0}\left[1 - \frac{x}{\sqrt{R^2+x^2}}\right] = \frac{\sigma}{5\epsilon_0}$$

$$= \frac{1}{2}\left[1 - \frac{3}{\sqrt{R^2+x^2}}\right] = \frac{1}{5}$$

$$= 1 - \frac{3}{\sqrt{R^2+x^2}} = \frac{2}{5} \Rightarrow \frac{3}{5} = \frac{3}{\sqrt{R^2+x^2}}$$

$R^2 + 3^2 = 5^2$

$R = 4m$

3. Ans. 2

Sol. $$\pi R^2 E = \frac{Q}{2\epsilon_0}$$

$$E = \frac{Q}{2\pi\epsilon_0 R^2}$$

4. Ans. 3

Sol. $m_{snow} = m_{water} = (90 - V_{Al})\ 1\ gm/cc$

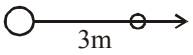
$$= \left(90 - \frac{162}{8.1}\right) = 70\ gm$$

$$\text{Density} = \frac{70}{150}\ gm/cc.$$

$$= \frac{1400}{3}\ kg/m^3$$

5. Ans. 3

Sol.



$F = 3a$

$$F - \frac{9\times10^9 \times 2\times10^{-9}}{9} = 1a = \frac{F}{3}$$

$$\frac{2F}{3} = 2 \Rightarrow F = 3$$

6. Ans. 8

Sol. $2\rho Vg - \rho Vg = C \times 10$

$\rho Vg = C \times 10$

$2\rho Vg - T = 0$

$T - CV + \rho Vg - 2\rho Vg = 0$

$CV = \rho Vg$

7. Ans. 3

Sol. $$\frac{\Delta\rho}{\rho g} = \frac{u^2 - 4}{2g}$$

$$250 \times 10^{-3} \times 10 = \frac{u^2 - 4}{2} \Rightarrow u^2 - 4 = 5$$

$u^2 = 9$

8. Ans. 5

Sol. $$\frac{1}{2}\times\left(\frac{10}{10^{-7}}\right)^2 \times \frac{1}{10^{11}} \times 10^{-7} \times 1 = 100 \times 10^{-2} \times \alpha \times 10^{-3}$$

PART–2 : CHEMISTRY — SOLUTION

SECTION - I

1. Ans. (A,B,D)

SO_2 is molecular (polar) solid.

2. Ans. (A,C,D)

(B) Both hcp and fcc have 74% packing

(D) $0.414 \le \frac{r_+}{r_-} < 0.732$ then most probable co-ordination number of cation is 6.

(C) $\frac{r_{0V}}{r} = 0.414$, $\frac{r_{tv}}{r} = 0.225$

3. Ans. (A,B,C,D)

4. Ans. (B,D)

5. Ans. (A,C,D)

6. Ans. (A,C,D)

7. Ans. (A,B,C,D)

8. Ans. (A,B,D)

9. Ans. (B)

$6 \times \frac{\sqrt{3}}{4}(2 \times 10^{-10}\text{m})^2$ is occupied by '3' CH_3COOH molecules

$\sqrt{3}\times10^3\text{m}^2$ is occupied by

$$\frac{3}{6\times\frac{\sqrt{3}}{4}(2\times10^{-10})}\times\sqrt{3}\times10^3$$

$$= \frac{1}{2}\times10^{23}\text{ molecules}$$

$$= \frac{1}{12}\text{ moles}$$

10. Ans. (B)

Say initial % w/v = x

$$\frac{x\times10}{60}\times0.5-\frac{1}{12}=\frac{1}{3}\times0.5$$

x = 3

11. Ans. (D)

12. Ans. (A)

SECTION - IV

1. Ans. 2

$$B_{8\times\frac{1}{8}+6\times\frac{1}{2}}\ A_{12\times\frac{1}{4}+1+\frac{8}{2}} = B_4A_8 \text{ or } A_2B$$

x = 2

2. Ans. 30 [OMR Ans. 3]

$$\overset{10\text{ml}}{CO} + \frac{1}{2}O_2 \longrightarrow \underset{10\text{ml}}{CO_2}$$

$V_f = V_{CO_2}$ + Volume of remaining air.

= 10 + 20 = 30 ml

3. Ans. 2

4. Ans. 5

5. Ans. 70 [OMR Ans. 7]

6. Ans. 6

7. Ans. 4

8. Ans. 4

PART-3 : MATHEMATICS SOLUTION

SECTION-I

1. Ans. (A,C)

$$\lim_{x\to 0}\left(\frac{\sin 3x+\alpha x+\beta x^3}{x^3}\right)$$

$$=\lim_{x\to 0}\left(\frac{\left(3x-\frac{(3x)^3}{3!}+....\right)+\alpha x+\beta x^3}{x^3}\right)$$

for existence of limit $\alpha=-3$ & $\beta=9/2$

2. Ans. (Bonus)

$RHL = f(0^+) = \lim_{x\to 0^+} f(x)$

$$=\lim_{x\to 0^+} 3\left(1+\frac{|\sin x|}{3}\right)^{\frac{6}{|\sin x|}} = 3e^2$$

$LHL = f(0^-) = \lim_{x\to 0^-} f(x) = 3e^a$

Now, $3e^2 = b = 3e^a$

$\therefore\ b = 3e^2$ & $a = 2$

3. Ans. (A,B)

$$\sum_{\lambda=1}^{5}\left(\tan^{-1}(\lambda+1)-\tan^{-1}\lambda\right)=\tan^{-1}\frac{5}{7}=\cot^{-1}\frac{7}{5}$$

$$\therefore\ 5\cot\cot^{-1}\left(\frac{7}{5}\right)=7$$

4. Ans. (A,B,C)

Do yourself

5. Ans. (A)

$4\{x\} = x + [x]$

The above equation has 2 solutions

i.e. $x = 0$ & $x = 5/3$

6. Ans. (B,D)

$x^2 + kx + k \geq 0\ \forall\ x \in R$

$D \leq 0 \Rightarrow k \in [0, 4]$.....(1)

Also, $x^2 + k \neq 0\ \forall\ x \in R$

$(1) \cap (2)$

$k \in (0, 4]$

7. Ans. (A,C or A,C,D)

8. Ans. (A,B,D)

It is obvious

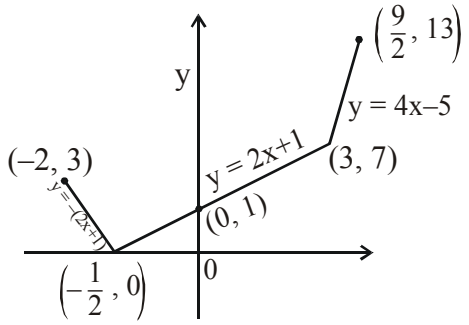
Paragraph for Question 9 and 10

9. Ans. (C)

10. Ans. (C)

$$f(g(x)) = \begin{cases} -(2x+1)\ ;\ -2 \leq x -\frac{1}{2} \\ 2x+1\ ;\ -\frac{1}{2} \leq x \leq 3 \\ 4x-5\ ;\ 3 < x \leq \frac{9}{2} \end{cases}$$

$y = f(g(x))$



Paragraph for Question 11 and 12

11. Ans. (A)

12. Ans. (D)

$f(x) = x\ \forall\ x \in R$

$g(x) = |x| + |x-1|\,|x+1|\ \forall\ x \in R$

$g(f(x)) = g(x)$,

Hence, $g(f(x))$ is non-derivable at $x = -1, 0, 1$

SECTION – IV

1. Ans. 2

$$\lim_{a\to\infty}\left(\frac{\left(a^2+8a+3\right)-\left(a^2+4a+2\right)}{\sqrt{a^2+8a+3}+\sqrt{a^2+4a+2}}\right)=2$$

$\therefore\ \tan^2\alpha + \cot^2\alpha = 2 \Rightarrow \tan^2\alpha = 1$

$\Rightarrow\ \sin^2\alpha = \cos^2\alpha = \frac{1}{2}$

$$\sum_{n=1}^{\infty}(\sin^{2n}\alpha+\cos^{2n}\alpha)=\sum_{n=1}^{\infty}\left[\left(\frac{1}{2}\right)^n+\left(\frac{1}{2}\right)^n\right]=2$$

2. Ans. 5

3. Ans. 0

$$f(x) = \cos(2x-1)\frac{\pi}{2}.|(x-2)(x-3)| + 2ex$$

derivable on R

der. on R

Hence, 0 points of non–derivability

4. Ans. 4

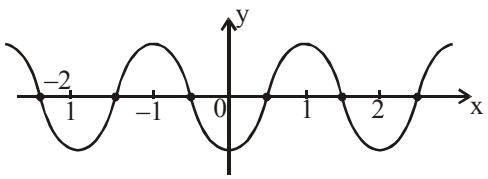
$k = 4$

$f(x) = x^2$

$$\lim_{x\to 0}(1+x^2)^{\left(\frac{2}{1-\cos x}\right)} = e^4$$

5. Ans. 6

$\lim\limits_{x\to\infty} P(x) \to \infty$ and $\lim\limits_{x\to(-\infty)} P(x) \to \infty$.



$P(0) = -1$ and $P(x)$ is even this

$P(1) = P(-1) = 1$ & $P(2) = P(-2) = -1$.

Hence, from IVT minimum no. of zeroes are 6.

6. Ans. 2

Both roots of equation $x^2 - x + k - 2 = 0$ must be distinct and positive

then, $k \in \left(2, \frac{9}{4}\right)$

$\therefore \quad 8\,(b - a) = 2$

7. Ans. 1

$$\lim_{x\to 0^-}\left[\frac{4f(x)-12}{\tan(2f(x)-6)}\right] = \lim_{x\to 0^-}\left[\frac{2(2f(x)-6)}{\tan(2f(x)-6)}\right] = 1$$

8. Ans. 2

$g(x) = f(f^2(x))$

$g'(x) = f'(f^2(x)).\,(2f(x).\,f'(x))$

$g'(0) = f'(f^2(0)).\,(2f(0).f'(0))$

$= f'(1).\,(2(-1).(1))$

$= (-1)(-2) = 2$

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PAPER-2

PART-1 : PHYSICS SOLUTION

SECTION-I

1. Ans. (D)

Sol. $\dfrac{K\times\left(5\times10^{-6}\right)^2}{r^2\times2.5}=\dfrac{K(5-Q)(5+Q)\times10^{-12}}{r^2}$

2. Ans. (B)

Sol. Electric field is maximum at $\dfrac{R}{\sqrt{2}}$ so force will be maximum at $\dfrac{R}{\sqrt{2}}$

3. Ans. (A)

Sol. $E_1=\dfrac{nkQR}{\left(R^2+R^2\right)^{\frac{3}{2}}}$

$E_2=\dfrac{nkQ(2R)}{\left(R^2+(2R)^2\right)^{\frac{3}{2}}}$

$\dfrac{E_1}{E_2}=\dfrac{5\sqrt{5}}{4\sqrt{2}}$

4. Ans. (C)

Sol. $\phi=\oint\vec{E}\cdot\overrightarrow{dA}$

$=3.00yj\times(1.4)^2$

$=3\times1.4\times(1.4)^2$

$=8.23\ Nm^2/C]$

5. Ans. (D)

Sol. Induction effect.

6. Ans. (C)

7. Ans. (A)

8. Ans. (D)

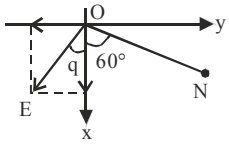
Sol. $\rho=10^5+\int_0^{10}\left(100+6h^2\right)gdh$

$=1.3\times10^5\ Pa$

9. Ans. (C)

10. Ans. (D)

Sol. The direction of electric field is in x-y plane as shown in figure



The magnitude of electric field is

$E=\sqrt{E_x^2+E_y^2}=\sqrt{3+1}=2V/m.$

11. Ans. (B)

Sol. $0.5\times4200\times(80-0)+300\times(80-0)=\Delta Q$

$\Rightarrow\dfrac{\Delta Q}{\Delta t}=\dfrac{2400\times80}{10}=19200\ J/m$

$\Delta Q=19200\times15=300\times(50-0)+0.7\times S\times50$

$S=7800\ J/kg°C$

12. Ans. (C)

Sol. $19200\times7=\dfrac{0.7\times L}{2}$

$L=3.84\times10^5\ J/kg$

SECTION-II

1. Ans. (A)-(P,Q,R); (B)-(S); (C)-(P,T); (D)-(S)

2. Ans. (A)-(S); (B)-(S); (C)-(Q); (D)-(R)

Sol. Use equation of continuity and concept "pressure is greater at lower and broader section".

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SECTION-IV

1. Ans. 5

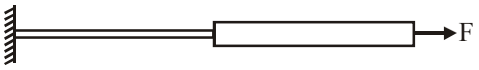
2. Ans. 1

Sol. $64 = \sigma T^4 (2\pi r l)$

$r = 10^{-5}$ m = 10 mm)

3. Ans. 9

4. Ans. 8

Sol. 

$$\frac{F}{A_1} = y\frac{\Delta\ell_1}{\ell}$$

$$\frac{F}{A_2} = y\frac{\Delta\ell_2}{\ell}$$

$$\Delta\ell_1 + \Delta\ell_2 = 10\text{mm}$$

$$\frac{F\ell}{A_1 y} + \frac{F\ell}{4A_1 y} = 10\text{mm} \Rightarrow \frac{F\ell}{A_1 y} = 8\text{mm}$$

5. Ans. 5

Sol. $$\frac{k\times(4.32\times10^{-6})^2}{(30)^2} = \frac{k\times4.32\times10^{-6}\times Q}{(25)^2}\times\cos 53°$$

$Q = 5$

6. Ans. 3

Sol. $$E_\perp = \frac{9\times10^9\times2\sqrt{2}\times10^{-9}}{12}\left[\frac{3}{5}+\frac{4}{5}\right]$$

$$E_\parallel = \frac{9\times10^9\times2\sqrt{2}\times10^{-9}}{12}\left[\frac{4}{5}-\frac{3}{5}\right]$$

$$E = \sqrt{E_\perp^2 + E_\parallel^2}$$

$$E = \frac{\sqrt{900}}{10} = 3\text{N/C}$$

PART–2 : CHEMISTRY SOLUTION

SECTION - I

1. Ans. (D)

Crystalline compounds are anisotropic

2. Ans.(B)

Volume occupied by atoms in an bcc unit cell is -

$$2\times\frac{4}{3}\pi r^3 = \left[\frac{2\times\frac{M}{N_A}}{\rho}\right]\times\frac{\sqrt{3}\pi}{8}$$

3. Ans.(C)

$$\frac{\rho_{fcc,Fe}}{\rho_{bcc,Fe}} = \frac{\pi/3\sqrt{2}}{\sqrt{3}\pi/8}$$

4. Ans. (C)

5. Ans. (C)

6. Ans. (D)

7. Ans. (A)

8. Ans. (B)

9. Ans. (B)

10. Ans. (D)

11. Ans. (C)

12. Ans. (B)

SECTION - II

1. Ans. (A)-(Q,R,T); (B)-(P,S); (C)-(P,Q,T); (D)-(P)

2. Ans. (A)-(P,R,S,T); (B)-(P,Q,R,S;T); (C)-(P,R,S,T); (D)-(P,R,S,T)

SECTION - IV

1. Ans. 9

$$\frac{6\times12}{8} = 9$$

2. Ans 50 [OMR Ans. 5]

Moles of $CO_2 = \frac{5.6}{22.4} = \frac{1}{4}$ mole

Moles of carbon in $CO_2 = \frac{1}{4}$ mole

Moles of $CaCO_3 = \frac{1}{4}$ mole

Wt. of $CaCO_3 = \frac{1}{4}\times100 = 25$gm

3. Ans. 0

4. Ans. 4

5. Ans. 4

6. Ans. 6

PART-3 : MATHEMATICS — SOLUTION

SECTION-I

1. Ans. (B)

$$\frac{\pi}{2}-2\tan^{-1}\left(\sqrt{\cos 1}\right)=\alpha$$

$$\frac{\pi}{2}-\tan^{-1}\left(\frac{2\sqrt{\cos 1}}{1-\cos 1}\right)=\alpha$$

$$\frac{\pi}{2}-\cos^{-1}\left(\frac{1-\cos 1}{1+\cos 1}\right)=\alpha$$

$$\therefore \quad \sin\alpha=\frac{1-\cos 1}{1+\cos 1}=\tan^2\frac{1}{2}<\frac{1}{3}$$

2. Ans. (C)

$$L=\lim_{x\to 1}\frac{(x-1)(3x^2+5x+6)}{(x-1)(x+1)}=7$$

function $f(x)=7$

3. Ans. (B)

$f(x) = 7$

4. Ans. (D)

$$f'(5^+)=\lim_{h\to 0^+}\frac{f(5+h)-f(5)}{h}$$

$$\lim_{h\to 0^+}\frac{5+h+10-21}{h}=\text{DNE}$$

5. Ans. (C)

If is discontinuous at $x=\pm 2, \pm 1, \pm\sqrt{2}, \pm\sqrt{3}$

6. Ans. (C)

$$y=e^x.e^{-\frac{x^2}{2}}.e^{\frac{x^3}{3}}.e^{-\frac{x^4}{4}}.....=e^{x-\frac{x^2}{2}+\frac{x^3}{3}+.....}$$

$$y=e^{\ell n(1+x)} \quad \Rightarrow \quad y=1+x$$

$$\Rightarrow \quad \frac{dy}{dx}=1 \text{ at } x=\frac{1}{2}$$

7. Ans. (D)

Condinuous at x = 1

$$\therefore \quad \cos^2\theta(\alpha^2+4)=1-4\beta^2$$

$$\Rightarrow \quad \alpha^2\cos^2\theta+4\beta^2+4\cos^2\theta=1 \qquad .....(i)$$

Constinuous at x = 3

$$\therefore \quad 3-4\beta^2=\alpha\beta-\beta^2-3\beta^2+2$$

$$\Rightarrow \quad \alpha\beta=1 \qquad .....(ii)$$

Use A.M. $\geq$ G.M.

$$\frac{\alpha^2\cos^2\theta+4\beta^2}{2}\geq 2\alpha\beta|\cos\theta|$$

$$1-4\cos^2\theta\geq 4|\cos\theta|$$

$$\Rightarrow \quad \text{Maximum value of } \cos\theta=\frac{\sqrt{2}-1}{2}$$

8. Ans. (A)

]–3, 9[means (3, 9)

$f(x) = x + 1$ is invertible

$\Rightarrow$ S $\equiv$ Range of $f(x)$

S $\equiv$ (–2, 10)

g(x) is continuous $\quad \therefore \quad P > 0$

g(x) is differentiable at x = 0 $\Rightarrow$ $P \geq 2$

g(x) has vertical tangent at x = 0

$\Rightarrow$ integral value of P = 1

$\therefore \quad P_{integer} = \{1, 2, 3, ..., 9\}$

9. Ans. (A)

$$\sum_{x=1}^{100}g(x)=\sum_{x=1}^{100}\frac{1}{\sqrt{x}}$$

Use : $\sqrt{x+1}-\sqrt{x}<\frac{1}{2\sqrt{x}}<\sqrt{x}-\sqrt{x-1}$

We get

$$\sqrt{101}-1<\frac{1}{2}\left[\frac{1}{\sqrt{1}}+\frac{1}{\sqrt{2}}+...+\frac{1}{\sqrt{100}}\right]<\sqrt{100}-\frac{1}{2}$$

$$\Rightarrow \quad 18<\sum_{x=1}^{100}\frac{1}{\sqrt{x}}<19$$

10. Ans. (D)

$$f(x)=\begin{cases}a_n+\cos\pi x & , \quad x\in\left[2n,\ 2n+\frac{2}{3}\right]\\ c_{n-2}+\sin\pi x+\cos\frac{\pi x}{2} & , \quad x\in\left(2n+\frac{2}{3},2n+\frac{3}{2}\right]\\ b_{n+3}+\sin\frac{\pi x}{2} & , \quad x\in\left(2n+\frac{3}{2},\ 2n+2\right)\end{cases}$$

$f(x)$ is continuous

$$a_n+\cos\frac{2\pi}{3}=c_{n-2}+\sin\frac{2\pi}{3}+\cos\left(n\pi+\frac{\pi}{3}\right) \quad ...(1)$$

and $c_{n-2}+\sin\frac{3\pi}{2}+\cos\left(n\pi+\frac{3\pi}{4}\right)$

$$=b_{n+3}+\sin\left(n\pi+\frac{3\pi}{4}\right) \qquad .....(2)$$

and $b_{n+3} = a_{n+1} + \cos(n+1)2\pi$ .....(3)

on add this equations

$$\therefore \quad a_n - \frac{1}{2} - 1 + \cos\left(n\pi + \frac{3\pi}{4}\right)$$

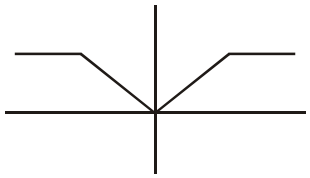
$$= a_{n+1} + \frac{\sqrt{3}}{2} + \cos\left(n\pi + \frac{\pi}{3}\right)$$

$$+ \sin\left(n\pi + \frac{3\pi}{4}\right) + \cos(n+1)2\pi$$

if n odd $a_n - a_{n+1} = \frac{4 + \sqrt{3} - 2\sqrt{2}}{2}$

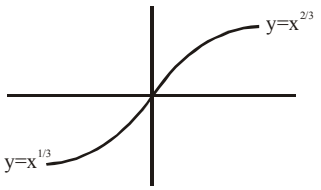
and if n even $a_n - a_{n+1} = \frac{6 + \sqrt{3} + \sqrt{8}}{2}$

11. Ans. (B)



$\therefore \quad n_1 = 3$ and $n_2 = 0$

12. Ans. (D)



g(x) is continuous and have vartical tangent

$f'(0^+) \to \infty$

$f'(0^-) \to \infty$

SECTION – II

1. Ans. (A)→(R); (B)→(Q); (C)→(S); (D)→(R)

2. Ans. (A)→(Q); (B)→(P); (C)→(R); (D)→(Q)

$\lim\limits_{x \to 0^-} f(x) = a + 2$

$\lim\limits_{x \to 0^+} f(x) = \frac{1}{2}, \; b > 0$

$f(0) = C$

$\therefore \quad a = -\frac{3}{2}, \; c = \frac{1}{2}$

SECTION – IV

1. Ans. 6

$$\lim_{x \to 0}\left[\frac{3\sin x}{x}\right] = 2 \text{ and } \lim_{x \to 0}\left[\frac{4\tan x}{x}\right] = 4$$

2. Ans. 0

zero values of x.

3. Ans. 4

$$\tan\left(\cos^{-1}\sqrt{1-x^2}\right) = \sin\left(\tan^{-1}\left(\sqrt{3}x\right)\right)$$

$$\tan\left(\tan^{-1}\frac{|x|}{\sqrt{1-x^2}}\right) = \sin\left(\sin^{-1}\frac{\sqrt{3}x}{\sqrt{1+3x^2}}\right)$$

$$\therefore \quad \frac{|x|}{\sqrt{1-x^2}} = \frac{\sqrt{3}x}{\sqrt{1+3x^2}}$$

$$\Rightarrow \quad x = 0, \frac{1}{\sqrt{3}} \quad \Rightarrow \quad \alpha_1 = 0, \; \alpha_2 = \frac{1}{\sqrt{3}}$$

$$\therefore \quad 6\left(\tan^{-1}0 + \tan^{-1}\sqrt{3}\right) = 2\pi$$

4. Ans. 1

$3x^7 + 4x^5 + 2x + 1 = 10$

$x = 1$

5. Ans. 3

$f(x)$ is continuous $\quad A + B = A + 3 - B$

$$\Rightarrow \quad B = \frac{3}{2}$$

$f(x)$ is differentiable $2B = 6 + A$

$$\Rightarrow \quad A = -3$$

6. Ans. 2

If is possible when all equation have one common root.

$$\left.\begin{array}{l} x^2 + \lambda x + 12 = 0 \\ x^2 + \mu x + 15 = 0 \\ x^2 + (\lambda + \mu)x + 36 = 0 \end{array}\right\} \text{common root} \quad \begin{array}{c} \lambda = 7, \; \mu = 2 \\ \text{or} \\ \lambda = -7, \mu = -2 \end{array}$$

$x^2 + (\lambda + \mu)x + 36 = 0$ has equal roots and r(x), $f(x)$ have a common factor.

We get $\lambda, \mu \in \phi$

$x^2 + (\lambda + \mu)x + 36 = 0$

have equal roots and $f(x)$, g(x) have a common factor

we get $\lambda, \mu \in \phi$

Exactly two possibility that

$\lambda = 7, \mu = 2$ or $\lambda = -7, \mu = -2$