Sri Chaitanya IIT Academy.,India.

A.P T.S KARNATAKA TAMILNADU MAHARASTRA DELHI RANCHI

A right Choice for the Real Aspirant

ICON Central Office - Madhapur - Hyderabad

SEC: Sr.Super60_STERLING BT **JEE-MAIN** **Date: 30-08-2025**

Time: 09:00AM to 12:00PM **RPTM-04** **Max. Marks: 300**

KEY SHEET

MATHEMATICS

1	**2**	2	**3**	3	**2**	4	**2**	5	**2**
6	**2**	7	**4**	8	**3**	9	**3**	10	**3**
11	**3**	12	**3**	13	**1**	14	**1**	15	**4**
16	**1**	17	**3**	18	**4**	19	**4**	20	**1**
21	**4**	22	**3**	23	**11**	24	**5**	25	**3**

PHYSICS

26	**3**	27	**3**	28	**1**	29	**2**	30	**1**
31	**1**	32	**3**	33	**1**	34	**2**	35	**3**
36	**1**	37	**1**	38	**3**	39	**2**	40	**4**
41	**2**	42	**4**	43	**1**	44	**4**	45	**4**
46	**145**	47	**6**	48	**81**	49	**20**	50	**40**

CHEMISTRY

51	**4**	52	**1**	53	**1**	54	**4**	55	**4**
56	**2**	57	**2**	58	**1**	59	**2**	60	**3**
61	**1**	62	**3**	63	**1**	64	**3**	65	**3**
66	**3**	67	**4**	68	**4**	69	**1**	70	**4**
71	**4**	72	**3**	73	**4**	74	**4**	75	**3**

SOLUTIONS
MATHEMATICS

1. $I(x)=\int \dfrac{dx}{(x-11)^{\frac{11}{13}}(x+15)^{\frac{15}{13}}}$

$put\ \dfrac{x-11}{x+15}=t \Rightarrow \dfrac{26}{(x+5)^2}dx=dt$

$I(x)=\dfrac{1}{26}\int \dfrac{dt}{t^{11/13}}=\dfrac{1}{26}.\dfrac{t^2/^{13}}{2/13}$

$I(x)=\dfrac{1}{4}\left(\dfrac{x-11}{x+15}\right)^{2/13}+C$

$I(37)-I(24)=\dfrac{1}{4}\left(\dfrac{26}{52}\right)^{2/13}-\dfrac{1}{4}\left(\dfrac{13}{39}\right)^{2/13}$

$=\dfrac{1}{4}\left(\dfrac{1}{2^{2/13}}-\dfrac{1}{3^{2/13}}\right)$

$=\dfrac{1}{4}\left(\dfrac{1}{4^{1/13}}-\dfrac{1}{g^{1/13}}\right)$

$\therefore b=4, c=9$

$3(b+c)=39$

2. $I=\int \dfrac{1}{x\dfrac{41}{25}+x\dfrac{9}{25}}dx$

$x=t^{25}\Rightarrow dx=25t^{25}dt$

$I=\int \dfrac{25t^{24}}{(t)^{25}\dfrac{41}{25}+(t)^{25}\dfrac{9}{25}}dt$

$=25\int \dfrac{t^{24}}{t^{41}+(t)^9}$

$=25\int \dfrac{t^{24}}{t^9(t^{32}+1)}dt$

$=25\int \dfrac{t^{15}}{(t^{16})^2+1}dt$

$=\dfrac{25}{16}\int \dfrac{dz}{z^2+1}$

$=\dfrac{25}{16}\tan^{-1}(t^{16})+C$

$=\dfrac{25}{16}\tan^{-1}\left(x^{\frac{16}{25}}\right)+C$

3. $\dfrac{d}{dx}\left(\dfrac{x.\sin^{-1}x}{\sqrt{1-x^2}}\right)-\sin^{-1}x.\left(\dfrac{1.\sqrt{1-x^2}+\dfrac{x.2x}{2\sqrt{1-x^2}}}{1-x^2}\right)$

$$\frac{x}{\sqrt{1-x^2}}.\frac{1}{\sqrt{1-x^2}}$$

$$\frac{\sin^{-1}x}{\left(1-x^2\right)^{3/2}}+\frac{x}{1-x^2}$$

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

$$=e^x.f(x)+C$$

$$I=e^x.\frac{x.\sin^{-1}x}{\sqrt{1-x^2}}+C=g(x)+C$$

$$\Rightarrow g(x)=\frac{xe^x\sin^{-1}x}{\sqrt{1-x^2}} \text{ and } g(1/2)=\frac{\pi}{6}\sqrt{\frac{e}{3}}$$

4. $f'(x)=6x^2-18ax+12a^2$

$f'(x)=6\left(x^2-3ax+2a^2\right)$

Roots are a,2a

$p^2=q\Rightarrow a^2=2a$

$a=2$

$f(x)=2x^3-18x^2+48x+1$

$f(3)=37$

5. $f(x)=x^2+ax^2+b\ln|x|+1, x\neq 0$

$f(x)=3x^2+2ax+\frac{b}{x}$

$f'(-1)=3-2a-b=0$

$f'(-2)=12+4a-\frac{b}{2}=0$

$a=\frac{-9}{2}, b=12$

$f'(x)=3x^2-9x+\frac{12}{x}=\frac{3(x+1)(x+2)^2}{x}$

$\max.at$ n= -1

f(x)=x$^2\frac{9}{2}x^2+12\ln|x|+1$

$f(-1)=-1-\frac{9}{2}+1=-\frac{9}{2}$

$M=-4.5$

$\min.value\ at$ x= -2

f(-2)=-8-18+12ln2+1

m= -25 + 12 ln2= -16.6

$|M+m|=21.1$

6. **WE KNOW THAT** $a\cos\theta+b\sin\theta=\sqrt{a^2+b^2}\cos(\theta-\alpha)$

=where $=\alpha=\tan^{-1}\frac{b}{a}$

$$= I = \int \frac{\frac{2x^2}{x^2+1}dx}{\cos\left(2x - \tan^{-1}\frac{1}{2}\left(x - \frac{1}{x}\right)\right)}$$

$$= 2x\cos 2x + x^2 - 1\sin 2x$$

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

$$= let\ t = 2x - \tan^{-1}\frac{1}{2}\left(x - \frac{1}{x}\right)$$

$$= dt = \left[2 - \frac{1}{1 + \frac{1}{4}\left(x - \frac{1}{x}\right)^2} \times \frac{1}{2}\left(1 - \frac{1}{x^2}\right)\right]dx$$

$$= \left[2 - \frac{4x^2}{4x^2 + \left(x^2-1\right)^2} \times \frac{1}{2x^2}\left(1 + x^2\right)\right]dx$$

$$\Rightarrow dt = \frac{2x^2}{x^2+1}dx$$

$$= I = \int \frac{dt}{\cos t} = In\left|\tan\left(\frac{\pi}{4} + \frac{t}{2}\right)\right| + C$$

= where t=f(x)

=f(1)=2

7. $= f(x) = \int \frac{1+x^4}{\left(1-x^4\right)^{3/2}}dx$

Take out x^2 from the D^r,it will come out as x^2

$$= \int \frac{x + \frac{1}{x^3}}{\left(\frac{1}{x^2} - x^2\right)^{3/2}}dx$$

$$= put = \frac{1}{x^2} - x^2 = t^2 \Rightarrow -2\left(x + \frac{1}{x^3}\right)dx = 2t\ dt$$

$$\therefore f(x) = \int \frac{t\ dt}{t^3}dt = \frac{1}{t} + C = \frac{x}{\sqrt{1-x^4}} + C_1$$

=as $f(0) = 0 \Rightarrow C_1 = 0$

$$= now = \int \frac{x}{\sqrt{1-x^4}}dx = \frac{1}{2}\sin^{-1}x^2 + C_2$$

=but $= g(0) = 0 \Rightarrow C_2 = 0$

$$= \int \underset{I}{x^2}.\frac{d}{dx}\underbrace{\left(\frac{3x^2+1}{x^7 + 2x^5 + 2x^4 + x^3 + 2x^2 + 5x}\right)}_{II}dx$$

$$= g\left(\frac{1}{\sqrt{2}}\right) = \frac{\pi}{2} \equiv \frac{\pi}{k} \Rightarrow k = 12$$

ALTERNATIVELY:

$$= I = \int \frac{1-x^4-2x^4}{\left(1-x^4\right)^{3/2}}dx$$

$$= \int\left(\frac{1}{\left(1-x^4\right)^{1/2}}+\frac{2x^4}{\left(1-x^4\right)^{3/2}}\right)dx$$

This is of the form $\left(f(x)+xf'(x)\right)$

hence $I=\frac{x}{\sqrt{1-x^4}}+C$

8. LET $\frac{x^2+1}{x}=t \Rightarrow x+\frac{1}{x}=t \Rightarrow \left(1-\frac{1}{x^2}\right)dx=dt.$

$$\therefore \frac{x^2+1}{x^2}e^{\frac{x^2+1}{x}}dx=\int e^t dt=e^t+c=e^{\frac{x^2+1}{x}}+c$$

Let $f(x)=t.Then f'(x)dx=dt.$

$$\therefore \int f'(x)e^t dt=e^t+c=e^{f(x)}+c$$

$\therefore$ statement 1 and statement 2 both are true.

9. $$I_n=\int\frac{t^n dt}{\left(1+t+\frac{t^2}{2!}+......+\frac{t^n}{n!}\right)}=\frac{n!\int 1+t+\frac{t^2}{2!}+......+\frac{t^n}{n!}-\left(1+t+\frac{t^2}{2!}+.....+\frac{t^{n-1}}{(n-1)!}\right)}{\left(1+t+\frac{t^2}{2!}+......+\frac{t^n}{n!}\right)}dt$$

$$=\left[e^x\left(e^x+1\right)-\left(e^2-e^{-x}\right)+e^x\right]$$

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

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

$$=\left(e^x+1\right)e^{e^x+e^{-x}}+C$$

$$\therefore g(x)=e^x+1 \Rightarrow g(0)=2$$

$$=e^x\left(e^x+1\right)-e^{-x}\left(e^x+1\right)+e^x$$

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

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

$$=\left(e^x+1\right)e^{e^x+e^{-x}}+C$$

$$\therefore g(x)=e^x+1 \Rightarrow g(0)=2$$

10. $$\int e^x\left(\tan x-x+\tan^2 x-\tan^2 x-2\tan x\sec^2 x\right)dx$$

$$=\int e^x\left(\tan x-x+\tan^2 x\right)dx-\int e^x\left(\text{an}^2 x+2\tan x\sec^2 x\right)dx$$

$$=e^x\left(\tan x-x+\tan^2 x\right)+C$$

$$=f(x)=\tan x-x-\tan^2 x$$

$$=f\left(\frac{\pi}{4}\right)=\frac{-\pi}{4}$$

11. $\because \dfrac{f(x)}{x(x+1)^2(x-2)^3} = \dfrac{A}{x} + \dfrac{B}{x+1} + \dfrac{C}{(x+1)^2} + \dfrac{D}{x-2} + \dfrac{E}{(x-2)^2} + \dfrac{F}{(x-2)^3}$

$= \int \dfrac{f(x)}{x(x+1)^2(x-2)^3}dx$ will be a logarithm function if $C = E = F = 0$

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

12. $Put\ e^x = t$

$$I_n = \int \frac{t^n dt}{\left(1+t+\frac{t^2}{2!}+.......+\frac{t^n}{n!}\right)} = \frac{n!\int 1+t+\frac{t^2}{2!}+......+\frac{t^n}{n!} - \left(1+t+\frac{t^2}{2!}+.....+\frac{t^{n-1}}{(n-1)!}\right)}{\left(1+t+\frac{t^2}{2!}+.......+\frac{t^n}{n!}\right)}dt$$

$$= n!\left(t - \int \frac{1+t+\frac{t^2}{2!}+......+\frac{t^{n-1}}{(n-1)!}}{1+t+\frac{t^2}{2!}+....+\frac{t^2}{n!}}dt\right)$$

$$let 1+t+\frac{t^2}{2!}+....+\frac{t^2}{n!} = v;\ dv = 1+t+\frac{t^2}{2!}+....+\frac{t^{n-1}}{(n-1)!}dt$$

$$\therefore I_n = n!\left(t - \ln 1 + \left(t+\frac{t^2}{2!}+....+\frac{t^2}{n!}\right)\right)+c$$

$$= n!\left(e^x - \ln\left(1+e^x+\frac{e^{2x}}{2!}+....+\frac{e^{nx}}{n!}\right)\right)+c$$

$$\therefore g(x) = \lim_{x\to\infty} ln\left(1+e^x+\frac{e^{2x}}{2!}+....+\frac{e^{nx}}{n!}\right) = \ln(e^{e^x}) = e^x$$

Number of solutions of $e^x = x^2 is 3$.

13. **LET I=**$\displaystyle\int \frac{\cos ec^2 x - 2011}{(\cos x)^{2011}}dx$

$$\int (\cos x)^{-2011}\cos ec^2 x dx - \int \frac{2011}{(\cos x)^{2011}}dx$$

$$(\cos x)^{-2011}(-\cot x) - \int (-2011)(\cos x)^{-2012}(-\sin x) = -\frac{\cot x}{(\cos x)^{2011}} + C$$

14. (i) $f(x) = \int x^{\sin x}(1 + x\sin x.\log x + \sin x)dx$

$if\ f(x) = x^{\sin x} = e^{\sin x \log x}$

$$f\left(\frac{\pi}{4}\right) = \frac{\pi}{4}\left(\frac{\pi}{4}\right)^{1/\sqrt{2}} = \left(\frac{\pi}{4}\right)^{1+1/\sqrt{2}}$$

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

$$= \int \cos x.\frac{1}{\cos x+2}dx + \int \frac{\sin^2 x}{(\cos x+2)^2}dx$$

$$= \frac{\sin x}{\cos x+2} + C$$

Alternate method

$$g(x)=\frac{\sin x}{\cos x+2}\Rightarrow g\left(\frac{\pi}{2}\right)=\frac{1}{2}$$

(iii) let $x+5=14\cos\theta$

$y-12=14\sin\theta$

$$\therefore \left|\sqrt{x^2-y^2}\right|_{\min}=\sqrt{365-28\times 13}=\sqrt{365-364}=1$$

15. $2x^2+5x+9=A(x^2+x+1)+B(2x+1)+C$

$A=2$ B$=\frac{3}{2}$ C$=\frac{11}{2}$

$$=2\int\sqrt{x^2+x+1}\,dx+\frac{3}{2}\int\frac{2x+1}{\sqrt{x^2+x+1}}dx+\frac{11}{2}\int\frac{dx}{\sqrt{x^2+x+1}}$$

$$=2\int\sqrt{\left(x+\frac{1}{2}\right)^2+\left(\frac{\sqrt{3}}{2}\right)^2}\,dx+3\sqrt{x^2+x+1}+\frac{11}{2}\int\frac{dx}{\sqrt{\left(x+\frac{1}{2}\right)^2+\left(\frac{\sqrt{3}}{2}\right)^2}}$$

$$=2\left(\frac{x+\frac{1}{2}}{2}\sqrt{x^2+x+1}+\frac{3}{8}\ln\left(x+\frac{1}{2}+\sqrt{x^2+x+1}\right)\right)+3\sqrt{x^2+x+1}$$

$$=+\frac{11}{2}\ln\left(x+\frac{1}{2}+\sqrt{x^2+x+1}\right)+C$$

$$=\alpha=\frac{7}{2}\qquad \beta=\frac{25}{4}$$

$$=\alpha+2\beta=16$$

16. $I=\int\frac{\left(\sin^n\theta-\sin\theta\right)^{\frac{1}{n}}\cos\theta}{\sin^{n+1}\theta}d\theta$ let $\sin\theta=u$

$$\therefore I=\int\frac{\left(u^n-u\right)^{\frac{1}{n}}}{u^{n+1}}du$$

$$\Rightarrow \cos\theta d\theta=du$$

$$=\int\frac{\left(1-\frac{1}{u^{n+1}}\right)^{\frac{1}{n}}}{u^n}du\int u^{-n}\left(1-u^{1-n}\right)^{\frac{1}{n}}du$$

Let $1-u^{1-n}=v$

$$\Rightarrow -(1-n)u^{-n}du=dv$$

$$\Rightarrow u^{-n}du=\frac{dv}{n-1}$$

$$\therefore I=\int v^{\frac{1}{n}}.\frac{dv}{n-1}=\frac{1}{n-1}.\frac{v^{\frac{1}{n}+1}}{\frac{1}{n}+1}$$

$$=\frac{n}{n^2-1}v^{\frac{n+1}{n}}+C=\frac{n}{n^2-1}\left(1-\frac{1}{u^{n-1}}\right)+C$$

$$=\frac{n}{n^2-1}\left(1-\frac{1}{\sin^{n-1}}\right)^{\frac{n+1}{n}}+C$$

17. **GIVEN THAT** $I(x)=\int x^2\left(\frac{x\sec^2 x+\tan x}{(x\tan x+1)^2}\right)dx$

Applying integration by parts

$$\int f(x)g(x)dx=f(x)\int g(x)dx-\int(f'(x)\int g(x)dx)dx$$

$$x^2\int x^2\left(\frac{x\sec^2 x+\tan x}{(x\tan x+1)^2}\right)dx-\int\left(\frac{dx^2}{dx}\int\left(\frac{x\sec^2 x+\tan x}{(x\tan x+1)^2}\right)dx\right)dx$$

Let $x\ \tan x+1$=p

$$\left(x\sec^2 x+\tan x\right)dp=dx$$

$$\therefore\int\frac{x^2\left(x\sec^2 x+\tan x\right)}{(x\tan x+1)^2}dx$$

$$=\frac{-x^2}{x\tan x+1}+2\log\left|\frac{1}{\sqrt{2}}\left(\frac{\pi}{4}\right)+\frac{1}{\sqrt{2}}\right|$$

$$=\log_e\frac{(\pi+4)^2}{32}-\frac{\pi^2}{4(\pi+4)}$$

Hence this is the correct option

18. $\int\frac{\sin^{\frac{3}{2}}x+\cos^{\frac{3}{2}}x}{\sqrt{\sin^3 x\cos^3 x\sin(x-\theta)}}dx$

$$\int\frac{\sin^{\frac{3}{2}}x+\cos^{\frac{3}{2}}x}{\sqrt{\sin^3 x\cos^3 x\sin x\cos-\theta-\cos x\sin\theta)}}dx$$

$$\int\frac{\sin^{\frac{3}{2}}x}{\sin^3 x\cos^3 x\sqrt{\tan x\cos\theta-\sin\theta}}dx+\int\frac{\cos^{\frac{3}{2}}x}{\sin^2 x\cos^{\frac{3}{2}}x\sqrt{\cos\theta-\cot x\sin\theta}}dx$$

$$=\int\frac{\sec^2 x}{\sqrt{\tan x\cos\theta-\sin\theta}}dx+\int\frac{co\sec^2 x}{\sqrt{\cos\theta-\cot x\sin\theta}}$$

$$I=I_1+I_2.......let$$

$$\sec^2 xdx=\frac{2tdt}{\cos\theta}$$

$$\int\frac{2tdt}{\cos\theta t}+\int\frac{2zdz}{\sin\theta z}$$

$$\frac{2t}{\cos\theta}+\frac{2z}{\sin\theta}$$

Comparing AB=8cosec2θ

19. $\int\cos ec^3.\cos ec^2 xdx=I$

By applying integration by parts

$$= I - \cot x \cos ec^3 x + \int \cot x\left(-3\cos ec^2 x \cot x \cos ecx\right) = 2I_1 = -\cos ec\ x \cot x + \ln\left|\tan\frac{x}{2}\right|$$

$$= I_1 = -\frac{1}{2}\cos ec\ x \cot x + \frac{1}{2}\ln\left|\tan\frac{x}{2}\right| \quad = 4I_1 = -\cot x \cos ec^3\ x - \frac{3}{2}\cos ecx \cot x + \frac{3}{2}\ln\left|\tan\frac{x}{2}\right| + 4C$$

$$\therefore \alpha = \frac{-1}{4}, \beta = \frac{3}{8} \to 8\left(\alpha+\beta\right) = 1$$

20. $\int \frac{3e^x - 5e^{-x}}{4e^x + 5e^{-x}}dx = ax + b\log\left|4e^x + 5e^{-x}\right| + c$

by differentiaion both sides

$$\frac{3e^x - 5e^{-x}}{4e^x + 5e^{-x}} = a + b\left(\frac{4e^x - 5e^{-x}}{4e^x + 5e^{-x}}\right)$$

$$3e^x - 5e^{-x} = a\left(4e^x + 5e^{-x}\right) + b\left(4e^x + 5e^{-x}\right)$$

by comparing coefficients of e^2*and* e^{-x}

$$-5 = 5a - 5b$$

21. $g(x) = \int \frac{\cos x(\cos x + 2)\sin^2 x}{\left(\cos x + 2\right)^2}dx = \int \underbrace{\cos x}_{II} \underbrace{\frac{1}{\left(\cos x + 2\right)}}_{I} dx + \int \frac{\sin^2 x}{\cos x + 2}dx$

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

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

$$g(0) = 0 \Rightarrow C = 0$$

22. $\int \frac{\sin x}{\cos^3 x\left(1 + \tan^3 x\right)}dx = \int \frac{\tan x.\sec^2 x}{1 + \tan^3 x}dx$

$$\tan x = t$$

$$= \int \frac{t}{1+t^3}dt$$

$$\frac{t}{1+t^3} = \frac{A}{1+t} + \frac{Bt + C}{1 + t^2 - t}$$

find values of A and B ad solve

23. $\int \left(x^{50} + x^{20} + x^{10}\right)\left(2x^{40} + 5x^{10} + 10\right)^{1/10} dx$

$$\int \left(x^{50} + x^{20} + x^{10}\right)\left(\frac{2x^{50} + 5x^{20} + 10x^{10}}{x^{10}}\right)^{1/10} dx$$

$$\int \left(\frac{x^{50} + x^{20} + x^{10}}{x}\right)\left(2x^{50} + 5x^{20} + 10x^{10}\right)^{1/10} dx$$

$$\int \left(x^{49} + x^{19} + x^9\right)\left(\underbrace{2x^{50} + 5x^{20} + 10x^{10}}_{t}\right)^{1/10} dx$$

$$\int t^{1/10}\left(\frac{1}{100}\right)dt$$

$$= \frac{1}{100}\frac{t^{11/10}}{\frac{11}{10}} + c$$

$$\frac{10}{11} \times \frac{1}{100}.t^{\frac{11}{10}} + c$$

$$\frac{1}{110}.t^{\frac{11}{10}} + c$$

24. $\frac{x}{2^{r+1}}=\theta, T_r=\frac{\tan\left(\frac{x}{2^{r+1}}\right)+\tan^3\left(\frac{x}{2^{r+1}}\right)}{\left(1-\tan^2\left(\frac{x}{2^{r+1}}\right)\right)}$ *then*

$$\int\frac{1-(\cot x)^{2008}}{\tan x+(\cot x)^{2009}}dx=\int\frac{\left((\sin x)^{2008}-(\cos x)^{2008}\right)(\sin x)^{2009}\cos x}{\left((\sin x)^{2010}+(\cos x)^{2010}\right)(\sin x)^{2008}}dx$$

$$(2010)\left\{(\sin x)^{2008}(\cos x)^{2010}\right\}\sin x\cos x dx=dt$$

$$\int\frac{dt}{(2010)}=\frac{1}{2010}\log\left((\sin x)^{2010}+(\cos x)^{2010}\right)+C$$

25. **LET** $f(x)=\frac{1}{x^3+1}=\frac{1}{(x+1)(x^2-x+1)}$

$$f(x)=\frac{1}{(x+1)(x^2-x+1)}=\frac{A}{x+1}+\frac{Bx+C}{x^2-x+1}\ \Rightarrow 1=A(x^2-x+1)+(Bx+C)(x+1)$$

Comparing the coefficients of x^2,x and constant

$0=A+B, 0=-A+B+C, 1=A+C$

$$\Rightarrow A=1/3, B=-1/3\ \&\ c=2/3\Rightarrow f(x)=\frac{\frac{1}{3}}{x+1}+\frac{-\frac{x}{3}+\frac{2}{3}}{x^2-x+1}=\frac{1}{3(x+1)}-\frac{1}{6}\frac{(2x-4)}{x^2-x+1}$$

$$\frac{1}{3(x+1)}-\frac{2x-1}{6(x^2-x+1)}+\frac{1}{\left\{\left(x-\frac{1}{2}\right)^2+\left(\frac{\sqrt{3}}{2}\right)^2\right\}}$$

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

Hence the value of $\beta=\frac{1}{3}\, so\, \frac{1}{\beta}=3$

PHYSICS

26. Conceptual

27. Conceptual

28. CONSIDERE THE DIAGRAM, THE RAY (P) IS INCIDENT AT AN ANGLE θ and gets reflected in the direction p' and refracted in the direction p''.due to reflection from the glass medium, there is a phase change of π.
time taken to travel along op''

$$\Delta t=\frac{OP}{v}=\frac{d/\cos r}{c/n}=\frac{nd}{c\cos r}$$

From snell's law , $n=\frac{\sin\theta}{\sin r}$

$$\Rightarrow\frac{\sin\theta}{n}$$

$$\cos r=\sqrt{1-\sin^2 r}=\sqrt{1-\frac{\sin^2\theta}{n^2}}$$

$$\Delta t=\frac{nd}{c\left(1-\frac{\sin^2\theta}{n^2}\right)^{1/2}}=\frac{n^2 d}{c}\left(1-\frac{\sin^2\theta}{n^2}\right)^{-1/2}$$

Phase difference = $\Delta\phi=\frac{2\pi}{T}\times\Delta t\frac{2\pi nd}{\lambda}\left(1-\frac{\sin^2\theta}{n^2}\right)^{-1/2}$

So, net phase difference= $\Delta\phi+\pi$

$$\frac{4\pi d}{\lambda}\left(1-\frac{1}{n^2}\sin^2\theta\right)^{-1/2}+\pi$$

29. RESULTANT INTENSITY DUE TO SUPERPOSITION OF TWO WAVES ON THE SCREEN IS GIVEN AS

$$I(\phi)=I_1+I_2+\sqrt[2]{I_1 I_2}\cos\phi$$

$$here, I_1=I \text{ and } I_2=4I$$

$$at point A, \phi=\frac{\pi}{2}\therefore I_A=I+4I=5I$$

$$at point B, \phi=\pi\therefore I_B=I+4I-4I=I$$

$$\therefore I_A-I_B=4I$$

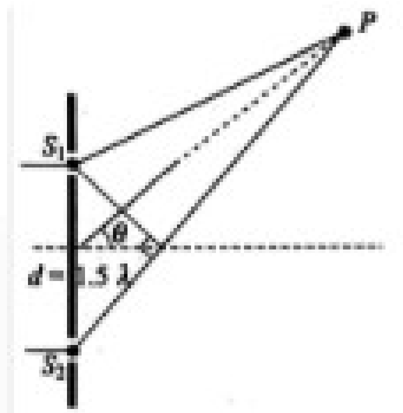
30. Conceptual

31. $\delta=$ phase difference between the waves from S_1 and S_2 at

$$p=\frac{\pi}{2}-\frac{2\pi}{2}(d\sin\theta)$$

For maximum intensity at P, $\delta=n\pi, where\ n=0,\pm1,\pm2,.....$

$\therefore \frac{2\pi}{2}(1.5\lambda \sin\theta)\frac{\pi}{2} = n\pi$



$n - \frac{1}{2} = 3\sin\theta$

$\Rightarrow \sin\theta = \left(\frac{n-\frac{1}{2}}{3}\right)$

For n=0, $\sin\theta = -\frac{1}{6}$

$for\ n = \pm 1, \sin\theta = \frac{1}{6}, \frac{1}{2}$

$for\ n = \pm 2, \sin\theta = \frac{1}{2}, -\frac{5}{6}$

32. INTENSITY OF POLARIZED LIGHT FROM FIRST POLARIZER$=\frac{100}{2} = 50\%$

$I = 50\cos^2 60^0 = \frac{50}{4} = 12.5\%$

33. THE EXPERIMENTAL SET-UP IS IN A LIQUID, THEREFORE THE WAVELENGTH OF LIGHT WILL CHANGE

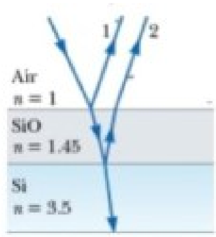
$\lambda_{liquid} = \frac{\lambda_{air}}{\mu} = \frac{6300}{1.33} = \frac{6300\times10^{-10}}{1.33}m$

Fringe width,

$\beta = \frac{\lambda_{liquid}D}{d} = \frac{\lambda_{air}D}{\mu d} = \frac{6300\times10^{-10}}{1.33}\times\frac{1.33}{10^{-3}} = 6.3\times10^{-4}m$

34. Conceptual
35. Conceptual
36. Conceptual
37. Conceptual
38. Conceptual
39. I'$=\frac{1}{2}\cos^2\theta = \frac{1}{6}\ or \cos\theta = \frac{1}{\sqrt{3}} \therefore \theta = 55^0$

40.



` $\Delta x = \dfrac{\lambda_\mu}{2}$ $\Rightarrow 2t = \dfrac{\lambda}{2_\mu}$

41. ANGULAR SEPARATION IS λ / d.

For angular separation to be 10% greater , λ should be 10%greater

= new wavelength= $\left(589 + \dfrac{589}{10}\right) nm$

$= (589 + 58.9) nm$

$= 647.9 nm (\approx 648 nm)$

42. Conceptual

43. Conceptual

44. ACCORDING TO MALUS LAW, INTENSITY OF EMERGING BEAM IS GIVENN BY,

$I = I_0 \cos^2 30^0$

$now, I_{A'} = I_A \cos^2 30^0$

$I_{B'} = I_B \cos^2 60^0$

$As\ I_{A'} = I_{B'}$

$\Rightarrow I_A \times \dfrac{3}{4} = I_B \times \dfrac{1}{4} \therefore \dfrac{I_A}{I_B} = \dfrac{1}{3}$

45. CONCEPTIONAL

$d = 0.5mm\ and$ D=0.5m

separation=3β+1.5β=4.5β

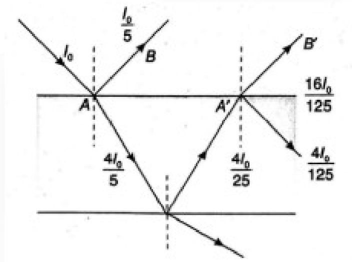
$= 4.5 \times \dfrac{\lambda D}{d} = 2.25mm$

46. Conceptual

47. Conceptual

48. ACCORDING TO THE GIVEN CONDITION IN QUESTION , INTENSITY OF RAY AB, $I_1 = \frac{I_0}{5}$, and intensity of ray $A'B'$ is given corresponding to 20% reflection at each surface as

$I_2 = \frac{16I_0}{125}$



For light rays AS and A'B'. after interference maximum and minimum intensities are given as

49. THE SECOND ORDER MAXIMA OCCURS IN DIRECTION GIVEN BY

$d\sin\theta = 2\lambda$

$\sin\theta = \frac{2\lambda}{d} = \frac{2\times 250\times 10^{-9}}{5\times 10^{-6}} = 0.1$

THE REQUIRED HEIGHT IS $h = R\sin\theta = 2\times 0.1 = 0.2m$

50. AT $\theta = 0.5^0$, we have first minima

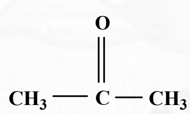
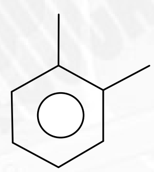
$\therefore d\sin\theta = \frac{\lambda}{2}$

$\therefore d\theta \simeq \frac{\lambda}{2}$

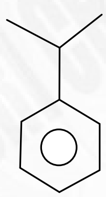
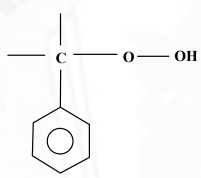
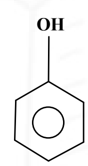
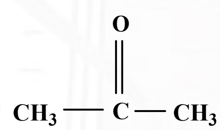
$d = \frac{7500\times 10^{-7}\,mm}{2\times\left(0.5\times\frac{3.14}{180}rad\right)} = 0.04mm$

CHEMISTRY

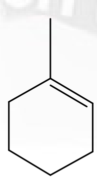
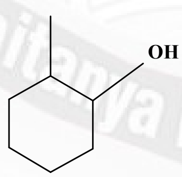
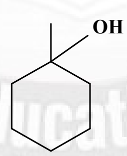
51. PHENOL ON NITRATION WITH NITRATION MIXTURE GIVES PICRIC ACID
52. PRESENCE OF NITROGROUP AT ORTHO AND PARA POSITION INCREASES THE RATE OF AROMATIC NUCLEOPHILIC SUBSTITUTION REACTION.
53. I-EAS II-ADDITION III-SN IV-ELEMINATION
54. ACID HYDROLYSIS OF 1-BUTENE GIVES 2-BUTANOL
55. T-BUTYL CHLORIDE REACTS WITH SODIUM ETHOXIDE GIVES ELIMATION PRODUCT AS MAJOR
56. ALCOHOLS >ETHERS > HYDROCARBONS
57. WITHDRAWING GROUPS INCREASES THE ACIDIC STRENGTH
58. $NaBH_4$ doesn't reduce esters
59. AS PER NCERT TEXT BOOK
60. JONES REAGENT OXIDISES 1^0 alcohol to carboxylic acid and $2^{'}$-alcohol to ketones
61. IT IS SN^1 reaction
62. 1^{ST} REACTION IS SN^1 and 2^{nd} reaction is SN^2
63. STABLE CARBOCATION FORMATION PREFER SN^1 reaction
64. NEIGHBOURING GROUP PARTICIPATION
65.

D:  

66. PINACOL-PINACOLONE REACTION
67.

A:  B:  C:  D: 

68. (C) AND (D) ARE HOFFMANN'S PRODUCES
69.

A:  P:  Q: 

70. IT IS E_1 REACTION
71. B, C, E, G GIVES IODOFORM TEST
72. 3 MOLES OF HI ARE REQUIRED
73. 4 MOLES OF CH_3MgI are required
74. C,D,E,F,G ARE REQUIRED
75. **A,C,E ARE USED TO IDENTIFY THE PHENOL**