DIRECTORATE OF GOVERNMENT EXAMINATIONS, CHENNAI – 600 006
HSE FIRST YEAR PUBLIC EXAMINATIONS – MARCH - 2024
MATHEMATICS MARKING SCHEME – ENGLISH MEDIUM

GENERAL INSTRUCTIONS

MAXIMUM MARKS : 90

1. The answers given in the marking scheme are Textbook and Solution book bound.
2. **If a student has given any answer which is different from one given in the marking scheme, but carries the prescribed content meaning (rigorous) such answers should be given full credit with suitable distribution.**
3. Follow the footnotes which are given under certain answer schemes.
4. If a particular stage is wrong and if the candidate writes the appropriate formula then award 1 mark for the formula (for the stage mark 2*). This mark (*) is attached with that stage. This is done with the aim that a student who did the problem correctly without writing the formula should not be penalized.
5. In the case of Part II, Part III and Part IV, if the solution is correct then award full mark directly. The stage mark is essential only if the part of the solution is incorrect.
6. Answers written only in Black or Blue ink should be evaluated.

PART – I

1. One mark to write the correct option and the corresponding answer.
2. If one of them (answer or option) is wrong, then award zero mark only **20×1=20**

TYPE A			TYPE B		
Q.NO	**OPTION**	**ANSWER**	**Q.NO**	**OPTION**	**ANSWER**
1.	(d)	$\frac{n(n+1)}{2}$	**1.**	(c)	$\frac{1}{5}$
2.	(c)	3	**2.**	(a)	$\frac{1}{2}a^2$
3.	(a)	$\frac{1}{2}a^2$	**3.**	(a) or (b)	$P\left(\frac{A}{B}\right) \geq P(A)$ (or) $P\left(\frac{A}{B}\right) = \frac{P(A)}{P(B)}$
4.	(b)	2^n	**4.**	(c)	10
5.	(a) or (b)	$P\left(\frac{A}{B}\right) \geq P(A)$ (or) $P\left(\frac{A}{B}\right) = \frac{P(A)}{P(B)}$	**5.**	(d)	18
6.	(d)	0	**6.**	(b)	$\sqrt{tanx} + C$
7.	(d)	4	**7.**	(c)	3
8.	(c)	3	**8.**	(c)	3
9.	(c)	$\frac{1}{5}$	**9.**	(c)	[0,9]
10.	(a)	26	**10.**	(d)	$4\hat{\imath} + 5\hat{\jmath}$
11.	(c)	10	**11.**	(a)	0
12.	(a)	$-\frac{4}{15}$	**12.**	(a)	0
13.	(a)	0	**13.**	(c)	$\cos x\, e^{\sin x}$
14.	(c)	$\cos x\, e^{\sin x}$	**14.**	(b)	2^n
15.	(d)	18	**15.**	(a)	$-\frac{4}{15}$
16.	(d)	$4\hat{\imath} + 5\hat{\jmath}$	**16.**	(d)	$\log\left(\frac{a}{b}\right)$
17.	(b)	$\sqrt{tanx} + C$	**17.**	(d)	$\frac{n(n+1)}{2}$
18.	(a)	0	**18.**	(d)	0
19.	(c)	[0,9]	**19.**	(a)	26
20.	(d)	$\log\left(\frac{a}{b}\right)$	**20.**	(d)	4

Part – II

Important Note for Part- II Part – III and Part – IV

In an answer to a question, between any two particular stages of marks (greater than one) if a student starts from a stage with correct step but reaches the next stage with a wrong result then suitable credits should be given to the related steps instead of denying the entire marks meant for the stage.

Answer any seven questions. Question No.30 is compulsory. 7×2=14

Q.NO	CONTENT	MARKS
21	$A = 81$	2
22	$m_1 = m_2 = -\frac{3}{2}$ Two lines are parallel	1 1
23	$\|A\| = 3(-6+4) - 4(0-10) + 1(0+5)$ $= 39$	1 1
24	$P(\bar{A} \cup \bar{B}) = 1$	2*
25	$\vec{a} \times \vec{b} = 4\hat{\imath} - 3\hat{\jmath} - \hat{k}$ $\|\vec{a} \times \vec{b}\| = \sqrt{26}$	1 1
26	$x = \frac{\pi}{6}$ Domain $= R - \left\{n\pi + \frac{(-1)^n \pi}{6}\right\}, n \epsilon Z$	1 1
27	$\tan(45° - A) = \frac{\tan 45° - \tan A}{1 + tan45° tanA}$ $= \frac{1 - \tan A}{1 + tanA}$	1 1
28	$f'(x) = -x\sin x + \cos x$ $f''(x) = -x\cos x - 2\sin x$	1 1
29	$(5x + y)(x + y) = 0$ $5x + y = 0 \quad , \quad x + y = 0$	1 1
30	ways $= \frac{5!}{2!}$ $= 60$	1 1

PART – III

Answer any seven questions. Question No.40 is compulsory. 7×3=21

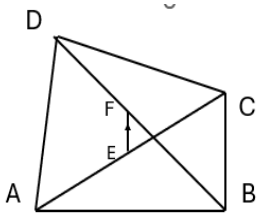
Q.NO	CONTENT	MARKS
31	$= 3 + \sqrt{8} - \sqrt{8} - \sqrt{7} + \sqrt{7} + \sqrt{6} - \sqrt{6} - \sqrt{5} + \sqrt{5} + 2$	2
	$= 5$	1
32	$\int xe^x dx = xe^x - \int e^x dx$	(2*)
	$= xe^x - e^x + C$	1
	(or) Any alternative method	
33	$S = 6(1 + 11 + 111 + \cdots n\ terms)$	1
	$S = \frac{6}{9}((10 + 100 + 1000 + \cdots$ ....n terms) $-\mathrm{n})$	1
	$S = \frac{6}{9}\left[\frac{10(10^n-1)}{9} - n\right]$ or $S = \frac{20(10^n-1)}{27} - \frac{2n}{3}$	1
34	$= \frac{9 - 18 + 5}{27 - 24 + 7}$	2
	$= -\frac{2}{5}$	1
35	$y' = x\,e^x\,\frac{1}{x} + xe^x logx + e^x logx$	(2*)
	$y' = e^x + xe^x logx + e^x logx$	1
36	$\frac{nP_r}{nC_r} = \frac{720}{120}$	1
	$r = 3$	1
	$n = 10$	1
37	$\cos 105° = \cos 60° \cos 45° - sin60° sin45°$	(2*)
	$= \frac{1 - \sqrt{3}}{2\sqrt{2}}$	1
38	$f(-3) = 1$	1
	$f(5) = 38$	1
	$f(0) = -3$	1

39	$\|\overrightarrow{a}\| = \sqrt{6}$, $\|\vec{b}\| = \sqrt{41}, \|\vec{c}\| = \sqrt{35}$ $\|\overrightarrow{a}\|^2 + \|\overrightarrow{c}\|^2 = \|\overrightarrow{b}\|^2$ or they form a right angled triangle (or) Any alternative method	(2*) 1
40	$LHS = \frac{1 + tan11°}{1 - tan11°}$ $= \frac{tan45° + tan11°}{1 - tan45°tan11°}$ $= tan56°$ (or) Any alternative method	1 1 1

Part – IV

Answer All the Questions **7×5=35**

Q.NO	CONTENT	MARKS
41(a)	$\frac{2x}{(x^2+1)(x-1)} = \frac{A}{x-1} + \frac{Bx+C}{x^2+1}$ $A = 1\,,\ B = -1\,,\ C = 1$ (1+1+1 Mark) $\frac{2x}{(x^2+1)(x-1)} = \frac{1}{x-1} + \frac{1-x}{x^2+1}$ (or) Any alternative method	1 3 1
	OR	
41(b)	$y' = \frac{e^{\tan^{-1}x}}{1+x^2}$ $(1+x^2)y' = y$ $(1+x^2)y'' + (2x-1)y' = 0$	2 1 2

42(a)	 Rough diagram	1
	$\overrightarrow{AB} = \overrightarrow{AE} + \overrightarrow{EF} + \overrightarrow{FB}$ $\overrightarrow{AD} = \overrightarrow{AE} + \overrightarrow{EF} + \overrightarrow{FD}$ $\overrightarrow{CB} = \overrightarrow{CE} + \overrightarrow{EF} + \overrightarrow{FB}$ $\overrightarrow{CD} = \overrightarrow{CE} + \overrightarrow{EF} + \overrightarrow{FD}$	2
	$\overrightarrow{AB} + \overrightarrow{AD} + \overrightarrow{CB} + \overrightarrow{CD} = 4\overrightarrow{EF}$	
	(or) Any Alternative Method	2
	OR	
42(b)	$\lim_{x\to 0} f(x) = 2$	2
	$f(0) = 2$	1
	$\lim_{x\to 0} f(x) = f(0)$	1
	f is continuous at $x = 0$	1
43(a)	$LHS = \log_{10} 2 + \log_{10}\left(\frac{16}{15}\right)^{16} + \log_{10}\left(\frac{25}{24}\right)^{12} + \log_{10}\left(\frac{81}{80}\right)^{7}$	1
	$= \log_{10}\left(2 \times \frac{2^{64}}{3^{16} \times 5^{16}} \times \frac{5^{24}}{2^{36} \times 3^{12}} \times \frac{3^{28}}{2^{28} \times 5^{7}}\right)$	2
	=1	2
	OR	
43(b)	$P(A_1) = \frac{1}{2}$, $P(A_2) = \frac{1}{2}$, $P(B/A_1) = \frac{6}{10}$, $P(B/A_2) = \frac{2}{4}$	1+1
	$P(B) = \frac{11}{20}$	1
	$P(A_1/B) = \frac{6}{11}$	2*

44(a)	$3x + 5 = A(2x + 4) + B$	1
	$A = \frac{3}{2}$, $B = -1$	1
	$I = \int \frac{\frac{3}{2}(2x+4)-1}{x^2+4x+7}dx$	1
	$= \frac{3}{2}\log\lvert x^2+4x+7\rvert - \frac{1}{\sqrt{3}}\tan^{-1}\frac{x+2}{\sqrt{3}} + C$	2
	OR	
44(b)	$\cot\left(7\frac{1}{2}^\circ\right) = cot\theta = \frac{2\cos^2\theta}{sin2\theta}$	1
	$= \frac{1+\cos 15^\circ}{sin15^\circ}$	2
	$= \sqrt{2}+\sqrt{3}+\sqrt{4}+\sqrt{6}$	2
	(or) Any alternative method	
45(a)	$\sqrt[3]{x^3+6} - \sqrt[3]{x^3+3} = (x^3+6)^{\frac{1}{3}} - (x^3+3)^{\frac{1}{3}}$	1
	$= x\left(1+\frac{6}{x^3}\right)^{\frac{1}{3}} - x\left(1+\frac{3}{x^3}\right)^{\frac{1}{3}}$	1
	$= x(1+\frac{2}{x^3}+\ldots\ldots-1-\frac{1}{x^3}-\cdots\ldots)$	1
	$= \frac{1}{x^2}$ (app.)	2
	OR	
45(b)	To prove one-one	2
	To prove on-to	1
	f is bijection	1
	$f^{-1}(x) = \frac{x+3}{2}$	1
	(or) Any alternative method	

46(a)	Napier Formula (Any one) $In\ \Delta ABC$, **(1)** $\tan\frac{A-B}{2}=\frac{a-b}{a+b}\cot\frac{C}{2}$ **(2)** $\tan\frac{B-C}{2}=\frac{b-c}{b+c}\cot\frac{A}{2}$ **(3)** $\tan\frac{C-A}{2}=\frac{c-a}{c+a}\cot\frac{B}{2}$ $a=2RsinA\ ,\quad b=2RsinB\ ,\quad c=2RsinC$ Remaining Part of proof	2 1 2
	OR	
46(b)	$\lambda=2$ $x-2y+3=0\ ,2x-6y-1=0$ intersection point $\left(-10,-\frac{7}{2}\right)$ $\theta=\tan^{-1}\left(\frac{1}{7}\right)$	(2*) 1 1 1
47(a)	To prove $(a-b)$ is a factor $(b-c),(c-a)$ are also a factor Remaining factor $k(a+b+c)$ $k=1$ $\begin{vmatrix} b+c & a & a^2 \\ c+a & b & b^2 \\ a+b & c & c^2 \end{vmatrix}=(a+b+c)(a-b)(b-c)(c-a)$	1 1 1 1 1
	OR	
47(b)	P(1) is true Assume P(k) is true To prove P(k+1) is true conclusion (or) Any Alternative Method	1 1 2 1