DIRECTORATE OF GOVERNMENT EXAMINATION CHENNAI-600 006

HSE SECOND YEAR PUBLIC EXAMINATION-MARCH-2024

MATHEMATICS MARKING SCHEME

Maximum Marks : 90

GENERAL INSTRUCTIONS

1. The answers given in the marking scheme are Text book and solution book bound.

2. **If a student has given any answer which is different from one given in the marking scheme, but carriers the prescribed content meaning (rigorous) such answer 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 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

CODE A			CODE B		
Q.NO	**OPTION**	**ANSWER**	**Q.NO**	**OPTION**	**ANSWER**
1.	a)	$\frac{8}{3}$	**1.**	a)	45°
2.	d)	$\frac{3\pi a^4}{16}$	**2.**	d)	8
3.	a)	10	**3.**	a)	$\frac{8}{3}$
4.	d)	2	**4.**	a)	10
5.	d)	8	**5.**	d)	$\frac{1}{\sqrt{5}}$
6.	a)	$[\vec{\alpha}, \vec{\beta}, \vec{\gamma}] = 0$	**6.**	c)	- 4
7.	d)	$\frac{d^2y}{dx^2} - y = 0$	**7.**	b)	$-\frac{q}{r}$
8.	b)	y=0	**8.**	d)	$\frac{3\pi a^4}{16}$
9.	d)	$\frac{1}{(x+1)^2}dx$	**9.**	d)	adj (AB) = (adj A) (adj B)
10.	a)	$x^2 + y^2$	**10.**	a)	$[\vec{\alpha}, \vec{\beta}, \vec{\gamma}] = 0$
11.	c)	2	**11.**	d)	$\frac{d^2y}{dx^2} - y = 0$
12.	d)	Parabola	**12.**	c)	2
13.	c)	$\begin{bmatrix} 5 & -2 \\ 3 & -1 \end{bmatrix}$	**13.**	d)	Parabola
14.	a)	45°	**14.**	d)	2
15.	d)	$\frac{1}{\sqrt{5}}$	**15.**	c)	$\begin{bmatrix} 5 & -2 \\ 3 & -1 \end{bmatrix}$
16.	b)	$-\frac{q}{r}$	**16.**	a)	$x^2 + y^2$
17.	a) (or) (c)	0 (or) Var(3)	**17.**	b)	y=0
18.	c)	2	**18.**	a) (or)(c)	0 (or) Var(3)
19.	d)	adj (AB) = (adj A) (adj B)	**19.**	c)	2
20.	c)	- 4	**20.**	d)	$\frac{1}{(x+1)^2}dx$

PART-II

Answer Any Seven Questions. Question No.30 is compulsory **7×2=14**

Q.NO	CONTENT	MARKS
21.	$i+i^2+i^3+\ldots\ldots+i^{12}$	1
	0	1
22.	$\alpha+\beta=\frac{7}{2},\ \alpha\beta=\frac{13}{2}$	1
	$x^2+\frac{3}{4}x+\frac{169}{4}=0$	1
23.	df=(2x+3)dx	1
	df=0.18	1
24.	y=mx	1
	y=xy' (or) Any other form	1
25.	Mere Attempt	2
26.	$(x+3)^2+(y+4)^2=3^2$	1
	$x^2+y^2+6x+8y+16=0$	1
27.	$\begin{vmatrix}-1 & 3\\ 4 & -7\end{vmatrix}=-5\neq 0$	1
	Rank of the matrix is 2.	1
	Note : Any other second order minor which does not vanish. One can do by rank Method.	
28.	$I=\frac{9}{10}\times\frac{7}{8}\times\frac{5}{6}\times\frac{3}{4}\times\frac{1}{2}\times\frac{\pi}{2}$	1
	$I=\frac{63\pi}{512}$	1
29.	$\lim_{x\to 1}\frac{x^2-3x+2}{x^2-4x+3}=\frac{0}{0}$	1
	$\lim_{x\to 1}\frac{2x-3}{2x-4}=\frac{1}{2}$	1
30.	$\begin{vmatrix}2 & -1 & 3\\ 1 & -1 & 0\\ 3 & -1 & 6\end{vmatrix}=0$	1
	Coplanar vectors	1

Important Note for 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.

PART-III

Answer Any Seven Questions. Question No.40 is compulsory 7×3=21

Q.NO	CONTENT	MARKS
31.	$\cot^{-1}\left(\frac{1}{\sqrt{x^2-1}}\right)=\alpha$ $\sec\alpha = x$ $\cot^{-1}\left(\frac{1}{\sqrt{x^2-1}}\right)=\sec^{-1}x$ Note:Full mark to be awarded for alternative method	**1** **1** **1**
32.	Equation of tangent $4x+2y+2=0$ (or) $2x+y+1=0$ Equation of Normal $x-2y-7=0$	 **2*** **1**
33.	$\left[\vec{a}-\vec{b},\vec{b}-\vec{c},\vec{c}-\vec{a}\right]=\begin{vmatrix}1&-1&0\\0&1&-1\\-1&0&1\end{vmatrix}\left[\vec{a},\vec{b},\vec{c}\right]$ $\left[\vec{a}-\vec{b},\vec{b}-\vec{c},\vec{c}-\vec{a}\right]=0$	**2** **1**
34.	$n=\frac{3}{2}$ $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\frac{3}{2}u$	**1** **2***
35.	$P=x(12-x)$ P is maximum at x= 6 x=6, y=6	**1** **1** **1**
36.	$I=\int_{\frac{\pi}{8}}^{\frac{3\pi}{8}}\frac{1}{1+\sqrt{\tan x}}dx$ $I=\int_{\frac{\pi}{8}}^{\frac{3\pi}{8}}\frac{\sqrt{\tan x}}{1+\sqrt{\tan x}}dx$ $I=\frac{\pi}{8}$	**1** **1** **1**

37.	$\frac{1+i}{1-i} = \mathrm{i}$ $\frac{1-i}{1+i} = -i$ $\left(\frac{1+i}{1-i}\right)^3 - \left(\frac{1-i}{1+i}\right)^3 = -2i$	**1** **1** **1**
38.	$\frac{dy}{1+y^2} = \frac{dx}{1+x^2}$ $\tan^{-1} y = \tan^{-1} x + c$	**1** **2**
39.	S={HHH, HHT, HTH, THH, TTT, TTH, THT, HTT} (or) n(S) =8 x: 0, 1, 2, 3 f(x): $\frac{1}{8}$, $\frac{3}{8}$, $\frac{3}{8}$, $\frac{1}{8}$ (If sample space is not written then THREE marks to be awarded to the table)	**1** **2**
40.	$\lvert A\rvert = -1$ $\lvert adj(adj\ A)\rvert = 1$	**1** **2***

PART – IV

Answer All the Questions. **7×5=35**

Q.NO	CONTENT	MARKS
41.(a)	Point of intersection $\left(\frac{3}{2}, \frac{9}{4}\right)$ $m_1 = 3$ $m_2 = -3$ $\theta = \tan^{-1}\left(\frac{3}{4}\right)$	**1** **1** **1** **2***
	(OR)	
41.(b)	$\tan^{-1}\left[\frac{\frac{x-1}{x-2} + \frac{x+1}{x+2}}{1-\left(\frac{x-1}{x-2}\right)\left(\frac{x+1}{x+2}\right)}\right] = \frac{\pi}{4}$ $\frac{\frac{x-1}{x-2} + \frac{x+1}{x+2}}{1-\left(\frac{x-1}{x-2}\right)\left(\frac{x+1}{x+2}\right)} = 1$ $x = \pm\frac{1}{\sqrt{2}}$	**2*** **1** **2**

42.(a)

i) The probability mass function.

x	2	4	6	8	10
$f(x)$	$\frac{1}{36}$	$\frac{4}{36}$	$\frac{10}{36}$	$\frac{12}{36}$	$\frac{9}{36}$

2

ii) The cumulative distribution function.

x	2	4	6	8	10
$F(x)$	$\frac{1}{36}$	$\frac{5}{36}$	$\frac{15}{36}$	$\frac{27}{36}$	$\frac{36}{36}$

2

iii) $P(4 \leq x < 10) = \frac{26}{36}\ (or)\ \frac{13}{18}$ **1**

(OR)

42.(b)

$\frac{2z+1}{iz+1} = \frac{2(x+iy)+1}{i(x+iy)+1}$ **1**

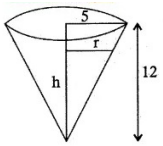
$\frac{2z+1}{iz+1} = \frac{(2x+1)+i\,2y}{(1-y)+ix} \times \frac{(1-y)-ix}{(1-y)-ix}$ **1**

$\frac{-x(2x+1)+2y(1-y)}{(1-y)^2+x^2} = 0$ **2**

$2x^2 + 2y^2 + x - 2y = 0$ **1**

43.(a)

Rough diagram



1

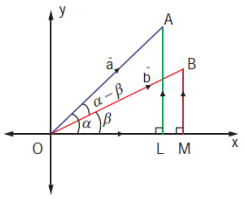
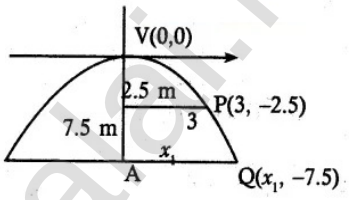
$r = \frac{5h}{12}$ **1**

$V = \frac{1}{3}\pi r^2 h$ **1**

$\frac{dv}{dt} = \frac{25\pi}{144} h^2 \frac{dh}{dt}$ **1**

$\frac{dh}{dt} = \frac{9}{10\pi}$ **1**

(OR)

43.(b)	Rough diagram 	**1**
	$\hat{a} = \cos\alpha\,\hat{\imath} + \sin\alpha\,\hat{\jmath}$ $\hat{b} = \cos\beta\,\hat{\imath} + \sin\beta\,\hat{\jmath}$	**1**
	$\hat{b} \times \hat{a} = \sin(\alpha - \beta)\,\hat{k}$	**1**
	$\hat{b} \times \hat{a} = (\sin\alpha\cos\beta - \cos\alpha\sin\beta)\hat{k}$	**1**
	$\sin(\alpha - \beta) = \sin\alpha\cos\beta - \cos\alpha\sin\beta$	**1**
44.(a)	Rough diagram 	**1**
	$x^2 = -4ay$	**1**
	$a = \frac{9}{10}$	**1**
	$x_1^2 = -4\left(\frac{9}{10}\right)(-7.5)$	**1**
	$x_1 = 3\sqrt{3}$	**1**
	(OR)	
44.(b)	$P = \frac{1}{x}$, $Q = sinx$	**1**
	$I.F = x$	**1**
	$xy = \int x\,sinx\,dx + c$	**2***
	$xy = -xcosx + sinx + c$	**1**
45.(a)	$\frac{dx}{dt} \propto x$	**1**
	$x = Ce^{kt}$	**1**
	$C = x_0$	**1**
	$e^{5k} = 3$	**1**
	$x = 9x_0$	**1**
	(OR)	

45.(b)

$\vec{a} = 2\hat{\imath} + 2\hat{\jmath} + \hat{k}$
$\vec{b} = 2\hat{\imath} + 3\hat{\jmath} + 3\hat{k}$
$\vec{c} = 3\hat{\imath} + 2\hat{\jmath} + \hat{k}$ **1**

Vector equation **(Parametric or non parametric form)**

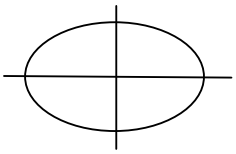
$\vec{r} = (2\,\hat{\imath} + 2\,\hat{\jmath} + \hat{k}) + s(2\hat{\imath} + 3\hat{\jmath} + 3\hat{k}) + t(3\hat{\imath} + 2\hat{\jmath} + \hat{k})$ **2***

Cartesian equation

$3x - 7y + 5z + 3 = 0$ **2***

46.(a)

Rough diagram

 **1**

$A = \frac{4b}{a}\int_0^a \sqrt{a^2 - x^2}\ dx$ **2***

$A = \pi ab$ **2***

(OR)

46.(b)

$(y-2)^2 = 8(x-1)$ **1**

$a = 2$ **1**

vertex : $(1,2)$ **1**

focus: $(3,2)$ **1**

equation of the directrix: $x = -1$ **1**

47.(a)

p	q	$p \leftrightarrow q$
T	T	T
T	F	F
F	T	F
F	F	T

3

$p \leftrightarrow q \equiv ((\sim p) \vee q) \wedge ((\sim q) \vee p)$ **2**

Note: If any mistake is in the table then award TWO marks for the table.

(OR)

47.(b)

$\Delta = -15$ **1**

$\Delta_1 = -15$ **1**

$\Delta_2 = -5$ **1**

$\Delta_3 = -5$ **1**

$x = 1, y = 3, z = 3$ **1**