MODEL HIGHER SECONDARY EXAMINATION

KEY FOR MATHS

PART - I

mathstimes.com

Section - A / B

- 1 mark to write the correct or the corresponding or both.
- If one write both **'option'** and **'answer'** with one of them is wrong, then award zero mark only.
- Instead of **1,2,3,4** if one writes **a,b,c,d** then marks should be awarded.

A

Q. No.	Key	Answer
1.	1	1
2.	4	k^{n-1} (adj I)
3.	4	no solutions
4.	4	$(A^{-1})^T$
5.	2	$-\sqrt{3}$
6.	2	$\vec{a}$ is perpendicular to $\vec{b}$
7.	2	8
8.	2	2
9.	4	$\sin\theta = \frac{\vec{b} \cdot \vec{n}}{\lvert\vec{b}\rvert \lvert\vec{n}\rvert}$
10.	1	(2, -1, 4), 5
11.	4	x + iy
12.	3	-z
13.	3	$\frac{-2}{13} - \frac{23}{13}i$
14.	3	– 1
15.	4	8
16.	3	2
17.	4	16
18.	2	y - 5 = 0
19.	3	$\frac{-1}{12}$
20.	1	1.5 cm^2/sec
21.	4	5
22.	2	Fermat's theorem
23.	2	an asymptote parallel to y-axis
24.	1	cos x
25.	1	0
26.	3	$\frac{\pi}{3}$
27.	1	$8\sqrt{5}\pi$
28.	4	$\int_a^b f(a+b-x)\,dx$
29.	2	log x
30.	2	$\frac{d^2y}{dx^2} = 0$

B

Q. No.	Key	Answer
1.	3	2
2.	4	16
3.	2	y - 5 = 0
4.	3	$\frac{-1}{12}$
5.	1	1.5 cm^2/sec
6.	4	x + iy
7.	3	-z
8.	3	$\frac{-2}{13} - \frac{23}{13}i$
9.	3	– 1
10.	4	8
11.	3	$\frac{\pi}{3}$
12.	1	$8\sqrt{5}\pi$
13.	4	$\int_a^b f(a+b-x)\,dx$
14.	2	log x
15.	2	$\frac{d^2y}{dx^2} = 0$
16.	2	$\vec{a}$ is perpendicular to $\vec{b}$
17.	2	8
18.	2	2
19.	1	(2, -1, 4), 5
20	4	$\sin\theta = \frac{\vec{b} \cdot \vec{n}}{\lvert\vec{b}\rvert \lvert\vec{n}\rvert}$
21.	2	If every element of a group is its own inverse, then the group is abelian.
22.	4	Z
23.	2	2
24.	4	$\frac{3}{10}$
25.	3	3
26.	3	0, 1
27.	4	$\frac{xe^{ax}}{g(a)}$
28.	4	2, 2
29.	3	$\sim p \vee q$
30.	1	25

A			B		
Q. No.	Key	Answer	Q. No.	Key	Answer
31.	4	$\frac{xe^{ax}}{g(a)}$	31.	1	1
32.	4	2, 2	32.	4	k^{n-1} (adj I)
33.	3	$\sim p \vee q$	33.	4	no solutions
34.	1	25	34.	4	$(A^{-1})^T$
35.	2	If every element of a group is its own inverse, then the group is abelian.	35.	2	$-\sqrt{3}$
36.	4	Z	36.	4	5
37.	2	2	37.	2	Fermat's theorem
38.	4	$\frac{3}{10}$	38.	2	an asymptote parallel to y-axis
39.	3	3	39.	1	cos x
40.	3	0, 1	40.	1	0

SECTION - B

41 $\begin{bmatrix} 7 & 3 \\ 2 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -1 \\ 0 \end{bmatrix}$ **- 1 mark**

$|A| = 1$ **- 1 mark**

$A^{-1} = \begin{bmatrix} 1 & -3 \\ -2 & 7 \end{bmatrix}$ **- 2 marks**

$x = -1 \qquad y = 2$ **- 2 marks**

---

42 $[A, B] = \begin{bmatrix} 1 & -4 & 7 & 14 \\ 3 & 8 & -2 & 13 \\ 7 & -8 & 26 & 5 \end{bmatrix}$ **- 2 marks**

$\sim \begin{bmatrix} 1 & -4 & 7 & 14 \\ 0 & 20 & -23 & -30 \\ 0 & 0 & 0 & -63 \end{bmatrix}$ **- 2 marks**

$\rho(A) = 2$ and $\rho(A, B) = 3$

(or)

$\rho(A) \neq \rho(A, B)$ **- 1 mark**

The given system is inconsistent

(or) it has no solution. **- 1 mark**

---

43. a) $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ **- 1 mark**

$(2\vec{i} - \vec{j} + \vec{k}) \cdot (\vec{i} - \vec{3} - 5\vec{k}) = 0$ **- 1 mark**

$\therefore$ angle between two side is 90^0 **- 1 mark**

Note : For any another method, full marks may be given

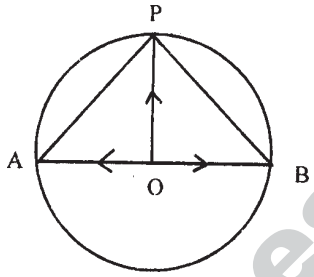
(b) $\vec{d} = \vec{i} + \vec{j} + \vec{k}$ **- 1 mark**

workdone $= \vec{F} \cdot \vec{d}$ **- 1 mark**

$a = 3$ **- 1 mark**

---

44. Diagram **- 1 mark**



$\vec{PB} = \vec{OB} - \vec{OP}$ **- 1 mark**

$\vec{AP} = \vec{OP} - \vec{OA} = \vec{OP} + \vec{OB}$ **- 1 mark**

$\vec{AP} \cdot \vec{PB} = |\vec{OB}|^2 - |\vec{OP}|^2$ **- 1 mark**

$\vec{AP} \cdot \vec{PB} = \vec{O}$ **- 1 mark**

$\therefore$ AB substends a right angle at P on the surface **- 1 mark**

---

45. $Z = x + iy$ **- 1 mark**

$\arg(z - 1) = \frac{\pi}{6} \Rightarrow x - 1 = \sqrt{3}\, y$ **- 2 marks**

$\arg(z + 1) = \frac{2\pi}{3} \Rightarrow \sqrt{3}(x + 1) = -y$ **- 2 marks**

$x^2 + y^2 = 1$

$|Z| = 1$ **- 1 mark**

Note : Different method can be adopted

---

46. $1 + i\sqrt{3}) = 2\left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right)$ **- 3 marks**

$(1 + i\sqrt{3})^n = 2^n\left(\cos\frac{n\pi}{3} + i\sin\frac{n\pi}{3}\right)$ **- 1 mark**

$(1 + i\sqrt{3})^n = 2^n\left(\cos n\frac{\pi}{3} + i\sin n\frac{\pi}{3}\right)$ **- 1 mark**

$(1 + i\sqrt{3})^n + (1 + i\sqrt{3})^n = 2^{n+1}\cos n\frac{\pi}{3}$ **- 1 mark**

---

47. Another asymptotes equation is $x + 3y + k = 0$ **- 1 mark**

$K = -5$ **- 1 mark**

Combined equation of asymptotes

$(3x - y - 5)(x + 3y - 5) = 0$ **- 1 mark**

Equation of RH is

$(3x - y - 5)(x + 3y - 5) = C$ **- 1 mark**

$C = 7$ **- 1 mark**

RH equation is

$(3x - y - 5)(x + 3y - 5) = 7$ **- 1 mark**

---

48. $V = f(x) = 12\pi x^2$ **- 2 marks**

$f^1(x) = 24\pi C$ **- 1 mark**

Take $C = 2.01$ **- 1 mark**

By Law of mean,

$f(2.06) - f(2) = 0.06 \times 24\pi \times 2.06$

$= 2.89\pi$ cubic mm **- 2 marks**

NOTE : Any suitable value C between 2 and 2.06 other than 2.01 also will be give other estimates

---

49. $xy = 100$ **- 1 mark**

$S = x + \frac{100}{x}$ **- 2 marks**

$\frac{ds}{dx} = 1 - \frac{100}{x^2}$

$\frac{ds}{dx} = 0$, $x = 10$

$\frac{d^2s}{dx^2} = -\frac{200}{x} < 0$ **- 1 mark**

There is minimum at $x = 10$. The numbers are 10, 10 **- 2 marks**

---

50. $\frac{dw}{dt} = \frac{\partial w}{\partial x} \cdot \frac{dx}{dt} + \frac{\partial w}{\partial y} \cdot \frac{dy}{dt} + \frac{\partial w}{\partial z} \cdot \frac{dz}{dt}$ **- 2 marks**

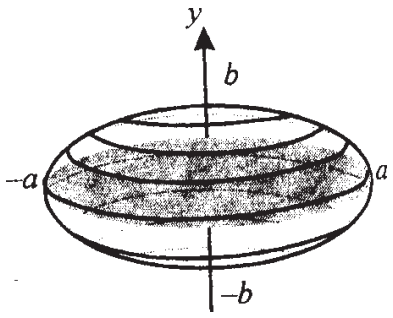
$\frac{\partial w}{\partial x} = 1$, $\frac{dx}{dt} = \cos t$ **- 1 mark**

$\frac{\partial w}{\partial y} = 2$, $\frac{dy}{dt} = -\sin t$ **- 1 mark**

$\frac{\partial w}{\partial y} = 2z$, $\frac{dz}{dt} = 1$ **- 1 mark**

$\frac{dw}{dt} = (\cos t) - 2\sin t + 2t$ **- 1 mark**

51. Rough diagram



- 1 mark

putting $x = 0$

$y = + b$ **- 1 mark**

$$V = \int_{-b}^{b} \pi \frac{a^2}{b^2} (b^2 - y^2)\, dy$$ **- 2 marks**

$$= 2\pi \frac{a^2}{b^2} \left(b^2 y - \frac{y^3}{3} \right)_0^b$$ **- 1 mark**

$$V = \frac{4}{3} \pi a^2 b \text{ cubic unit}$$

- 1 mark

---

52. $2p^2 + 5p + 2 = 0$ **- 1 mark**

$CF = Ae^{-\frac{1}{2}x} + Be^{-2x}$ **- 1 mark**

$PI = \frac{x}{3} e^{-\frac{x}{2}}$ **- 2 marks**

$y = Ae^{-\frac{1}{2}x} + Be^{-2x} + \frac{x}{3} e^{-\frac{x}{2}}$ **- 2 marks**

---

53. Order of [1] is 1 **- 1 mark**

Order of [2] is 4 **- 1 mark**

Order of [3] is 4 **- 2 marks**

Order of [4] is 2 **- 2 marks**

---

54. (i) $F(2) = \int_{-\infty}^{2} f(x)\, dx$ **- 1 mark**

$$= \frac{e^4 - 1}{e^4}$$ **- 2 marks**

(ii) $\sum_{x=0}^{2\infty} p(x) = \sum_{x=0}^{\infty} \frac{e^{-\lambda} - \lambda^x}{\angle x}$ **- 1 mark**

$$= \frac{e^{-\lambda} \cdot \lambda^0}{\angle 0} + \frac{e^{-\lambda} \lambda^1}{\angle 1} + \frac{e^{-\lambda} \lambda^2}{\angle 2} +$$ **- 1 mark**

$= 1$ **- 1 mark**

---

55. a) $E(x) = 0$ **- 2 marks**

$E(x^2) = 48$ **- 2 marks**

variance = 48 **- 2 marks**

(OR)

b)

p	q	r	$p \wedge q$	$\sim r$	$(p \wedge q) \vee (\sim r)$
T	T	T	T	F	T
T	T	F	T	T	T
T	F	T	F	F	F
T	F	F	F	T	T
F	T	T	F	F	F
F	T	F	F	T	T
F	F	T	F	F	F
F	F	F	F	T	T

First four columns (each one mark) **- 4 marks**

Last column **- 2 marks**

Note : The order of the rows need not be same as in the scheme

---

SECTION - C

56. $[A, B] = \begin{bmatrix} 2 & 5 & 7 & 52 \\ 1 & 1 & 1 & 9 \\ 2 & +1 & -1 & 0 \end{bmatrix}$ **- 1 mark**

$\sim \begin{bmatrix} 1 & 1 & 1 & 9 \\ 0 & -1 & -3 & -18 \\ 0 & 0 & -4 & -20 \end{bmatrix}$ **- 3 marks**

$\varrho(A) = \varrho(A, B) = 3$ **- 2 marks**

The system is consistant (or) has unique solution **- 1 mark**

$x = 1$ **- 1 mark**

$y = 3$ **- 1 mark**

$z = 5$ **- 1 mark**

Note : The echelon form need not be the same as in the scheme. Full credit should be given for such echelon form.

---

57. Condition for intersecting

$[\ (\vec{a_2} - \vec{a_1})\ \vec{u}\ \vec{v}\ ] = 0$ **- 1 mark**

$$\begin{vmatrix} 1 & 2 & -1 \\ 1 & -1 & 3 \\ 1 & 2 & -1 \end{vmatrix} = 0$$ **- 2 marks**

given lines are intersecting

Take $\frac{x-1}{1} = \frac{y+1}{-1} = \frac{z}{3} = \lambda$ **- 1 mark**

point $(\lambda + 1, -\lambda - 1, 3\lambda)$ **- 1 mark**

Take $\frac{x-2}{1} = \frac{y-1}{2} = \frac{z+1}{-1} = \mu$ **- 1 mark**

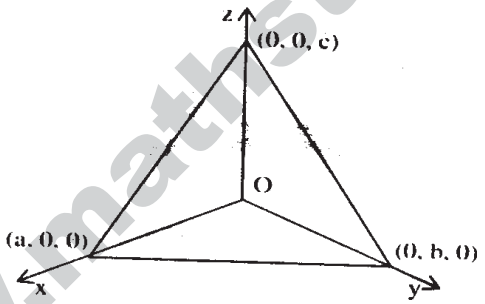
point $(\mu + 2, 2\mu + 1, -\mu - 1)$ **- 1 mark**

Solving $\lambda = 0$, $\mu = -1$ **- 1 mark**

Intersecting point $(1, -1, 0)$ **- 2 marks**

---

58. Rough Diagram **- 1 mark**



Taking a, b and c as the x, y and z intercepts of the plane respectively,

(OR)

Taking the points as (a, o, o), (o, b, o) and (o, o, c) **- 1 mark**

Vector form :

$\vec{r} = (1 - s - t)\ a\vec{i} + s\ b\vec{j} + t\ c\vec{k}$ **- 2 marks**

Cartesian form :

The equation is

$$\begin{vmatrix} x - a & y - 0 & z - 0 \\ -a & b - 0 & 0 \\ -a & 0 & c - 0 \end{vmatrix} = 0$$ **- 3 marks**

$\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$ **- 3 marks**

---

59. $x^4 + x^3 + x^2 + x + 1 = 0$

mul by $x - 1$, we get $x^5 - 1 = 0$ **- 3 marks**

$x^5 = 1$

$x = (1)^{\frac{1}{5}}$ **- 1 mark**

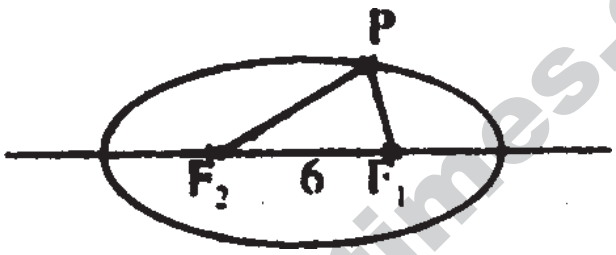
$x = (\text{ciso})^{\frac{1}{5}}$ **-1 mark**

$x = \text{cis}\left(\frac{2K\pi}{5}\right)$, $k = 0, 1, 2, 3, 4$ (omit the root $x = 1$) **- 2 marks**

The roots are $\text{cis}\frac{2\pi}{5}$, $\text{cis}\frac{4\pi}{5}$, $\text{cis}\frac{6\pi}{5}$, $\text{cis}\frac{8\pi}{5}$ **- 3 marks**

---

60. Rough Diagram **- 2 marks**



finding $a = 4$ **- 2 marks**

finding $ae = 3$ **- 1 mark**

$e = ¾$ **- 1 mark**

$b^2 = 7$ **- 2 marks**

The equation of the path is $\frac{x^2}{16} + \frac{y^2}{7} = 1$ **- 2 marks**

Note : Instead of first type, one may take it as second type ellipse also.

---

61. Equations of the two asymptotes are of the form

$x + 2y + l = 0$ and $x - 2y + m = 0$ **- 2 marks**

$l = -10$, $m = 6$ **- 2 marks**

Equation of the asymptotes are

$x + 2y - 10 = 0$ and $x - 2y + 6 = 0$ **- 1 mark**

Combined equation of the asymptotes is

$(x + 2y - 10)(x - 2y + 6) = 0$ **- 1 mark**

The equation of the hyperbola is of the form

$(x + 2y - 10)(x - 2y + 6) + k = 0$ **- 1 mark**

$k = 64$ **- 2 marks**

Equation of the hyperbola is

$(x + 2y - 10)(x - 2y + 6) + 64 = 0$ (or) **- 1 mark**

any equivalent form

---

62. $(\cot x)^{\sin x}$ is of the type ∞^0 **- 1 mark**

$y = (\cot x)^{\sin x}$

$\log y = \dfrac{\log(\cot x)}{\operatorname{cosec} x}$ **- 2 marks**

$\lim\limits_{x \to 0} \log y = \dfrac{\infty}{\infty}$ form **- 2 marks**

using l' H rule

$\lim\limits_{x \to 0} \log y = \lim\limits_{x \to 0} \dfrac{\sin x}{\cos^2 x} = 0$ **- 3 marks**

$\lim\limits_{x \to 0} (\cot x)^{\sin x} = 1$ **- 2 marks**

---

63. $\dfrac{\partial u}{\partial x} = 3 \cos 3x \cos 4y$ **- 2 marks**

$\dfrac{\partial^2 u}{\partial x \partial y} = -12 \cos 3x \sin 4y$ **- 2 marks**

$\dfrac{\partial u}{\partial y} = -4 \sin 3x \sin 4y$ **- 2 marks**

$\dfrac{\partial^2 u}{\partial x \partial y} = -12 \cos 3x \sin 4y$ **- 2 marks**

$\dfrac{\partial^2 u}{\partial x \partial y} = \dfrac{\partial^2 u}{\partial y \partial x}$ **- 2 marks**

---

64. Put $y = 0$ **- 2 marks**

$t = 0, \pi, 2\pi$ **- 1 mark**

Required area $= \int_a^b y \, dx$ **- 2 marks**

$= \int_0^{\pi} a(1 - \cos 2t) \, 2a(1 - \cos 2t) \, dt$

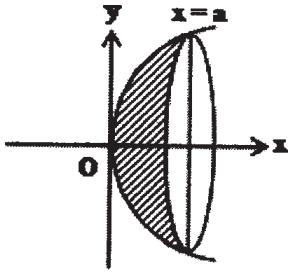
$= 8a^2 \int_0^{\pi} \sin^4 t \, dt$ **- 1 mark**

$= 2 \times 8a^2 \int_0^{\pi/2} \sin^4 t \, dt$ **- 2 marks**

$= 3\pi a^2$ sq. unit **- 2 marks**

---

65. Rough Diagram



- 2 marks

$y\sqrt{1 + (y^1)^2} = 2\sqrt{a}\ \sqrt{x + a}$ **- 3 marks**

$$\textbf{S. A} = 4\sqrt{a}\,\pi\left[\frac{(x+a)^{3/2}}{3/2}\right]_o^a$$ **- 3 marks**

(or) any other form

$$\textbf{S. A} = \frac{8\,a^2\pi}{3}\ [\,2\sqrt{2} - 1\,]$$ Sq. unit **- 2 marks**

---

66. $\frac{dx}{dy} + x = e^{-y}\ \sec^2 y$

$P = 1\ ,\ Q = e^{-y}\ \sec^2 y$ **- 1 mark**

$IF = e^{\int pdy} = e^y$ **- 3 marks**

$xe^y = \int e^{-y}\ \sec^2 y\ e^y\ dy + c$ **- 3 marks**

$= \int \sec^2 y\ dy + c$ **- 1 mark**

$= \tan y + c$ **- 1 mark**

$x\,e^y = \tan y + c$ **- 1 mark**

---

67. (i) $\frac{dA}{dt} = -3t^{1/2}$

$A = -2t^{3/2} + c$ **- 3 marks**

When $t = 0$, $A = 10 \Rightarrow c = 10$ **- 1 mark**

$A = 10 - 2\,e^{3/2}$ **- 1 mark**

(ii) When $A = 0$ **- 1 mark**

$5 = t^{3/2}$ **- 2 marks**

$t = 2.9$ hours **- 1 mark**

Hence the patient will be drug free in 2.9 hours or 2 hours 54 min **- 1 mark**

---

68. **(i) Closure axiom :** **- 1 mark**

Proving $a * b \neq -1$ and hence $a * b \in G$ **- 1 mark**

(ii) Associative axiom : **- 1 mark**

$a * (b * c) = a + b + c + bc + ab + ac + abc$ **- 1 mark**

$(a * b) * c = a + b + c + ab + ac + bc + abc$

(iii) Identity axiom : **- 1 mark**

$e = 0$ **- 1 mark**

(iv) Inverse axiom : **- 1 mark**

$a^{-1} = \frac{-a}{1+a}$ **- 1 mark**

(v) Commutative axiom : **- 1 mark**

Proving $a* b = b * a$ **- 1 mark**

---

69. (i) when $x = 120 , z = -2.067$ **- 1 mark**

when $x = 155, z = 0.2667$ **- 1 mark**

$P (120 < x < 155) = 0.5829$ **- 2 marks**

Number of students weigh lies between 120 cm and 155 is 291 **- 1 mark**

(ii) When $x = 185 , z = 2.2667$ **- 1 mark**

$P (x > 185) = 0.0119$ **- 1 mark**

Number of students weigh more than 185 pounds is 6 **- 3 marks**

---

70. (a) $(y + 3)^2 = 8x$ **- 2 marks**

axis $y + 3 = 0$ **- 1 mark**

Vertex : (0, -3) **- 1 mark**

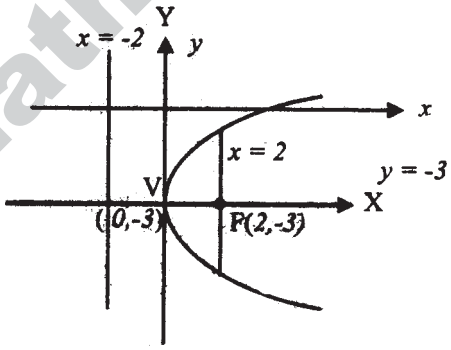
Focus : (2, -3) **- 1 mark**

Directrix $x = -2$ **- 1 mark**

LR $x = 2$ **- 1 mark**

Length = 8 **- 1 mark**

Rough diagram **- 2 marks**



(OR)

70. (b)

$y^1 = -2 xe^{-x2}$ **- 1 mark**

$y^{11} = 2 e^{-x2} (2x^2 - 1)$ **- 1 mark**

For $y^{11} = 0 \Rightarrow x = -\frac{1}{\sqrt{2}} , \frac{1}{\sqrt{2}}$ **- 3 marks**

$(-\infty , -\frac{1}{\sqrt{2}}) \rightarrow$ cancave upward (or) convex downward **- 1 mark**

$(-\frac{1}{\sqrt{2}} , \frac{1}{\sqrt{2}}) \rightarrow$ cancave downward (or) convex upward **- 1 mark**

$(\frac{1}{\sqrt{2}}, \infty) \rightarrow$ cancave upward (or) convex downward **- 1 mark**

points of inflextion $(-\frac{1}{\sqrt{2}} , e^{-½})$ and $(\frac{1}{\sqrt{2}} , e^{-½})$ **- 2 marks**

PIMS®
EDUCATIONAL ACADEMY
Regd. No. : 130/10

Entrance Coaching Programme

for

JEE-Main, AIPMT, JIPMER, AIIMS, AFMC

Class starts on 27-3-2015

Salient Features of Our Training :-

- Comprehensive **Study Material.**
- Maximum number of Teaching / Training sessions (6hrs per day) and **sessionwise spot tests.**
- Training in an efficient way of answering - involving speed, accuracy and **intelligent shortcuts.**
- Topicwise unit tests, **Four Revision** tests and **Two model** tests.
- Supply of Key and **Solutions to all questions.**
- All Model tests followed by **Discussion Sessions.**

OUR COACHING CENTRES :

☐	**1. Puducherry**	-	**Professional Institute for Meritorious Students** **# 29 & 31, Vallalar Salai, 2nd Floor, Kamaraj Nagar, Puducherry-11.**
☐	**2. Cuddalore**	-	Krishnasamy Memorial Matric Hr. Sec. School
☐	**3. Neyveli**	-	C.N.N., 5, Swamy Vivekananda Salai, Block-5
☐	**4. Villupuram**	-	Nityanandha Hr. Sec. School, (Near New Bus Stand)
☐	**5. Thiruvannamalai**	-	Mount Saint Joseph Matric Hr. Sec. School
☐	**6. Chidambaram**	-	Nirmala Matric Hr. Sec. School
☐	**7. Kallakurichi**	-	A K T Academy Matric Hr. Sec. School

Cell : 99945 13453