School Education Department-Vellore District
MARKING SCHEME – MATHEMATICS-ENGLISH MEDIUM

HIGHER SECONDARY – SECOND YEAR -REVISION TEST-1-FEB 2022

GENERAL INSTRUCTIONS

Maximum Marks-90

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 carries the prescribed content meaning (rigorous) such answer should be given full credit with suitable distribution.
3. Follow the foot notes which are given with 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^*) and 2 marks (for the stage mark 3^*). 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. That is, mark should not be deducted for not writing the formula.

   ***** mark indicates these places in the scheme.
5. In the case of Part -II, Part II 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. **1 mark to write the correct option or the corresponding answer or both.**
2. **If one of them (option or answer) is wrong, then award ZERO mark only.**

Question No.	Option	Answer
1	d	$2A^{-1}$
2	a	$\begin{bmatrix} 4 & -1 \\ 1 & -2 \end{bmatrix}$
3	b	$(A^T)^2$
4	d	1
5	a	0
6	a	$\frac{1}{2}\|z\|^2$
7	a	$Re(z) = \frac{z - \bar{z}}{2}$
8	b	Imaginary axis
9	a	1
10	d	-4
11	Mere attempt	One negative and two imaginary zeros
12	a	$[1, 2]$
13	c	$\frac{\pi}{2} - x$
14	d	$\frac{\pi}{2}$
15	d	Does not exist
16	b	4
17	b	0
18	c	n complex roots
19	a	mn
20	c	$[-2, -\sqrt{2}] \cup [\sqrt{2}, 2]$

PART – II

Q.No	Content	Marks
21.	$\lvert adjA\rvert = 36$ $A^{-1} = \pm\frac{1}{6}\begin{bmatrix} 0 & -2 & 0 \\ 6 & 2 & -6 \\ -3 & 0 & 6 \end{bmatrix}$	1 1
22.	$AA^T = \begin{bmatrix} cos\theta & -sin\theta \\ sin\theta & cos\theta \end{bmatrix}\begin{bmatrix} cos\theta & sin\theta \\ -sin\theta & cos\theta \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ AA^T=I , A is orthogonal. (or) Any other method	1 1
23.	$\sqrt{-5-12i} = \pm\left[\sqrt{\frac{13-5}{2}} - i\sqrt{\frac{13+5}{2}}\right]$ $\sqrt{-5-12i} = \pm(2 - i3)$	1 1
24.	$\alpha + \beta = \frac{7}{2}, \alpha\beta = \frac{13}{2}$ $\alpha^2 + \beta^2 = (\alpha+\beta)^2 - 2\alpha\beta = \frac{-3}{4}$	1 1
25.	$\alpha = 2-\sqrt{3}, \beta = 2+\sqrt{3}$ $\alpha + \beta = 4, \alpha\beta = 1$ $x^2 - 4x + 1 = 0$	1 1
26.	$2cos^{-1}\left(\frac{1}{2}\right) + sin^{-1}\left(\frac{1}{2}\right) = 2\frac{\pi}{3} + \frac{\pi}{6}$ $= \frac{5\pi}{6}$ (or)$150°$	1 1
27.	$tan^{-1}\left(\tan(\frac{5\pi}{4})\right) = tan^{-1}\left(\tan(\pi + \frac{\pi}{4})\right)$, $\frac{5\pi}{4} \notin \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ $= tan^{-1}\left(tan\frac{\pi}{4}\right) = \frac{\pi}{4} \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$	1 1
28.	$A^T = A$, $adj(A^T) = (adj\ A)^T$ $adj\ A = (adj\ A)^T \Rightarrow adj\ A$	1 1
29.	$i^{59} + \frac{1}{i^{59}} = -i + i$ $i^{59} + \frac{1}{i^{59}} = 0$	1 1
30.	$z_1(z_2 z_3) = 84 - 105i$ $(z_1 z_2)z_3 = 84 - 105i$	1 1

PART – III

Q.No	Content	Marks
31.	$A = \begin{bmatrix} 1 & 1 & 1 & 3 \\ 2 & -1 & 3 & 4 \\ 5 & -1 & 7 & 11 \end{bmatrix}$ $\sim \begin{bmatrix} 1 & 1 & 1 & 3 \\ 0 & -3 & 1 & -2 \\ 0 & -6 & 2 & -4 \end{bmatrix} \begin{matrix} R_2 \to R_2 - 2R_1 \\ R_3 \to R_3 - 5R_1 \end{matrix}$ $\sim \begin{bmatrix} 1 & 1 & 1 & 3 \\ 0 & -3 & 1 & -2 \\ 0 & 0 & 0 & 0 \end{bmatrix} R_3 \to R_3 - 2R_2$ $\rho(A) = 2$	1 1 1
32.	$z = \left(2 + i\sqrt{3}\right)^{10} - \left(2 - i\sqrt{3}\right)^{10}$ $\bar{z} = \overline{\left(2 + i\sqrt{3}\right)^{10} - \left(2 - i\sqrt{3}\right)^{10}}$ $\bar{z} = \left(2 - i\sqrt{3}\right)^{10} - \left(2 + i\sqrt{3}\right)^{10}$ $\bar{z} = -z \Rightarrow z$ is purely imaginary	1 1 1
33.	$\lvert z + 3 + 4i \rvert \leq 7$ $\lvert z + 3 + 4i \rvert \geq 3$ $3 \leq \lvert z + 3 + 4i \rvert \leq 7$ (or) Any other method	1 1 1
34.	A cubic equation $x^3 - S_1x^2 + S_2x - S_3 = 0$ $S_1 = \frac{7}{2}, S_2 = \frac{7}{2}, S_3 = 1$ $2x^3 - \frac{7}{2}x^2 + \frac{7}{2}x - 1 = 0$ $2x^3 - 7x^2 + 7x - 2 = 0$	1 1 1
35.	It has no real zero x=0 is a zero It has 8 imaginary zeros.	1 1 1
36.	$-1 \leq \frac{2 + sinx}{3} \leq 1$ $-3 \leq 2 + sinx \leq 3$ (or) $-5 \leq sinx \leq 1$ $-1 \leq sinx \leq 1$) (or) $x \epsilon \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$	1 1 1
37.	$cos^{-1}(1) + sin^{-1}(-\frac{\sqrt{3}}{2}) - sec^{-1}(-\sqrt{2}) \neq \frac{-5\pi}{6}$	Mere attempt

38.	$\lvert A\rvert = -1$ $adjA = \begin{bmatrix} 7 & 9 & -10 \\ 12 & 15 & -17 \\ -1 & -1 & 1 \end{bmatrix}$ $A^{-1} = \begin{bmatrix} -7 & -9 & 10 \\ -12 & -15 & 17 \\ 1 & 1 & -1 \end{bmatrix}$	**1** **1** **1**
39.	$sin^{-1}(-1) + cos^{-1}(\frac{1}{2}) + cot^{-1}(2) = -\frac{\pi}{2} + \frac{\pi}{3} + cot^{-1}(2)$ $sin^{-1}(-1) + cos^{-1}(\frac{1}{2}) + cot^{-1}(2) = cot^{-1}(2) - \frac{\pi}{6}$ **(or)** $cot^{-1}(2) - 30°$	**1** **2***
40.	$AB = \begin{bmatrix} 8 & -3 \\ 11 & -4 \end{bmatrix}$, $\lvert AB\rvert = 1$, $(AB)^{-1} = \begin{bmatrix} -4 & 3 \\ -11 & 8 \end{bmatrix}$ $(A)^{-1} = \begin{bmatrix} 3 & -2 \\ -7 & 5 \end{bmatrix}$, $(B)^{-1} = \begin{bmatrix} 1 & 1 \\ 1 & 2 \end{bmatrix}$, $B^{-1}A^{-1} = \begin{bmatrix} -4 & 3 \\ -11 & 8 \end{bmatrix}$	**1** **1** **1**

PART – III

Q.No	Content	Marks
41.a	$\lvert A\rvert = 0$ $adjA = \begin{bmatrix} 5 & 10 & 10 \\ 10 & 20 & 20 \\ 10 & 20 & 20 \end{bmatrix}$ $A(adjA) = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}\begin{bmatrix} 5 & 10 & 10 \\ 10 & 20 & 20 \\ 10 & 20 & 20 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} = \lvert A\rvert I$ $(adjA)A = \begin{bmatrix} 5 & 10 & 10 \\ 10 & 20 & 20 \\ 10 & 20 & 20 \end{bmatrix}\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} = \lvert A\rvert I$ $A\,(adjA) = (adjA)\,A = \lvert A\rvert I$	**1** **1** **1** **1** **1**
	OR	
41.b	$\lvert F(\alpha)\rvert = 1$ $adj\left(F(\alpha)\right) = \begin{bmatrix} cos\alpha & 0 & -sin\alpha \\ 0 & 1 & 0 \\ sin\alpha & 0 & cos\alpha \end{bmatrix}$ $(F(\alpha))^{-1} = \begin{bmatrix} cos\alpha & 0 & -sin\alpha \\ 0 & 1 & 0 \\ sin\alpha & 0 & cos\alpha \end{bmatrix}$ $F(-\alpha) = \begin{bmatrix} cos\alpha & 0 & -sin\alpha \\ 0 & 1 & 0 \\ sin\alpha & 0 & cos\alpha \end{bmatrix}$ $(F(\alpha))^{-1} = F(-\alpha)$	**1** **1** **2*** **1**

42.a	$X=\frac{1}{x}, Y=\frac{1}{y}, Z=\frac{1}{z}3$ $3X-4Y-2Z=1, X+2Y+Z=2, 2X-5Y-4Z=-1$ $\Delta=\begin{vmatrix}3 & -4 & -2\\1 & 2 & 1\\2 & -5 & -4\end{vmatrix}=-15$ $\Delta_X=\begin{vmatrix}1 & -4 & -2\\2 & 2 & 1\\-1 & -5 & -4\end{vmatrix}=-15$ $\Delta_Y=\begin{vmatrix}3 & 1 & -2\\1 & 2 & 1\\2 & -1 & -4\end{vmatrix}=-5$ $\Delta_Z=\begin{vmatrix}3 & -4 & 1\\1 & 2 & 2\\2 & -5 & -1\end{vmatrix}=-5$ $X=\frac{\Delta}{\Delta_X}=\frac{-15}{-15}=1, Y=\frac{\Delta}{\Delta_Y}=\frac{-5}{-15}=\frac{1}{3}, Z=\frac{\Delta}{\Delta_Z}=\frac{-5}{-15}=\frac{1}{3}$ $\left(X=\frac{1}{x}, Y=\frac{1}{y}, Z=\frac{1}{z}\right)$ $x=1, y=3, z=3$	1 1 1 1 1
	OR	
42.b	$z_1=1, z_2=\frac{-1}{2}+i\frac{\sqrt{3}}{2},\ z_3=\frac{-1}{2}-i\frac{\sqrt{3}}{2}$ $\lvert z_1-z_2\rvert=\left\lvert 1-\left(\frac{-1}{2}+i\frac{\sqrt{3}}{2}\right)\right\rvert=\sqrt{3}$ $\lvert z_2-z_3\rvert=\left\lvert\left(\frac{-1}{2}+i\frac{\sqrt{3}}{2}\right)-\left(\frac{-1}{2}-i\frac{\sqrt{3}}{2}\right)\right\rvert=\sqrt{3}$ $\lvert z_3-z_1\rvert=\left\lvert\left(\frac{-1}{2}-i\frac{\sqrt{3}}{2}\right)-1\right\rvert=\sqrt{3}$ **It forms an equilateral triangle.** **(or) Any other method**	1 1 1 2*
43.a	$\frac{2z+1}{iz+1}=\frac{2(x+iy)+1}{i(x+iy)+1}=\frac{2x+1+i2y}{1-y+ix}$ $=\frac{(2x+y)+i2y}{1-y+ix}\times\frac{(1-y)-ix}{(1-y)-ix}$ $Im\left[\frac{2z+1}{iz+1}\right]=0\Rightarrow\frac{2y(1-y)-x(2x+1)}{(1-y)^2+x^2}$ $\Rightarrow 2x^2+2y^2+x-2y=0$	1 1 2* 1
	OR	
43.b	$z_1=\frac{r^2}{\overline{z_1}}, z_2=\frac{r^2}{\overline{z_2}}, z_3=\frac{r^2}{\overline{z_3}}$ $z_1+z_2+z_3=\frac{r^2}{\overline{z_1}}+\frac{r^2}{\overline{z_2}}+\frac{r^2}{\overline{z_3}}$	1 1

	$\|z_1+z_2+z_3\| = r^2\left\|\dfrac{\overline{z_2}\,\overline{z_3}+\overline{z_1 z_3}+\overline{z_1 z_2}}{\overline{z_1 z_2 z_3}}\right\|$ $= r^2\dfrac{\|z_1z_2+z_1z_2+z_2z_3\|}{\|z_1\|\|z_2\|\|z_3\|}$ $\|z_1+z_2+z_3\| = r^2\dfrac{\|z_1z_2+z_1z_2+z_2z_3\|}{r^3}$ $\left\|\dfrac{z_1z_2+z_1z_3+z_2z_3}{z_1+z_2+z_3}\right\| = r$ **(or) Any other method**	1 1 1
44.a	**Given roots are** $2+i, 3-\sqrt{2}$ $(x-(2+i)),(x-(2-i)),(x-(3-\sqrt{2})$ *and* $\left(x-(3+\sqrt{2})\right)$ **are factors. (or)** **Thus their product** $(x-(2+i))(x-(2-i))(x-(3-\sqrt{2})\left(x-(3+\sqrt{2})\right)$ **is a factor.** **That is,** $(x^2-4x+5)(x^2-6x+7)$ **is a factor.** **Dividing the given polynomial equation by this factor,** **we get** $(x^2-4x+5) \Rightarrow x=4,-1$ **The roots are** $2+i, 2-i, 3-\sqrt{2}, 3+\sqrt{2}, -1, 4.$ **Note: One can do in a different method**	1 1 2* 1
	OR	
44.b	$6x^4-5x^3-38x^2-5x+6=0,$ **Given** $\frac{1}{3}$ **is a solution for the reciprocal equation. Hence 3 is a solution.** | 6 -5 -38 -5 6 $1/3$ | 0 2 -1 -13 -6 | 6 -3 -39 -18 | 0 3 | 0 18 45 18 | 6 15 6 | 0 $6x^2+15x+6=0$ $(x+2)\left(x+\frac{1}{2}\right)=0$ $x=-2, x=-\frac{1}{2}$ **Hence the roots are** $\frac{1}{3}, 3, -2, -\frac{1}{2}$ **Note: One can do in a different method**	1 1 2* 1
45.a	$\theta = \sin^{-1}x, x=\sin\theta, \theta\epsilon\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$ $\tan(\sin^{-1}x) = \tan\theta = \dfrac{\sin\theta}{\cos\theta}$ $\tan(\sin^{-1}x) = \dfrac{x}{\sqrt{1-x^2}}, -1<x<1$ **Note: One can do in a different method**	1 2* 2*

	OR	
45.b	$cot^{-1}\left(\frac{1}{7}\right)=\theta, \quad \theta\epsilon(0,\pi)$ $cot\theta=\frac{1}{7}$ (or) $tan\theta=7$ $cos\theta=\frac{1}{5\sqrt{2}}$ **(or) Any other method**	1 1 3*
46.a	$\frac{19+9i}{5-3i}=\frac{19+9i}{5-3i}\times\frac{5+3i}{5+3i}=\frac{68+102i}{34}=2+3i$ $\frac{8+i}{1+2i}=\frac{8+i}{1+2i}\times\frac{1-2i}{1-2i}=\frac{10-15i}{5}=2-3i$ $z=(2+3i)^{15}-(2-3i)^{15}$ $\bar{z}=-(2+3i)^{15}+(2-3i)^{15}$ $\bar{z}=-z \Rightarrow z$ **purely imaginary.**	1 1 1 1 1
	OR	
46.b	$x^4-14x^2+45=0$ $x^2=t$ $t^2-14t+45=0$ $(t-9)(t-5)=0\Rightarrow t=9,5$ $x^2=9\Rightarrow x=3,-3$ $x^2=5\Rightarrow x=\sqrt{5},-\sqrt{5}$	2* 1 1 1
47.a	$x\neq 0, \div x^2 =>$ $x^2-10x+26-\frac{10}{x}+\frac{1}{x^2}=0$ $\left(x^2+\frac{1}{x^2}\right)-10\left(x+\frac{1}{x}\right)+26=0$ $Put, y=x+\frac{1}{x}$ $y^2-10y+24=0$ $(y-6)(y-4)=0$ $y-6=0 \qquad y-4=0$ $x+\frac{1}{x}-6=0 \qquad x+\frac{1}{x}-4=0$ $x=3\pm 2\sqrt{2} \qquad x=2\pm\sqrt{3}$ **Hence, the roots are $3\pm 2\sqrt{2}$ and $2\pm\sqrt{3}$**	2* 2* 1
	OR	
47.b	(i) $sec^{-1}\left(-\frac{2\sqrt{3}}{3}\right)=\theta$, $sec\theta=-\frac{2}{\sqrt{3}}$, $\theta\epsilon[0,\pi]\setminus\left\{\frac{\pi}{2}\right\}$ $cos\theta=-\frac{\sqrt{3}}{2}, cos\theta=cos\left(\pi-\frac{\pi}{6}\right), \theta=\frac{5\pi}{6}$ (ii) $\tan\left(cos^{-1}\left(\frac{1}{2}\right)-\sin^{-1}(-\frac{1}{2})\right)=\tan\left(cos^{-1}\left(\frac{1}{2}\right)+\sin^{-1}(\frac{1}{2})\right)$ $=tan\frac{\pi}{2}=\infty$	1 2* 1 1