WINTER– 16 EXAMINATION

Model Answer

Subject Code: **17104**

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more importance (Not applicable for subject English and Communication Skills).
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answer and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q. N.	Answer	Marking Scheme
1		**Attempt any TEN of the following:**	**20**
	a)	Find x , if $\begin{vmatrix} 4 & 3 & 9 \\ 3 & 2 & 7 \\ 1 & 4 & x \end{vmatrix} = 0$	**02**
	Ans	$\begin{vmatrix} 4 & 3 & 9 \\ 3 & 2 & 7 \\ 1 & 4 & x \end{vmatrix} = 0$	
		$\therefore 4(2x-28)-3(3x-7)+9(12-2)=0$	1
		$\therefore 8x-112-9x+21+90=0$	½
		$\therefore -x-1=0$	
		$\therefore -x=1$	
		$\therefore x=-1$	½
		---	
	b)	If $A=\begin{bmatrix} 2 & 3 \\ 4 & 7 \end{bmatrix}, B=\begin{bmatrix} 1 & 3 \\ -2 & 5 \end{bmatrix}$, find $2A+3B-5I$, where I is the unit matrix of order two.	**02**
	Ans	$2A+3B-5I = 2\begin{bmatrix} 2 & 3 \\ 4 & 7 \end{bmatrix}+3\begin{bmatrix} 1 & 3 \\ -2 & 5 \end{bmatrix}-5\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
1	b)	$=\begin{bmatrix}4 & 6\\8 & 14\end{bmatrix}+\begin{bmatrix}3 & 9\\-6 & 15\end{bmatrix}-\begin{bmatrix}5 & 0\\0 & 5\end{bmatrix}$	1
		$=\begin{bmatrix}2 & 15\\2 & 24\end{bmatrix}$	1
	c)	If $A=\begin{bmatrix}2 & 4\\-1 & -2\end{bmatrix}$, show that A^2 is null matrix.	**02**
	Ans	$A^2=\begin{bmatrix}2 & 4\\-1 & -2\end{bmatrix}\begin{bmatrix}2 & 4\\-1 & -2\end{bmatrix}$	
		$=\begin{bmatrix}4-4 & 8-8\\-2+2 & -4+4\end{bmatrix}$	1
		$=\begin{bmatrix}0 & 0\\0 & 0\end{bmatrix}$	1
	d)	Resolve into partial fraction : $\frac{1}{x(x+1)}$	**02**
	Ans	Let $\frac{1}{x(x+1)}=\frac{A}{x}+\frac{B}{x+1}$	½
		$\therefore 1=A(x+1)+Bx$	
		Put $x=0$ $A=1,$	½
		Put $x=-1$ $B=-1$	½
		$\therefore \frac{1}{x(x+1)}=\frac{1}{x}-\frac{1}{x+1}$	½
	e)	Prove that $\cos 2\theta=2\cos^2\theta-1$	**02**
	Ans	$\cos 2\theta=\cos(\theta+\theta)$	½
		$=\cos\theta\cos\theta-\sin\theta\sin\theta$	½
		$=\cos^2\theta-\sin^2\theta$	
		$=\cos^2\theta-(1-\cos^2\theta)$	½
		$=\cos^2\theta-1+\cos^2\theta$	
		$=2\cos^2\theta-1$	½

WINTER – 16 EXAMINATION

Model Answer Subject Code: 17104

Q. No.	Sub Q. N.	Answer	Marking Scheme
1	f)	Find $\sin\alpha$, if $\tan\left(\frac{\alpha}{2}\right)=\frac{1}{\sqrt{3}}$	**02**
	Ans	$\tan\left(\frac{\alpha}{2}\right)=\frac{1}{\sqrt{3}}$	
		$\therefore \frac{\alpha}{2}=\tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$	½
		$=30^0$ or $\frac{\pi}{6}$	½
		$\therefore \alpha=60^0$ or $\frac{\pi}{3}$	
		$\sin\alpha=\sin 60^0$ or $\sin\frac{\pi}{3}$	½
		$=\frac{\sqrt{3}}{2}$ or 0.8660	½
	g)	Without using calculator , find the value of $\sin\left(-765^0\right)$	**02**
	Ans	$\sin\left(-765^0\right)=-\sin 765^0$	½
		$=-\sin\left(8\times 90^0+45^0\right)$ or $-\sin\left(8\times\frac{\pi}{2}+45^0\right)$	½
		$=-\sin 45^0$	½
		$=-\frac{1}{\sqrt{2}}$ or -0.7071	½
	h)	Find the principal value of $\sec\left[\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)\right]$.	**02**
	Ans	$\sec\left[\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)\right]$	
		$=\sec 30^0$ or $\sec\frac{\pi}{6}$	1
		$=\frac{2}{\sqrt{3}}$ or 1.1547	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
1	i)	Define compound angle.	**02**
	Ans	If A & B are any two angles, then sum or difference i.e $A+B$ or $A-B$ is compound angle.	2
	j)	Prove that the lines $3x+2y=5,$ and $2x-3y=6$ are perpendicular.	**02**
	Ans	slope of $3x+2y=5$ is	
		$m_1=-\frac{3}{2}$	½
		slope of $2x-3y=6$ is	
		$m_2=\frac{-2}{-3}=\frac{2}{3}$	½
		$m_1m_2=\left(-\frac{3}{2}\right)\left(\frac{2}{3}\right)=-1$	1
		$\therefore$ lines are perpendicular.	
	k)	Find the range & coefficient of range of the following data: 50, 90,120,40,180,200,80.	**02**
	Ans	$\text{Range}=\text{L}-\text{S}=200-40=160$	1
		Coefficient of range $=\frac{\text{L}-\text{S}}{\text{L}+\text{S}}=\frac{200-40}{200+40}=0.67$	1
	l)	Find AB if $A=\begin{bmatrix}1 & 2\\ 2 & 3\end{bmatrix}, B=\begin{bmatrix}1 & -5\\ 0 & 1\end{bmatrix}$	**02**
	Ans	$AB=\begin{bmatrix}1 & 2\\ 2 & 3\end{bmatrix}\begin{bmatrix}1 & -5\\ 0 & 1\end{bmatrix}$	
		$=\begin{bmatrix}1+0 & -5+2\\ 2+0 & -10+3\end{bmatrix}$	1
		$=\begin{bmatrix}1 & -3\\ 2 & -7\end{bmatrix}$	1
2		**Attempt any FOUR of the following**	**16**
	a)	Solve the following equations using Cramer's rule $2x+3y=5,\ \ y-3z=-2,\ \ z+3x=4$	**04**

WINTER – 16 EXAMINATION

Model Answer Subject Code: 17104

Q. No.	Sub Q. N.	Answer	Marking Scheme
2	a)	$2x+3y=5,\ \ y-3z=-2,\ 3x+z=4$	
	Ans	$D=\begin{vmatrix}2&3&0\\0&1&-3\\3&0&1\end{vmatrix}=2(1+0)-3(0+9)=-25$	1
		$D_x=\begin{vmatrix}5&3&0\\-2&1&-3\\4&0&1\end{vmatrix}=5(1+0)-3(-2+12)=-25$	½
		$D_y=\begin{vmatrix}2&5&0\\0&-2&-3\\3&4&1\end{vmatrix}=2(-2+12)-5(0+9)=-25$	½
		$D_z=\begin{vmatrix}2&3&5\\0&1&-2\\3&0&4\end{vmatrix}=2(4+0)-3(0+6)+5(0-3)=-25$	½
		$\therefore x=\dfrac{D_x}{D}=\dfrac{-25}{-25}=1$	½
		$\therefore y=\dfrac{D_y}{D}=\dfrac{-25}{-25}=1$	½
		$\therefore z=\dfrac{D_z}{D}=\dfrac{-25}{-25}=1$	½
		--	
	b)	If $A+I=\begin{bmatrix}1&3&4\\-1&1&3\\-2&-3&1\end{bmatrix}$, obtain the matrix $(A+I)(A-I)$	**04**
	Ans	$A=\begin{bmatrix}1&3&4\\-1&1&3\\-2&-3&1\end{bmatrix}-I$	
		$=\begin{bmatrix}1&3&4\\-1&1&3\\-2&-3&1\end{bmatrix}-\begin{bmatrix}1&0&0\\0&1&0\\0&0&1\end{bmatrix}$	½
		$=\begin{bmatrix}0&3&4\\-1&0&3\\-2&-3&0\end{bmatrix}$	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
2	b)	$A-I=\begin{bmatrix}0&3&4\\-1&0&3\\-2&-3&0\end{bmatrix}-\begin{bmatrix}1&0&0\\0&1&0\\0&0&1\end{bmatrix}$	
		$=\begin{bmatrix}-1&3&4\\-1&-1&3\\-2&-3&-1\end{bmatrix}$	1
		$(A+I)(A-I)=\begin{bmatrix}1&3&4\\-1&1&3\\-2&-3&1\end{bmatrix}\begin{bmatrix}-1&3&4\\-1&-1&3\\-2&-3&-1\end{bmatrix}$	
		$=\begin{bmatrix}-1-3-8&3-3-12&4+9-4\\1-1-6&-3-1-9&-4+3-3\\2+3-2&-6+3-3&-8-9-1\end{bmatrix}$	1
		$=\begin{bmatrix}-12&-12&9\\-6&-13&-4\\3&-6&-18\end{bmatrix}$	½
		--	
	c)	Show that matrix $A=\begin{bmatrix}\cos\theta&0&\sin\theta\\0&1&0\\-\sin\theta&0&\cos\theta\end{bmatrix}$ is an orthogonal matrix.	**04**
	Ans	$A=\begin{bmatrix}\cos\theta&0&\sin\theta\\0&1&0\\-\sin\theta&0&\cos\theta\end{bmatrix}$ $\therefore\ A^T=\begin{bmatrix}\cos\theta&0&-\sin\theta\\0&1&0\\\sin\theta&0&\cos\theta\end{bmatrix}$	1
		$A.A^T=\begin{bmatrix}\cos\theta&0&\sin\theta\\0&1&0\\-\sin\theta&0&\cos\theta\end{bmatrix}\begin{bmatrix}\cos\theta&0&-\sin\theta\\0&1&0\\\sin\theta&0&\cos\theta\end{bmatrix}$	
		$=\begin{bmatrix}\cos^2\theta+0+\sin^2\theta&0+0+0&-\cos\theta\sin\theta+\sin\theta\cos\theta\\0+0+0&0+1+0&0+0+0\\-\sin\theta\cos\theta+0+\cos\theta\sin\theta&0+0+0&\sin^2\theta+0+\cos^2\theta\end{bmatrix}$	2
		$=\begin{bmatrix}1&0&0\\0&1&0\\0&0&1\end{bmatrix}=I$	1
		$\therefore\ A$ is an orthogonal matrix.	

Q. No.	Sub Q. N.	Answer	Marking Scheme
2	d)	Find the inverse of the matrix ; $A=\begin{bmatrix}1&2&3\\2&4&5\\3&5&6\end{bmatrix}$ by adjoint method.	04
	Ans	$\therefore \lvert A\rvert=\begin{vmatrix}1&2&3\\2&4&5\\3&5&6\end{vmatrix}=1(24-25)-2(12-15)+3(10-12)$	
		$=-1+6-6$	
		$\lvert A\rvert=-1\neq 0$	½
		$\therefore A^{-1}$ exists	
		Matrix of minors $=\begin{bmatrix}\begin{vmatrix}4&5\\5&6\end{vmatrix}&\begin{vmatrix}2&5\\3&6\end{vmatrix}&\begin{vmatrix}2&4\\3&5\end{vmatrix}\\\begin{vmatrix}2&3\\5&6\end{vmatrix}&\begin{vmatrix}1&3\\3&6\end{vmatrix}&\begin{vmatrix}1&2\\3&5\end{vmatrix}\\\begin{vmatrix}2&3\\4&5\end{vmatrix}&\begin{vmatrix}1&3\\2&5\end{vmatrix}&\begin{vmatrix}1&2\\2&4\end{vmatrix}\end{bmatrix}=\begin{bmatrix}-1&-3&-2\\-3&-3&-1\\-2&-1&0\end{bmatrix}$	1
		Matrix of cofactors $=\begin{bmatrix}-1&3&-2\\3&-3&1\\-2&1&0\end{bmatrix}$	1
		OR	
		$C_{11}=+\begin{vmatrix}4&5\\5&6\end{vmatrix}=24-25=-1,\ C_{12}=-\begin{vmatrix}2&5\\3&6\end{vmatrix}=-(12-15)=3$	
		$C_{13}=+\begin{vmatrix}2&4\\3&5\end{vmatrix}=10-12=-2,\ C_{21}=-\begin{vmatrix}2&3\\5&6\end{vmatrix}=-(12-15)=3$	
		$C_{22}=+\begin{vmatrix}1&3\\3&6\end{vmatrix}=6-9=-3,\ C_{23}=-\begin{vmatrix}1&2\\3&5\end{vmatrix}=-(5-6)=1$	
		$C_{31}=+\begin{vmatrix}2&3\\4&5\end{vmatrix}=10-12=-2,\ C_{32}=-\begin{vmatrix}1&3\\2&5\end{vmatrix}=-(5-6)=1$	1
		$C_{33}=+\begin{vmatrix}1&2\\2&4\end{vmatrix}=4-4=0,$	
		Matrix of cofactors $=\begin{bmatrix}-1&3&-2\\3&-3&1\\-2&1&0\end{bmatrix}$	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
2	d)	$\text{Adj}.A=\begin{bmatrix}-1 & 3 & -2\\ 3 & -3 & 1\\ -2 & 1 & 0\end{bmatrix}$	½
		$A^{-1}=\frac{1}{\lvert A\rvert}\text{Adj}.A$	
		$A^{-1}=\frac{1}{-1}\begin{bmatrix}-1 & 3 & -2\\ 3 & -3 & 1\\ -2 & 1 & 0\end{bmatrix}=\begin{bmatrix}1 & -3 & 2\\ -3 & 3 & -1\\ 2 & -1 & 0\end{bmatrix}$	1
	e)	Resolve into partial fraction $\frac{x^3+x}{x^2-4}$	**04**
	Ans	$x^2-4\,\overline{)\,x^3+x\,}$ quotient x; x^3-4x; $-\ \ +$; remainder $5x$	
		$\therefore \frac{x^3+x}{x^2-4}=x+\frac{5x}{(x-2)(x+2)}$	1
		$\therefore \frac{5x}{(x-2)(x+2)}=\frac{A}{x-2}+\frac{B}{x+2}$	
		$\therefore 5x=(x+2)A+(x-2)B$	
		Put $x=2$ $\quad \therefore 5(2)=(2+2)A$	
		$A=\frac{10}{4}$	
		$A=\frac{5}{2}$	1
		Put $x=-2$ $\quad \therefore 5(-2)=(-2-2)B$	
		$B=\frac{-10}{-4}$	
		$B=\frac{5}{2}$	1
		$\therefore \frac{5x}{(x-2)(x+2)}=\frac{\frac{5}{2}}{x-2}+\frac{\frac{5}{2}}{x+2}$	½

Q. No.	Sub Q. N.	Answer	Marking Scheme
2	e)	$\therefore \ \dfrac{x^3+x}{x^2-4}=x+\dfrac{\frac{5}{2}}{x-2}+\dfrac{\frac{5}{2}}{x+2}$ or $x+\dfrac{5}{2}\left(\dfrac{1}{x-2}+\dfrac{1}{x+2}\right)$	½
		--	
	f)	Resolve into partial fraction : $\dfrac{3x-1}{(x-4)(2x+1)(x-1)}$	**04**
	Ans	$\therefore \ \dfrac{3x-1}{(x-4)(2x+1)(x-1)}=\dfrac{A}{x-4}+\dfrac{B}{2x+1}+\dfrac{C}{x-1}$	½
		$\therefore \ 3x-1=A(2x+1)(x-1)+B(x-4)(x-1)+C(x-4)(2x+1)$	
		Put $x=4$	
		$3(4)-1=A(2(4)+1)(4-1)$	
		$11=A(9)(3)$	
		$11=A(27)$	
		$\therefore A=\dfrac{11}{27}$	1
		Put $x=\dfrac{-1}{2}$	
		$3\left(\dfrac{-1}{2}\right)-1=B\left(\dfrac{-1}{2}-4\right)\left(\dfrac{-1}{2}-1\right)$	
		$\dfrac{-5}{2}=B\left(\dfrac{-9}{2}\right)\left(\dfrac{-3}{2}\right)$	
		$\dfrac{-5}{2}=B\left(\dfrac{27}{4}\right)$	
		$\therefore B=\dfrac{-10}{27}$	1
		Put $x=1$	
		$3(1)-1=C(1-4)(2(1)+1)$	
		$2=C(-3)(3)$	
		$\therefore C=\dfrac{-2}{9}$	1
		$\therefore \ \dfrac{3x-1}{(x-4)(2x+1)(x-1)}=\dfrac{\frac{11}{27}}{x-4}+\dfrac{\frac{-10}{27}}{2x+1}+\dfrac{\frac{-2}{9}}{x-1}$	½

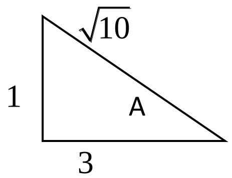
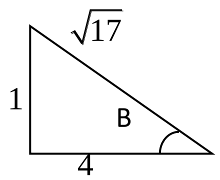
Q. No.	Sub Q. N.	Answer	Marking Scheme
3		**Attempt any FOUR of the following:**	**16**
	a)	Using matrix inversion method solve the system of equations : $x+y+z=3$, $3x-2y+3z=4$, $5x+5y+z=11$	**04**
	Ans	$Let\ A=\begin{bmatrix}1 & 1 & 1\\ 3 & -2 & 3\\ 5 & 5 & 1\end{bmatrix}$	
		$\lvert A\rvert=\begin{vmatrix}1 & 1 & 1\\ 3 & -2 & 3\\ 5 & 5 & 1\end{vmatrix}=1(-2-15)-1(3-15)+1(15+10)$ $=-17+12+25$ $\therefore \lvert A\rvert=20\neq 0$ $\therefore A^{-1}$ exists	½
		Matrix of minors $=\begin{bmatrix}\begin{vmatrix}-2 & 3\\ 5 & 1\end{vmatrix} & \begin{vmatrix}3 & 3\\ 5 & 1\end{vmatrix} & \begin{vmatrix}3 & -2\\ 5 & 5\end{vmatrix}\\ \begin{vmatrix}1 & 1\\ 5 & 1\end{vmatrix} & \begin{vmatrix}1 & 1\\ 5 & 1\end{vmatrix} & \begin{vmatrix}1 & 1\\ 5 & 5\end{vmatrix}\\ \begin{vmatrix}1 & 1\\ -2 & 3\end{vmatrix} & \begin{vmatrix}1 & 1\\ 3 & 3\end{vmatrix} & \begin{vmatrix}1 & 1\\ 3 & -2\end{vmatrix}\end{bmatrix}$ $=\begin{bmatrix}-17 & -12 & 25\\ -4 & -4 & 0\\ 5 & 0 & -5\end{bmatrix}$	½
		Matrix of cofactors $=\begin{bmatrix}-17 & 12 & 25\\ 4 & -4 & 0\\ 5 & 0 & -5\end{bmatrix}$	½
		OR	
		$C_{11}=+\begin{vmatrix}-2 & 3\\ 5 & 1\end{vmatrix}=-2-15=-17,\ C_{12}=-\begin{vmatrix}3 & 3\\ 5 & 1\end{vmatrix}=-(3-15)=12$ $C_{13}=+\begin{vmatrix}3 & -2\\ 5 & 5\end{vmatrix}=15+10=25,\ C_{21}=-\begin{vmatrix}1 & 1\\ 5 & 1\end{vmatrix}=-(1-5)=4$ $C_{22}=+\begin{vmatrix}1 & 1\\ 5 & 1\end{vmatrix}=1-5=-4,\ C_{23}=-\begin{vmatrix}1 & 1\\ 5 & 5\end{vmatrix}=-(5-5)=0$ $C_{31}=+\begin{vmatrix}1 & 1\\ -2 & 3\end{vmatrix}=3+2=5,\ C_{32}=-\begin{vmatrix}1 & 1\\ 3 & 3\end{vmatrix}=-(3-3)=0$	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
3	a)	$C_{33}=+\begin{vmatrix}1 & 1\\ 3 & -2\end{vmatrix}=-2-3=-5,$	
		Matrix of cofactors $=\begin{bmatrix}-17 & 12 & 25\\ 4 & -4 & 0\\ 5 & 0 & -5\end{bmatrix}$	
		$\text{Adj}.A=\begin{bmatrix}-17 & 4 & 5\\ 12 & -4 & 0\\ 25 & 0 & -5\end{bmatrix}$	
		$A^{-1}=\frac{1}{\lvert A\rvert}\text{Adj}.A$	
		$=\frac{1}{20}\begin{bmatrix}-17 & 4 & 5\\ 12 & -4 & 0\\ 25 & 0 & -5\end{bmatrix}$	1
		$\therefore\begin{bmatrix}x\\ y\\ z\end{bmatrix}=A^{-1}B=\frac{1}{20}\begin{bmatrix}-17 & 4 & 5\\ 12 & -4 & 0\\ 25 & 0 & -5\end{bmatrix}\begin{bmatrix}3\\ 4\\ 11\end{bmatrix}$	
		$=\frac{1}{20}\begin{bmatrix}-51+16+55\\ 36-16+0\\ 75+0-55\end{bmatrix}$	
		$=\frac{1}{20}\begin{bmatrix}20\\ 20\\ 20\end{bmatrix}$	1
		$\begin{bmatrix}x\\ y\\ z\end{bmatrix}=\begin{bmatrix}1\\ 1\\ 1\end{bmatrix}$	½
		$\therefore\ x=1,\ y=1,\ z=1.$	
		--	
	b)	Resolve into partial fraction : $\frac{\tan\theta}{(\tan\theta+2)(\tan\theta+3)}$	**04**
	Ans	Let $\tan\theta=t$	
		$\therefore\frac{t}{(t+2)(t+3)}=\frac{A}{t+2}+\frac{B}{t+3}$	1
		$\therefore\ t=(t+3)A+(t+2)B$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
3	b)	put $t=-2$	
		$-2=(-2+3)A$	1
		$\therefore A=-2$	
		put $t=-3$	
		$-3=(-3+2)B$	
		$-3=-B$	1
		$\therefore B=3$	
		$\therefore \frac{t}{(t+2)(t+3)}=\frac{-2}{t+2}+\frac{3}{t+3}$	
		$\frac{\tan\theta}{(\tan\theta+2)(\tan\theta+3)}=\frac{-2}{\tan\theta+2}+\frac{3}{\tan\theta+3}$	1
	c)	Resolve into partial fractions : $\frac{x^2+23x}{(x+3)(x^2+1)}$	**04**
	Ans	$\therefore \frac{x^2+23x}{(x+3)(x^2+1)}=\frac{A}{x+3}+\frac{Bx+C}{x^2+1}$	½
		$\therefore x^2+23x=(x^2+1)A+(x+3)(Bx+C)$	
		Put $x=-3$	
		$(-3)^2+23(-3)=((-3)^2+1)A$	
		$9-69=10A$	
		$\therefore A=-6$	1
		Put $x=0$, $\mathrm{A}=-6$	
		$0=(0+1)(-6)+(0+3)(0+C)$	
		$0=-6+3C$	
		$\therefore C=2$	1
		Put $x=1$, $\mathrm{A}=-6$, $C=2$	
		$(1)^2+23(1)=((1)^2+1)(-6)+(1+3)(B+2)$	
		$24=-12+4B+8$	
		$\therefore B=7$	1
		$\therefore \frac{x^2+23x}{(x+3)(x^2+1)}=\frac{-6}{x+3}+\frac{7x+2}{x^2+1}$	½
		--	

WINTER – 16 EXAMINATION

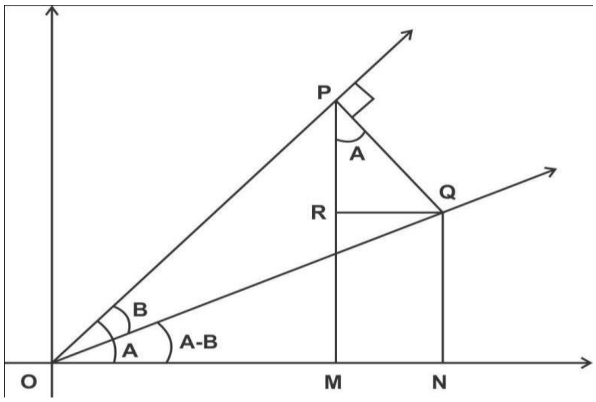
Model Answer Subject Code: 17104

Q. No.	Sub Q. N.	Answer	Marking Scheme
3	d)	Prove that $\tan^{-1}\left(\frac{1}{2}\right)+\tan^{-1}\left(\frac{1}{3}\right)=\frac{\pi}{4}$	**04**
	Ans	$\because \tan^{-1}x+\tan^{-1}y=\tan^{-1}\left(\frac{x+y}{1-xy}\right)$	
		$\therefore \tan^{-1}\left(\frac{1}{2}\right)+\tan^{-1}\left(\frac{1}{3}\right)=\tan^{-1}\left(\frac{\frac{1}{2}+\frac{1}{3}}{1-\frac{1}{2}\cdot\frac{1}{3}}\right)$	2
		$=\tan^{-1}\left(\frac{\frac{5}{6}}{1-\frac{1}{6}}\right)$	
		$=\tan^{-1}\left(\frac{\frac{5}{6}}{\frac{5}{6}}\right)$	
		$=\tan^{-1}(1)=\frac{\pi}{4}$	1+1
	e)	If $\tan A=\frac{1}{3},\ \tan B=\frac{1}{4}$, Where $0<A<\frac{\pi}{2},\ \pi<B<\frac{3\pi}{2}$, find $\sin(A+B)$	**04**
	Ans	$\tan A=\frac{1}{3}$, 	
		$0<A<\frac{\pi}{2}$ (A lies in first quadrant) $\sin A=\frac{1}{\sqrt{10}},\ \cos A=\frac{3}{\sqrt{10}}$	1
		$\tan B=\frac{1}{4}$, 	
		$\pi<B<\frac{3\pi}{2}$ (B lies in third quadrant) $\sin B=\frac{-1}{\sqrt{17}},\ \cos B=\frac{-4}{\sqrt{17}}$	1
		$\sin(A+B)=\sin A\cos B+\cos A\sin B$	

WINTER – 16 EXAMINATION

Model Answer Subject Code: 17104

Q. No.	Sub Q. N.	Answer	Marking Scheme
3	e)		
		$=\left(\frac{1}{\sqrt{10}}\right)\left(\frac{-4}{\sqrt{17}}\right)+\left(\frac{3}{\sqrt{10}}\right)\left(\frac{-1}{\sqrt{17}}\right)$	1
		$=-\frac{-7}{\sqrt{170}}$ or -0.5369	1
		--	
	f)	Without using calculator, find the value of :	**04**
		$\tan(585^o).\ \cot(-495^o)-\cot(405^o).\ \tan(-495^o)$	
	Ans	$\tan(585^o)=\tan(6\times90^0+45^o)$	
		$=\tan 45^o$	
		$=1$	½
		$\cot(-495^o)=-\cot(495^o)$	
		$=-\cot(5\times90^0+45^o)$	
		$=\tan 45^0$	½
		$=1$	½
		$\cot(405^o)=\cot(4\times90^0+45^o)$	
		$=\cot 45^o$	
		$=1$	½
		$\tan(-495^o)=-\tan(495^o)$	
		$=-\tan(5\times90^0+45^o)$	
		$=\cot 45^o$	½
		$=1$	½
		$\tan(585^o).\ \cot(-495^o)-\cot(405^o).\ \tan(-495^o)$	
		$=(1)(1)-(1)(1)$	
		$=0$	1
		Note: The above example may be proved in different ways by expressing the ratio in many ways e.g., instead of expressing $\tan(585^o)=\tan(6\times90^o+45^o)$**, one can express it as** $\tan(585^o)=\tan(7\times90^o-45^o)$ **and the get the desired value. Further here in this example it is expected that it must be proved without using calculator. If directly calculator is used, no marks to be given.**	
		--	

Q. No.	Sub Q. N.	Answer	Marking Scheme
4		**Attempt any FOUR of the following:**	**16**
	a)	Prove that : $\sin(A-B)=\sin A\cos B-\cos A\sin B$	**04**
	Ans		1

Right Angled Triangle	Acute Angle	Trigonometric Ratios
Δ OMP	∠MOP = A	$\sin A=\frac{PM}{OP},\quad \cos A=\frac{OM}{OP}$
Δ OPQ	∠POQ = B	$\sin B=\frac{PQ}{OQ},\quad \cos B=\frac{OP}{OQ}$
Δ PRQ	∠QPR = A	$\sin A=\frac{RQ}{PQ},\quad \cos A=\frac{PR}{PQ}$
Δ ONQ	∠NOQ = A-B	$\sin(A-B)=\frac{QN}{OQ},\quad \cos(A-B)=\frac{ON}{OQ}$

1

$$\therefore \sin(A-B)=\frac{QN}{OQ}=\frac{RM}{OQ}$$

$$=\frac{PM-PR}{OQ}$$ ½

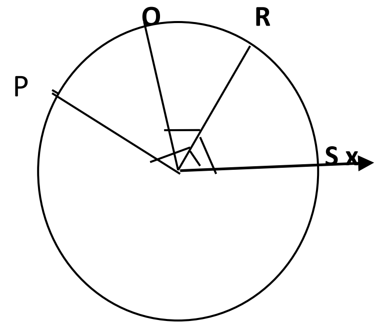
$$=\frac{PM}{OQ}-\frac{PR}{OQ}$$ ½

$$=\frac{PM}{OP}\times\frac{OP}{OQ}-\frac{PR}{PQ}\times\frac{PQ}{OQ}$$

$$=\sin A\cos B-\cos A\sin B.$$ 1

WINTER – 16 EXAMINATION

Model Answer Subject Code: 17104

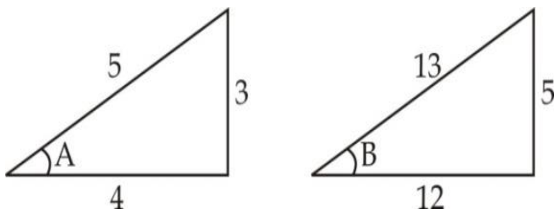
Q. No.	Sub Q. N.	Answer	Marking Scheme
4	a)	**OR**  Consider a standard unit circle	1
		Let P,Q,R,S be points such that	
		$\angle XOP = A$, $\angle XOQ = B$, $\angle XOR = A-B$	
		From fig.	
		$\angle POQ = A-B$	
		$\therefore \angle POQ = \angle XOR$ $P(\cos A, \sin A)$, $Q(\cos B, \sin B)$ $R(\cos(A-B), \sin(A-B))$, $S(1,0)$	½
		$\therefore$ Chord $PQ =$ Chord RS	
		$\sqrt{(\cos A-\cos B)^2+(\sin A-\sin B)^2} = \sqrt{[\cos(A-B)-1]^2+[\sin(A-B)-0]^2}$	
		$(\cos A-\cos B)^2+(\sin A-\sin B)^2 = [\cos(A-B)-1]^2+[\sin(A-B)-0]^2$	1
		$\therefore \cos^2 A+\cos^2 B-2\cos A\cos B+\sin^2 A+\sin^2 B-2\sin A\sin B =$	
		$\cos^2(A-B)+1-2\cos(A-B)+\sin^2(A-B)$	
		$\therefore 1+1-2(\cos A\cos B+\sin A\sin B) = 1+1-2\cos(A-B)$	
		$\therefore \cos A\cos B+\sin A\sin B = \cos(A-B)$	½
		Replace B by $-B$ in above equation	
		$\therefore \cos A\cos B-\sin A\sin B = \cos(A+B)$	
		Consider $\sin(A-B) = \cos\left(\frac{\pi}{2}-(A-B)\right)$	½
		$= \cos\left(\frac{\pi}{2}-A+B\right)$	
		$= \cos\left(\frac{\pi}{2}-A\right)\cos B-\sin\left(\frac{\pi}{2}-A\right)\sin B$	
		$= \sin A\cos B-\cos A\sin B$	½
		--	

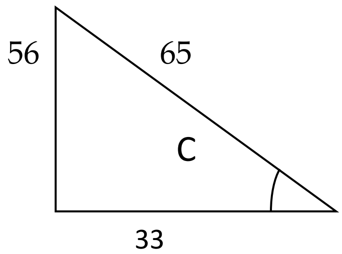
Q. No.	Sub Q. N.	Answer	Marking Scheme
4	b)	Prove that $\cos 2A = 2\cos^2 A - 1$	**04**
	Ans	$\cos 2A = \cos(A+A)$	1
		$= \cos A\cos A - \sin A\sin A$	1
		$= \cos^2 A - \sin^2 A$	1
		$= \cos^2 A - (1-\cos^2 A)$	
		$= \cos^2 A - 1 + \cos^2 A$	
		$= 2\cos^2 A - 1$	1
	c)	If $\tan(x+y) = \frac{1}{2}$ and $\tan(x-y) = \frac{1}{3}$, find $(i)\tan 2x$, $(ii)\tan 2y$.	**04**
	Ans	$(i)\tan 2x = \tan[(x+y)+(x-y)]$	½
		$= \frac{\tan(x+y)+\tan(x-y)}{1-\tan(x+y)\tan(x-y)}$	½
		$= \frac{\frac{1}{2}+\frac{1}{3}}{1-\frac{1}{2}\times\frac{1}{3}}$	½
		$= 1$	½
		$(ii)\tan 2y = \tan[(x+y)-(x-y)]$	½
		$= \frac{\tan(x+y)-\tan(x-y)}{1+\tan(x+y)\tan(x-y)}$	½
		$= \frac{\frac{1}{2}-\frac{1}{3}}{1+\frac{1}{2}\times\frac{1}{3}}$	½
		$= \frac{1}{7}$	½

WINTER – 16 EXAMINATION

Model Answer Subject Code: 17104

Q. No.	Sub Q. N.	Answer	Marking Scheme
4	d)	Prove that $\frac{\sin A+\sin 2A+\sin 3A+\sin 4A}{\cos A+\cos 2A+\cos 3A+\cos 4A}=\tan\left(\frac{5A}{2}\right)$	04
	Ans	$\text{L.H.S.}=\frac{(\sin A+\sin 4A)+(\sin 2A+\sin 3A)}{(\cos A+\cos 4A)+(\cos 2A+\cos 3A)}$	
		$=\frac{2\sin\left(\frac{5A}{2}\right)\cos\left(\frac{-3A}{2}\right)+2\sin\left(\frac{5A}{2}\right)\cos\left(\frac{-A}{2}\right)}{2\cos\left(\frac{5A}{2}\right)\cos\left(\frac{-3A}{2}\right)+2\cos\left(\frac{5A}{2}\right)\cos\left(\frac{-A}{2}\right)}$	2
		$=\frac{2\sin\left(\frac{5A}{2}\right)\left[\cos\left(\frac{-3A}{2}\right)+\cos\left(\frac{-A}{2}\right)\right]}{2\cos\left(\frac{5A}{2}\right)\left[\cos\left(\frac{-3A}{2}\right)+\cos\left(\frac{-A}{2}\right)\right]}$	
		$=\frac{\sin\left(\frac{5A}{2}\right)}{\cos\left(\frac{5A}{2}\right)}$	1
		$=\tan\left(\frac{5A}{2}\right)=\text{R.H.S.}$	1
		--	
	e)	Prove that $\cos^{-1}\left(\frac{4}{5}\right)+\cos^{-1}\left(\frac{12}{13}\right)=\cos^{-1}\left(\frac{33}{65}\right)$	04
	Ans	Let $\cos^{-1}\left(\frac{4}{5}\right)=A$	
		$\therefore \cos A=\frac{4}{5}$	
		$\therefore \sin^2 A=1-\cos^2 A$	
		$=1-\frac{16}{25}$	
		$=\frac{9}{25}$	
		$\therefore \sin A=\frac{3}{5}$	1
		$\cos^{-1}\left(\frac{12}{13}\right)=B$	
		$\therefore \cos B=\frac{12}{13}$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
4	e)	$\therefore \sin^2 B = 1 - \cos^2 B$	
		$= 1 - \frac{144}{169}$	
		$= \frac{25}{169}$	
		$\therefore \sin B = \frac{5}{13}$	1
		$\therefore \cos(A+B) = \cos A \cos B - \sin A \sin B$	
		$= \frac{4}{5}\frac{12}{13} - \frac{3}{5}\frac{5}{13}$	1
		$= \frac{48}{65} - \frac{15}{65}$	
		$\therefore \cos(A+B) = \frac{33}{65}$	½
		$\therefore A + B = \cos^{-1}\left(\frac{33}{65}\right)$	½
		$\therefore \cos^{-1}\left(\frac{4}{5}\right) + \cos^{-1}\left(\frac{12}{13}\right) = \cos^{-1}\left(\frac{33}{65}\right)$	
		OR	
		Let $\cos^{-1}\left(\frac{4}{5}\right) = A$	
		$\therefore \cos A = \frac{4}{5}$	
		$\therefore \tan A = \frac{3}{4}$	
		$A = \tan^{-1}\left(\frac{3}{4}\right)$	
			1
		$\therefore \cos^{-1}\left(\frac{4}{5}\right) = \tan^{-1}\left(\frac{3}{4}\right)$	
		$\cos^{-1}\left(\frac{12}{13}\right) = B$	
		$\therefore \cos B = \frac{12}{13}$	

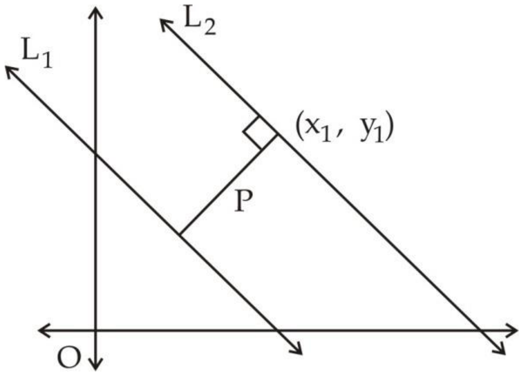
Q. No.	Sub Q. N.	Answer	Marking Scheme
4	e)	$\therefore \tan B = \frac{5}{12}$	
		$B = \tan^{-1}\left(\frac{5}{12}\right)$	
		$\therefore \cos^{-1}\left(\frac{12}{13}\right) = \tan^{-1}\left(\frac{5}{12}\right)$	1
		$L.H.S. = \tan^{-1}\left(\frac{3}{4}\right) + \tan^{-1}\left(\frac{5}{12}\right)$	
		$= \tan^{-1}\left(\frac{\frac{3}{4}+\frac{5}{12}}{1-\frac{3}{4}\frac{5}{12}}\right)$	½
		$= \tan^{-1}\left(\frac{\frac{36+20}{48}}{1-\frac{15}{48}}\right)$	
		$= \tan^{-1}\left(\frac{\frac{56}{48}}{\frac{48-15}{48}}\right)$	
		$= \tan^{-1}\left(\frac{56}{33}\right)$	½
		Let $\tan^{-1}\left(\frac{56}{33}\right) = C$	
		$\therefore \tan C = \frac{56}{33}$	
		$\therefore \cos C = \frac{33}{65}$ 	
		$\therefore C = \cos^{-1}\left(\frac{33}{65}\right)$	1
		---	
	f)	Prove that : $\tan^{-1}\left(\frac{1}{5}\right) + \tan^{-1}\left(\frac{1}{7}\right) + \tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{1}{8}\right) = \frac{\pi}{4}$	**04**
	Ans	$\therefore \tan^{-1}\left(\frac{1}{5}\right) + \tan^{-1}\left(\frac{1}{7}\right) + \tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{1}{8}\right)$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
4	f)	$=\tan^{-1}\left[\dfrac{\frac{1}{5}+\frac{1}{7}}{1-\frac{1}{5}\times\frac{1}{7}}\right]+\tan^{-1}\left[\dfrac{\frac{1}{3}+\frac{1}{8}}{1-\frac{1}{3}\times\frac{1}{8}}\right]$	2
		$=\tan^{-1}\left[\dfrac{\frac{12}{35}}{1-\frac{1}{35}}\right]+\tan^{-1}\left[\dfrac{\frac{11}{24}}{1-\frac{1}{24}}\right]$	
		$=\tan^{-1}\left(\dfrac{12}{34}\right)+\tan^{-1}\left(\dfrac{11}{23}\right)$	
		$=\tan^{-1}\left[\dfrac{\frac{12}{34}+\frac{11}{23}}{1-\frac{12}{34}\times\frac{11}{23}}\right]$	
		$=\tan^{-1}\left[\dfrac{\frac{276+374}{782}}{1-\frac{132}{782}}\right]$	1
		$=\tan^{-1}(1)$	½
		$=\dfrac{\pi}{4}$	½
		--	
5		**Attempt any FOUR of the following :**	**04**
	a)	Prove $\tan^{-1}x+\tan^{-1}y=\tan^{-1}\left[\dfrac{x+y}{1-xy}\right]$, if $1-xy>0$	
	Ans	put $\tan^{-1}x=A$ and $\tan^{-1}y=B\ \therefore\ x=\tan A$ and $y=\tan B$	1
		$\therefore\ \tan(A+B)=\dfrac{\tan A+\tan B}{1-\tan A\tan B}$ OR $\text{RHS}=\tan^{-1}\left[\dfrac{x+y}{1-xy}\right]$	
		$=\dfrac{x+y}{1-xy}$ $\quad=\tan^{-1}\left[\dfrac{\tan A+\tan B}{1-\tan A\tan B}\right]$	1
		$\therefore\ A+B=\tan^{-1}\left[\dfrac{x+y}{1-xy}\right]$ $\quad=\tan^{-1}\left(\tan(A+B)\right)$	1
		$=A+B$	
		$\therefore\tan^{-1}x+\tan^{-1}y=\tan^{-1}\left[\dfrac{x+y}{1-xy}\right]$ $\quad==\tan^{-1}x+\tan^{-1}y$ =LHS	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
5	b)	Prove that $\sin 10^0 \sin 30^0 \sin 50^0 \sin 70^0 = \frac{1}{16}$	04
	Ans	$\sin 10^0 \sin 30^0 \sin 50^0 \sin 70^0$	
		$= \sin 10^0 \frac{1}{2} \sin 50^0 \sin 70^0$	½
		$= \frac{1}{4}\left[2\sin 10^0 \sin 50^0\right]\sin 70^0$	
		$= \frac{1}{4}\left[\cos\left(-40^0\right) - \cos 60^0\right]\sin 70^0$	½
		$= \frac{1}{4}\left[\cos 40^0 - \frac{1}{2}\right]\sin 70^0$	½
		$= \frac{1}{4}\left[\cos 40^0 \sin 70^0 - \frac{1}{2}\sin 70^0\right]$	
		$= \frac{1}{4}\left[\frac{1}{2} 2\cos 40^0 \sin 70^0 - \frac{1}{2}\sin 70^0\right]$	½
		$= \frac{1}{8}\left[\sin 110^0 - \sin\left(-30\right) - \sin 70^0\right]$	½
		$= \frac{1}{8}\left[\sin\left(2\times 90^0 - 70\right) + \frac{1}{2} - \sin 70^0\right]$	½
		$= \frac{1}{8}\left[\sin 70^0 + \frac{1}{2} - \sin 70^0\right]$	½
		$= \frac{1}{16}$	½
		--	
	c)	Prove that $\sin C - \sin D = 2\cos\left(\frac{C+D}{2}\right)\sin\left(\frac{C-D}{2}\right)$	04
	Ans	We know that	
		$\sin\left(A+B\right) - \sin\left(A-B\right) = 2\cos A \sin B$	1
		Let $A+B=C$	
		$A-B=D$	1
		$\therefore 2A = C+D$	
		$\therefore A = \frac{C+D}{2}$	
		$\therefore B = \frac{C-D}{2}$	1
		$\sin C - \sin D = 2\cos\left(\frac{C+D}{2}\right)\sin\left(\frac{C-D}{2}\right)$	1

WINTER – 16 EXAMINATION

Model Answer Subject Code: 17104

Q. No.	Sub Q. N.	Answer	Marking Scheme
5	d)	Show that the distance between two parallel lines $ax+by+C_1=0$ & $ax+by+C_2=0$ is given by $d=\left\|\frac{C_2-C_1}{\sqrt{a^2+b^2}}\right\|$	04
	Ans		1
		$L_1: ax+by+C_1=0$ $L_2: ax+by+C_2=0$ Let P(x_1,y_1) be any point on the line L_2 $\therefore ax_1+by_1+C_2=0$ $\therefore ax_1+by_1=-C_2$	1
		PM is perpendicular on the line L_1 $\therefore PM=\left\|\frac{ax_1+by_1+C_1}{\sqrt{a^2+b^2}}\right\|$	1
		$\therefore d=\left\|\frac{-C_2+C_1}{\sqrt{a^2+b^2}}\right\|$ or $d=\left\|\frac{C_2-C_1}{\sqrt{a^2+b^2}}\right\|$	1
		--	
	e)	Find the length of the perpendicular on the line $3x+4y-5=0$ from the point $(3,4)$.	04
	Ans	$p=\left\|\frac{ax_1+by_1+c}{\sqrt{a^2+b^2}}\right\|$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
5	e)	$= \left\lvert \frac{3(3)+4(4)-5}{\sqrt{(3)^2+(4)^2}} \right\rvert$	2
		$= \left\lvert \frac{9+16-5}{\sqrt{9+16}} \right\rvert$	
		$= \left\lvert \frac{20}{\sqrt{25}} \right\rvert$	
		$= \frac{20}{5}$	
		p = 4 units	2
		--	
	f)	Find the equation of the line passing through the point the intersection of lines $2x+3y=13,\ 5x-y-7=0$ and perpendicular to the line $3x-2y+7=0$.	**04**
	Ans	$2x+3y=13$	
		$5x-y=7$	
		$\therefore \begin{array}{r} 2x+3y=13 \\ +\ 15x-3y=21 \\ \hline 17x=34 \end{array}$	
		$x=2$	½
		$\therefore\ 5(2)-y=7$	
		$\therefore -y=-3$	
		$\therefore y=3$	½
		$\therefore$ Point of intersection $=(2,\ 3)$	
		Slope of the line $3x-2y+7=0$. is,	
		$m_0=-\frac{a}{b}=-\frac{3}{-2}=\frac{3}{2}$	1
		$\therefore$ Slope of the required line is,	
		$m=-\frac{1}{m_0}=-\frac{1}{\frac{3}{2}}=-\frac{2}{3}$	1
		$\therefore$ *equation is*,	
		$y-y_1=m(x-x_1)$	
		$\therefore\ y-3=-\frac{2}{3}(x-2)$	½
		$\therefore 2x+3y-13=0$	½

WINTER – 16 EXAMINATION

Model Answer Subject Code: 17104

Q. No.	Sub Q. N.	Answer	Marking Scheme
6		**Attempt any FOUR of the following:**	**16**
	a)	Find the equation of line passing through the point of intersection of lines $x+y=0$ and $2x-y=9$ and a point $(2,5)$	
	Ans	$x+y=0$ $\underline{2x-y=9}$ $\therefore\ 3x=9$ $\therefore x=3$ $y=-3$ $\therefore$ Point of intersection $=(3,-3)$ $\therefore$ *equation is,* $\frac{y-y_1}{y_2-y_1}=\frac{x-x_1}{x_2-x_1}$ $\therefore \frac{y-5}{-3-5}=\frac{x-2}{3-2}$ $\therefore 8x+y-21=0$	 ½ ½ 2 1
		OR	
		$\therefore$ Point of intersection $=(3,-3)$ $\therefore$ *Slope* $m=\frac{y_2-y_1}{x_2-x_1}=\frac{-3-5}{3-2}=-8$ $\therefore$ *equation is,* $y-y_1=m(x-x_1)$ $\therefore y-5=-8(x-2)$ OR $y+3=-8(x-3)$ $\therefore 8x+y-21=0$	1 1 1 1
		--	
	b)	Find the mean deviation from median of the following distribution:	**04**
	Ans		

Weight (in gms)	10-15	15-20	20-25	25-30	30-35	35-40	40-45
No. of items	7	12	16	25	19	15	6

Q. No.	Sub Q. N.	Answer	Marking Scheme
6	b)	(table and working below)	

Class	xi	f_i	cf	$D_i = \lvert x_i - Med \rvert$	$f_i D_i$
10-15	12.5	7	7	15.5	108.5
15-20	17.5	12	19	10.5	126
20-25	22.5	16	35	5.5	88
25-30	27.5	25	60	0.5	12.5
30-35	32.5	19	79	4.5	85.5
35-40	37.5	15	94	9.5	142.5
40-45	42.5	6	100	14.5	87
		100			650

2

$$Median = L + \frac{\frac{N}{2} - cf}{f} \times h$$

$$= 25 + \frac{50-35}{25} \times 5$$

$$= 28$$

1

$$M.D. = \frac{\sum f_i d_i}{N} = \frac{650}{100}$$

$$= 6.5$$

1

----

c) Calculate : i) standard deviation ii) Co-efficient of variation from the following data: **04**

Rainfall	70-80	80-90	90-100	100-110	110-120	120-130	130-140	140-150
No.of places	06	07	12	19	21	18	11	06

Ans

Q. No.	Sub Q. N.	Answer	Marking Scheme
6	c)		

Class	x_i	f_i	$d_i = \frac{x_i - a}{h}$	$f_i d_i$	d_i^2	$f_i d_i^2$
70-80	75	06	-3	-18	9	54
80-90	85	07	-2	-14	4	28
90-100	95	12	-1	-12	1	12
100-110	105	19	0	0	0	0
110-120	115	21	1	21	1	21
120-130	125	18	2	36	4	72
130-140	135	11	3	33	9	99
140-150	145	06	4	24	16	96
		100		70		382

2

i) $S.D = \sigma = \sqrt{\frac{\sum f_i d_i^2}{N} - \left(\frac{\sum f_i d_i}{N}\right)^2} \times h$

$= \sqrt{\frac{382}{100} - \left(\frac{70}{100}\right)^2} \times 10$

$= 18.25$ 1

ii) Mean $= \bar{x} = \text{A} + \frac{\sum f_i d_i}{N} \times \text{h}$

$= 105 + \frac{70}{100} \times 10$

$= 112$ ½

$\therefore$ Co-efficient of variation $= \frac{\sigma}{\bar{x}} \times 100$

$= \frac{18.25}{112} \times 100 = 16.29.$ ½

OR

Q. No.	Sub Q. N.	Answer	Marking Scheme
6			

Class	x_i	f_i	$f_i x_i$	x_i^2	$f_i x_i^2$
70-80	75	06	450	5625	33750
80-90	85	07	595	7225	50575
90-100	95	12	1140	9025	108300
100-110	105	19	1995	11025	209475
110-120	115	21	2415	13225	277725
120-130	125	18	2250	15625	281250
130-140	135	11	1485	18225	200475
140-150	145	06	870	21025	126150
		100	11200		1287700

2

$$\text{Mean } \bar{x} = \frac{\sum f_i x_i}{N} = \frac{11200}{100} = 112$$

½

$$\text{i) S.D. } \sigma = \sqrt{\frac{\sum f_i x_i^2}{N} - (\bar{x})^2}$$

$$= \sqrt{\frac{1287700}{100} - (112)^2}$$

$$= \sqrt{12877 - 12544}$$

$$= \sqrt{333}$$

$$\sigma = 18.25$$

1

$$ii) \text{ Co-efficient of variation } = \frac{\sigma}{\bar{x}} \times 100$$

$$= \frac{18.25}{112} \times 100 = 16.29.$$

½

Q. No.	Sub Q. N.	Answer	Marking Scheme
6	d)	The weights of 100 students are given by the following distribution:	

Weight above or equal to	36	41	46	51	56	61	66	71
No. of students	100	96	79	56	28	11	5	2

Calculate: i) Mean,ii)Variance of the data using step deviation method

No student has weight above 75 kg.

Ans

Class	Class boundries	x_i	f_i	$d_i = \frac{x_i - a}{h}$	$f_i d_i$	d_i^2	$f_i d_i^2$
36-40	35.5-40.5	38	4	-4	-16	16	64
41-45	40.5-45.5	43	17	-3	-51	9	153
46-50	45.5-50.5-	48	23	-2	-46	4	92
51-55	50.5-55.5-	53	28	-1	-28	1	28
56-60	55.5-60.5	58	17	0	0	0	0
61-65	60.5-65.5	63	6	1	6	1	6
66-70	65.5-70.5	68	3	2	6	4	12
71-75	70.5-75.5	73	2	3	6	9	18
			100		-123		373

2

i) Mean $= \bar{x} = A + \frac{\sum f_i d_i}{N} \times h$

$= 58 + \frac{(-123)}{100} \times 5$

$= 51.85$

½

$$(ii) \quad S.D. = \sigma = \sqrt{\frac{\sum f_i d_i^2}{N} - \left(\frac{\sum f_i d_i}{N}\right)^2} \times h$$

$$= \sqrt{\frac{373}{100} - \left(\frac{-123}{100}\right)^2} \times 5$$

$\sigma = 7.44$

1

Variance $= \sigma^2 = (7.44)^2 = 55.35$

½

Q. No.	Sub Q. N.	Answer	Marking Scheme
6	e)	In the two factories A & B engaged in the same industry, the average weekly wages & standard deviation are as follows :	**04**

Factories	Average Wages	Standard deviation
A	34.5	5.0
B	28.5	4.5

Which factory is more consistent?

Ans

For factory A

$$C.V = \frac{\sigma}{\bar{x}} \times 100$$

$$= \frac{5.0}{34.5} \times 100$$

$$= 14.49\%$$

1½

For factory B

$$C.V = \frac{\sigma}{\bar{x}} \times 100$$

$$= \frac{4.5}{28.5} \times 100$$

$$= 15.79\%$$

1½

$C.V$ of A < $C.V$ of B

$\therefore$ Factory A is more consistent 1

Important Note

In the solution of the question paper, wherever possible all the possible alternative methods of solution are given for the sake of convenience. Still student may follow a method other than the given herein. In such case, first see whether the method falls within the scope of the curriculum, and then only give appropriate marks in accordance with the scheme of marking.
