CHAPTER-3

MATRICES

03 MARK TYPE QUESTIONS

Q. NO	QUESTION	MARK
1.	A trust fund has Rs.35000 is to be invested in two different types of bonds. The first bond pays 8% interest per annum which will be given to orphanage and second bond pays 10% interest per annum which will be given to an NGO. Use matrix multiplication, determine how to divide Rs.35,000 among two types of bonds if the trust fund obtain an annual total interest of Rs.3200.	3
2.	In a city there are two factories A and B. Each factory produces sports clothes for boys and girls. There are three types of clothes produced in both the factories type I, type II and type III. For boys the number of units of types I, II and III respectively are 80, 70 and 65 in factory A and 85, 64 and 72 are in factory B. For girls the number of units of types I, II and II respectively are 80, 75, 90 in factory A and 50, 55, 80 are in factory B. 1. Write the matrix P, if P represents the matrix of number of units of each type produced by factory A for both boys and girls. 2. Write the matrix Q, if Q represents the matrix of number of units of each type produced by factory B for both boys and girls. 3. Find the total production of sports clothes of each type for boys.	3
3.	The sum of three number is 6. If we multiply third number by 3 and add second number to it, we get 11. By adding first and third number we get double of the second number. The three numbers are respectively - i) 2,3,1 iii)3 ,3,2 ii) 2,1,3 iv)1,2,3	3
4.	If 3x+2Y = I and 2X -Y = 0 where I and 0 are the null matrices of order 3 respectively then :- i) X=1/7 , Y=2/7 ii) X=2/7 ,Y= 1/7 iii) X= (1/7)I , Y = (2/7)I iv) X= (2/7)I , Y = (1/7)I	3
5.	To control a crop disease it is necessary to use 8 units of chemical A ,14 units of chemical B, and 13 units of chemical C. One barrel of spray P contains 1 unit of A, 2units of B and 3 units of C. One unit of spray Q contains 2units of A, 3 units of B and 2 units of C. One barrel of spray R contains 1 unit of A, 2 units of B and 2 units of C . Based on the above information answer the following questions :- (**a**)if x barrels of spray P, y barrels of spray Q and z barrels of spray R are be used to just meet the requirement, then the above information can be represented in the form of : i)x+2y+z=8 2x+3y+2z=14 3x+2y+2z=13 ii) x+2y+3z=8 x+3y+2z=14 x+2y+2z=13 iii) x+2y+z=14 2x+3y+2z=8 3x+2y+2z=13 iv) x+2y+z=13 2x+3y+2z=8 3x+2y+2z=14	3

	  (**b**)if spray P, Q and R cost RS.500, RS.250 and RS.200 per barrel, the total cost incurred is i)1200 ii)1500 iii)950 iv)1600	
6.	If A = $\begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$ satisfies $A^3 - 6A^2 + 7A + kI_3 = 0$, find the value of k	3
7.	If A = $\begin{bmatrix} 3 & 9 \\ 5 & 7 \end{bmatrix}$ is written as A = P + Q, where P is a symmetric matrix and Q is skew-symmetric matrix, then write the matrix P	3
8.	For what value of x, is the matrix A = $\begin{bmatrix} 0 & 1 & -2 \\ -1 & 0 & 3 \\ x & -3 & 0 \end{bmatrix}$ a skew-symmetric matrix?	3
9.	Find the values of x, y, z if the matrix A=. $\begin{bmatrix} 0 & 2y & z \\ x & y-z & \\ x & -y & z \end{bmatrix}$ Satisfy the equation find A^TA = I3	3
10.	If $F(x) = \begin{bmatrix} \cos x & -\sin x & 0 \\ \sin x & \cos x & 0 \\ 0 & 0 & 1 \end{bmatrix}$, Show that $F(x).F(y) = F(x+y)$.	3
11.	If A= $\begin{bmatrix} -2 \\ 4 \\ 5 \end{bmatrix}$ and B=[1 3 -6]Prove that $(AB)^T$= $B^T A^T$	3
12.	If$\begin{bmatrix} 2x-1 \\ 5 \end{bmatrix} = \begin{bmatrix} 3 \\ x+y \end{bmatrix}$, find x and y.	3
13.	If f(x)=$x^2 - 4x + 1, find\ f(a), when\ a = \begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix}$	3MARKS
14.	If A=$[-2 \quad -1 \quad -4]$ and B=$\begin{bmatrix} -1 \\ 2 \\ 3 \end{bmatrix}$, Show that $(BA)^T = A^T B^T$.	3
15.	If $\begin{bmatrix} xy & 4 \\ z+6 & x+y \end{bmatrix} = \begin{bmatrix} 8 & w \\ 0 & 6 \end{bmatrix}$, then find values of x, y, z and w.	3

16.	Three persons A, B and C were given the task of creating a square matrix of order 2. Below is the matrix created by them A = $\begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}$, B = $\begin{bmatrix} 4 & 0 \\ 1 & 5 \end{bmatrix}$ and C = $\begin{bmatrix} 2 & 0 \\ 1 & -2 \end{bmatrix}$ (i) Find the sum of the matrices A, B and C (ii) Evaluate (A')' (iii)Find the matrix AC - BC	3
17.	If A = $\begin{bmatrix} 8 & 0 \\ 4 & -2 \\ 3 & 6 \end{bmatrix}$ and B = $\begin{bmatrix} 2 & -2 \\ 4 & 2 \\ -5 & 1 \end{bmatrix}$, then find the matrix X of order 3×2 such that 2A + 3X = 5B.	3
18.	Find A^2 -5A + 6I, if A = $\begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix}$	3
19.	If f(x) = $\begin{bmatrix} cosx & -sinx & 0 \\ sinx & cosx & 0 \\ 0 & 0 & 1 \end{bmatrix}$, show that f(x) f(y) = f(x + y).	3
20.	If A^T = $\begin{bmatrix} -2 & 3 \\ 1 & 2 \end{bmatrix}$ and B = $\begin{bmatrix} -1 & 0 \\ 1 & 2 \end{bmatrix}$, find $(A + 2B)^T$.	3
21.	Mahesh created two matrices A = $\begin{bmatrix} -2 & x-y & 5 \\ 1 & 0 & 4 \\ x+y & z & 7 \end{bmatrix}$ and B = $\begin{bmatrix} 0 & a & 3 \\ 2 & b & -1 \\ c & 1 & 0 \end{bmatrix}$. For what values of *x*, *y* and *z* the matrix A is symmetric and for what values of *a*, *b* and *c* the matrix B is skew-symmetric.	3
22.	A teacher gave a problem to his student to express the matrix A = $\begin{bmatrix} 1 & 3 & 5 \\ -6 & 8 & 3 \\ -4 & 6 & 3 \end{bmatrix}$ as the sum of a symmetric and a skew-symmetric matrices. The student gave the answer as A = $\frac{1}{2}\begin{bmatrix} 2 & -3 & 1 \\ -3 & 16 & 9 \\ 1 & 9 & 6 \end{bmatrix} + \frac{1}{2}\begin{bmatrix} 0 & 9 & 9 \\ -9 & 0 & -3 \\ -9 & 3 & 0 \end{bmatrix}$. Examine whether the answer is correct or incorrect.	3
23.	Two matrices are A and B are given as A = $\begin{bmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{bmatrix}$, B = $\begin{bmatrix} 2 & 0 & -1 \\ 5 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}$. Examine whether one is the inverse of the other or not.	3

ANSWERS:

Q. NO	ANSWER	MARKS
1.	Let investment in first type of bond be Rs.x The investment in second type of bond = Rs.35000-x $[x, 35000 - x].\begin{bmatrix} \frac{8}{100} \\ \frac{10}{100} \end{bmatrix} = [3200]$ After that will get investment in first bond = Rs.15000 And investment in second bond = Rs.20000	3
2.	1. $P = \begin{bmatrix} 80 & 80 \\ 70 & 75 \\ 65 & 90 \end{bmatrix}$ 2. $Q = \begin{bmatrix} 85 & 50 \\ 65 & 55 \\ 72 & 80 \end{bmatrix}$ 3. X+Y=[165 135 137]	3
3.	iv) 1,2,3 Ans:- The given problem can be represented as a+b+c = 6 b+3c =11 a-2b+c=0 corresponding matrix equation is $\begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 3 \\ 1 & -2 & 1 \end{bmatrix}\begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} 6 \\ 11 \\ 0 \end{bmatrix}$ (AX=B) $\begin{bmatrix} a \\ b \\ c \end{bmatrix} = \frac{1}{9}\begin{bmatrix} 7 & -3 & 2 \\ 3 & 0 & -3 \\ -1 & 3 & 1 \end{bmatrix}\begin{bmatrix} 6 \\ 11 \\ 0 \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ ($X=A^{-1}B=\frac{Adj\ A}{\|A\|}B$) So the three numbers are a= 1, b=2, c=3.	3
4.	iii)X=(1/7)I ,Y=(2/7)I ans:- 3X+2Y=I ....(1) 2X-Y=0 4X-2Y=0 ......(2) Solving (1) and (2) 7X=I i.e $X=\frac{1}{7}I$ and $Y=\frac{2}{7}I$	3
5.	(a)(i) x+2y+z=8 2x+3y+2z=14 3x+2y+2z=13 (b)(iv)1600 Ans:- (a)as x,y,z be the number of barrel of spray P, Q, R respectively spray P contains 1 unit of A, 2units of B and 3 units of C spray Q contains 2units of A, 3 units of B and 2 units of C spray R contains 1 unit of A, 2 units of B and 2 units of C . thus option (i) is correct representation (b)solving the liner equation by matrix method AX=B ie $X=BA^{-1}$	3

	$$\begin{bmatrix}x\\y\\z\end{bmatrix}=\begin{bmatrix}8\\14\\13\end{bmatrix}\begin{bmatrix}2&-2&1\\2&-1&0\\-5&4&-1\end{bmatrix}=\begin{bmatrix}1\\2\\3\end{bmatrix}$$ Prices of spray P,Q,R are RS.500 ,RS.250, RS.200 respectively So, the total cost incurred is 1x500+2x250+3x200=1600	
6.	$A^3 - 6A^2 + 7A + kI_3 = 0$ $$\begin{bmatrix}-2+k&0&0\\0&-2+k&0\\0&0&-2+k\end{bmatrix}=\begin{bmatrix}0&0&0\\0&0&0\\0&0&0\end{bmatrix}$$ K=2	3
7.	$$\begin{bmatrix}3&6\\6&9\end{bmatrix}$$	3
8.	$A= - A^T$ X=2	3
9.	$A=\begin{bmatrix}0&2y&z\\x&y&-z\\x&-y&z\end{bmatrix}$ $A^T=\begin{bmatrix}0&x&x\\2y&y&-y\\z&-z&z\end{bmatrix}$ $A^TA=13$ ⇨ $2x^2=1$ ⇨ $x=\pm\frac{1}{\sqrt{2}}$ ⇨ $4y^2=1$ ⇨ $y=\pm\frac{1}{2}$ ⇨ $3z^2=1$ ⇨ $z=\pm\frac{1}{\sqrt{3}}$	3
10.	$F(x)=\begin{bmatrix}\cos x&-\sin x&0\\\sin x&\cos x&0\\0&0&1\end{bmatrix}.$ $F(y)=\begin{bmatrix}\cos y&-\sin y&0\\\sin y&\cos y&0\\0&0&1\end{bmatrix}.$ $F(x)\times F(y)=\begin{bmatrix}\cos x&-\sin x&0\\\sin x&\cos x&0\\0&0&1\end{bmatrix}\times\begin{bmatrix}\cos y&-\sin y&0\\\sin y&\cos y&0\\0&0&1\end{bmatrix}$ $=\begin{bmatrix}\cos(x+y)&-\sin(x+y)&0\\\sin(x+y)&\cos(x+y)&0\\0&0&1\end{bmatrix}$	3

	= $F(x+y)$	
11.	A= $\begin{bmatrix}-2\\4\\5\end{bmatrix}$ ➔ A^T=[-2 4 5] B=[1 3 -6] ➔ $B^T=\begin{bmatrix}1\\3\\-6\end{bmatrix}$ $(AB)^T=\begin{bmatrix}-2&4&5\\-6&12&15\\12&-24&-30\end{bmatrix}$ $=B^TA^T$	3
12.	Here $\begin{bmatrix}2x-1\\5\end{bmatrix}=\begin{bmatrix}3\\x+y\end{bmatrix}$ this gives 2x-1=3 or 2x=3+1 or 2x =4 or x=2 and x +y=5 or 2+y=5 or y=5-2 or y=3	3
13.	f(x)=x^2-4x+1 therefore f(a)=a^2-4a+1 =$\begin{pmatrix}7&12\\4&7\end{pmatrix}-4\begin{pmatrix}2&3\\1&2\end{pmatrix}+$ $\begin{pmatrix}1&0\\0&1\end{pmatrix}$=$\begin{pmatrix}0&0\\0&0\end{pmatrix}=0$	3
14.	A=$[-2\ \ -1\ \ -4]$ and B=$\begin{bmatrix}-1\\2\\3\end{bmatrix}$ this gives $(BA)^T=\begin{bmatrix}2&1&4\\-4&-2&-8\\-6&-3&-12\end{bmatrix}^T=$ $\begin{bmatrix}2&-4&-6\\1&-2&-3\\4&-8&-12\end{bmatrix}$ and A^TB^T= $\begin{bmatrix}-2\\-1\\-4\end{bmatrix}$ $[-1\ \ 2\ \ 3]$=$\begin{bmatrix}2&-4&-6\\1&-2&-3\\4&-8&-12\end{bmatrix}$	3
15.	Since, it is given that $\begin{bmatrix}xy&4\\z+6&x+y\end{bmatrix}=\begin{bmatrix}8&w\\0&6\end{bmatrix}$ So. xy = 8, w = 4, x + y =6 and z+ 6 = 0 Solving we get x = 2, y = 4, z = - 6, w= 4 Or, x = 4, y = 2, z = - 6, w =4	3
16.	(i) A+B+C = $\begin{bmatrix}1&2\\-1&3\end{bmatrix}+\begin{bmatrix}4&0\\1&5\end{bmatrix}+\begin{bmatrix}2&0\\1&-2\end{bmatrix}=\begin{bmatrix}7&2\\1&6\end{bmatrix}$ (ii) A = $\begin{bmatrix}1&2\\-1&3\end{bmatrix}$ A' = $\begin{bmatrix}1&-1\\2&3\end{bmatrix}$ (A')' = $\begin{bmatrix}1&2\\-1&3\end{bmatrix}$ (iii) AC – BC = $\begin{bmatrix}1&2\\-1&3\end{bmatrix}\begin{bmatrix}2&0\\1&-2\end{bmatrix}-\begin{bmatrix}4&0\\1&5\end{bmatrix}\begin{bmatrix}2&0\\1&-2\end{bmatrix}$ $=\begin{bmatrix}4&-4\\1&-6\end{bmatrix}-\begin{bmatrix}8&0\\7&-10\end{bmatrix}=\begin{bmatrix}-4&-4\\-6&4\end{bmatrix}$	3

17.	Since, A = $\begin{bmatrix} 8 & 0 \\ 4 & -2 \\ 3 & 6 \end{bmatrix}$ and B = $\begin{bmatrix} 2 & -2 \\ 4 & 2 \\ -5 & 1 \end{bmatrix}$ and 2A + 3X = 5B So, we have 3X = 5B – 2A $= 5\begin{bmatrix} 2 & -2 \\ 4 & 2 \\ -5 & 1 \end{bmatrix} - 2\begin{bmatrix} 8 & 0 \\ 4 & -2 \\ 3 & 6 \end{bmatrix} = \begin{bmatrix} -6 & -10 \\ 12 & 14 \\ -31 & -7 \end{bmatrix}$ So, X = $\begin{bmatrix} -2 & -10/3 \\ 4 & 14/3 \\ -31/3 & -7/3 \end{bmatrix}$	3
18.	$\begin{bmatrix} \mathbf{1} & \mathbf{-1} & \mathbf{-3} \\ \mathbf{-1} & \mathbf{-1} & \mathbf{-10} \\ \mathbf{-5} & \mathbf{4} & \mathbf{4} \end{bmatrix}$	3
19.	Verification	3
20.	A + 2B = $\begin{bmatrix} -2 & 1 \\ 3 & 2 \end{bmatrix} + 2\begin{bmatrix} -1 & 0 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} -4 & 1 \\ 5 & 6 \end{bmatrix}$ ∴ $(A + 2B)^T = \begin{bmatrix} -4 & 5 \\ 1 & 6 \end{bmatrix}$.	1.5 1.5
21.	A is symmetric if A = A/ So $\begin{bmatrix} -2 & x-y & 5 \\ 1 & 0 & 4 \\ x+y & z & 7 \end{bmatrix} = \begin{bmatrix} -2 & 1 & x+y \\ x-y & 0 & z \\ 5 & 4 & 7 \end{bmatrix}$ $x - y = 1$, $x + y = 5$, $z = 4$ So $x = 3$, $y = 4$, $z = 4$ B is skew symmetric if B = - B/ So $\begin{bmatrix} 0 & a & 3 \\ 2 & b & -1 \\ c & 1 & 0 \end{bmatrix} = \begin{bmatrix} 0 & -2 & -c \\ -a & -b & -1 \\ -3 & 1 & 0 \end{bmatrix}$ Hence , a = -2, b = 0, c = -3	3
22.	Let P = $\frac{1}{2}\begin{bmatrix} 2 & -3 & 1 \\ -3 & 16 & 9 \\ 1 & 9 & 6 \end{bmatrix}$ P/ = $\frac{1}{2}\begin{bmatrix} 2 & -3 & 1 \\ -3 & 16 & 9 \\ 1 & 9 & 6 \end{bmatrix}$ As P = P/, P is symmetric Let Q = $\frac{1}{2}\begin{bmatrix} 0 & 9 & 9 \\ -9 & 0 & -3 \\ -9 & 3 & 0 \end{bmatrix}$ Q/ = $\frac{1}{2}\begin{bmatrix} 0 & -9 & -9 \\ 9 & 0 & 3 \\ 9 & -3 & 0 \end{bmatrix}$ $= -\frac{1}{2}\begin{bmatrix} 0 & 9 & 9 \\ -9 & 0 & -3 \\ -9 & 3 & 0 \end{bmatrix}$ = - Q So Q is skew-symmetric P + Q = $\begin{bmatrix} 1 & 3 & 5 \\ -6 & 8 & 6 \\ -4 & 6 & 3 \end{bmatrix}$ = A So the answer is correct.	3
23.	Since AB = BA = I So, one is the inverse of the other	3