Engineering Mathematics I-(BAS-103)
Unit 1 Matrices
Tutorial 7

Que 1. Find the inverse of matrix by employing elementary transformation

(i) A=$\begin{bmatrix} 2 & 3 & 4 \\ 4 & 3 & 1 \\ 1 & 2 & 4 \end{bmatrix}$ **[2020-21]** (ii) B=$\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$ **[2018-19]** (iii) C = $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$ **[2017-18]**

Que 2. Reduce matrix A into normal form and hence find its rank

(i) A = $\begin{bmatrix} 1 & 3 & 4 & 2 \\ 2 & -1 & 3 & 2 \\ 3 & -5 & 2 & 2 \\ 6 & -3 & 8 & 6 \end{bmatrix}$ **[2019-20]** (ii) B=$\begin{bmatrix} 1 & 2 & -1 & 4 \\ 2 & 4 & 3 & 4 \\ 1 & 2 & 3 & 4 \\ 1 & -2 & 6 & 7 \end{bmatrix}$ **[2018-19]**

Que 3. Find the value of b for which the rank of matrix A = $\begin{bmatrix} 2 & 4 & 2 \\ 3 & 1 & 2 \\ 1 & 0 & b \end{bmatrix}$ is 2. **[2019-20]**

Que 4. Reduce the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ into normal form and find its rank. **[2021-22] ,[2017-18]**

Que 5. Find the rank of matrix by employing elementary transformation A=$\begin{bmatrix} 2 & -1 & 3 & -1 \\ 1 & 2 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$ **[2017-18]**

Que 6. Test the consistency of the following system of equations and if system is consistent, solve them
$x + y + z = 6$, $x + 2y + 3z = 14, x + 4y + 7z = 30$ **[2022-23]**

Que 7. For what values of μ and ω the simultaneous equations $x + y + z = 6$, $x + 2y + 3z = 10, x + 2y + \omega z = \mu$ have (a) No solution (b) Unique solution (c) Infinite many solutions.

[2019-20] [2017-18] [2015-16]

Que 8. Find the value of k for which the system of equations $(3k - 8)x + 3y + 3z = 0$, $3x + (3k - 8)y + 3z = 0$,

$3x + 3y + (3k - 8)z = 0$ has a non- trivial solution. **[2021-22]**

Que 9. Solve the system of homogenous equations $x_1 + x_2 + x_3 + x_4 = 0, x_1 + 3x_2 + 2x_3 + 4x_4 = 0, 2x_1 + x_3 - x_4 = 0$

[2023-24]

Que 10. For what values of λ and μ the system of linear equations $x + y + z = 6$, $x + 2y + 5z = 10, 2x + 3y + \lambda z = \mu$ have (a) No solution (b) Unique solution (c) Infinite many solutions. Also find the solution when $\lambda = 2$ & $\mu = 10$.

[2021-22]

Que 11. Find the non singular matrix P and Q s.t. PAQ is in normal form where A = $\begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 3 \\ 0 & 1 & 1 \end{bmatrix}$ **[2020-21]**

Answers

1. $(\boldsymbol{i})\ \boldsymbol{A^{-1}} = \frac{1}{5}\begin{bmatrix} -10 & 4 & 9 \\ 15 & -4 & -14 \\ -5 & 1 & 6 \end{bmatrix}$ $(\boldsymbol{ii})\quad \boldsymbol{B^{-1}} = \begin{bmatrix} \mathbf{1} & \mathbf{-1} & \mathbf{0} \\ \mathbf{-2} & \mathbf{3} & \mathbf{-4} \\ \mathbf{-2} & \mathbf{3} & \mathbf{-3} \end{bmatrix}$ $(\boldsymbol{iii})\boldsymbol{C^{-1}} = \frac{1}{2}\begin{bmatrix} 1 & -1 & 1 \\ -8 & 6 & -2 \\ 5 & -3 & 1 \end{bmatrix}$

2. $(\boldsymbol{i})$ Rank A=3 $(\boldsymbol{ii})$ Rank B=4

3. $b = \frac{3}{5}$

4. Rank A=2

5. Rank A=4

6.$x = k - 2\,, y = 8 - 2k\,, z = k\,, where\ k\ is\ arbitrary$

7. (i) No solution $\omega = 3\,, \mu \neq 10$ (ii) Unique solution $\omega \neq 3\,, \mu\ may\ have\ any\ value$

(iii) Infinite many solution $\omega = 3\,, \mu = 10$

8. $k = \frac{2}{3}, \frac{11}{3}, \frac{11}{3}$

9. $x_1 = k_1 + 2k_2, x_2 = k_1, x_3 = -2k_1 - 3k_2\ \ and\ x_4 = k_2$

10. (i) No solution $\lambda = 6\,, \mu \neq 16$ (ii) Unique solution $\lambda \neq 6\,, \mu\ may\ have\ any\ value$

(iii) Infinite many solution $\lambda = 6\,, \mu = 16$. $x = \frac{13}{2}\ , y = -2\,, z = \frac{3}{2}$

11. $\mathrm{P} = \begin{bmatrix} 1 & 0 & 0 \\ -1 & 1 & 0 \\ 1 & -1 & 1 \end{bmatrix}\ and\ \mathrm{Q} = \begin{bmatrix} 1 & -1 & -1 \\ 0 & 1 & -1 \\ 0 & 0 & 1 \end{bmatrix}$