ABES Engineering College, Ghaziabad

Department of Applied Sciences & Humanities

Session: 2023-24 **Semester: I** **Section: Common to All**

Course Code: BAS-103 **Course Name: Engineering Mathematics-I**

<u>Assignment 1</u>

Date of Assignment: **Date of submission:**

S.No.	KL	CO	PI	Question	Marks
1	K3	CO1	1.3.1 2.1.3 2.4.1 2.4.4	Employing elementary row transformations, find the inverse of the matrix $A=\begin{bmatrix}0 & 1 & 2\\ 1 & 2 & 3\\ 3 & 1 & 1\end{bmatrix}$.	5
2.	K3	CO1	1.3.1 2.1.3 2.4.1 2.4.4 4.3.3	Reduce the matrix A to its normal form and hence find its rank where, $A=\begin{bmatrix}2 & 1 & -3 & -6\\ 3 & -3 & 1 & 2\\ 1 & 1 & 1 & 2\end{bmatrix}$	5
3.	K3	CO1	1.3.1 2.1.3 2.4.1 5.2.2	Find the eigen values and eigen vectors of the following matrices : $A=\begin{bmatrix}6 & -2 & 2\\ -2 & 3 & -1\\ 2 & -1 & 3\end{bmatrix}$	5
4.	K3	CO1	10.1.1 10.1.3 4.3.4	Find the value of λ for which the system has non-zero solution: $x+2y+3z=\lambda x, 3x+y+2z=\lambda y, 2x+3y+z=\lambda z$	5

5.	K3	CO1	1.3.1 2.1.3 2.4.1 2.4.4	Express the Hermitian matrix A = $\begin{bmatrix} 1 & -i & 1+i \\ i & 0 & 2-3i \\ 1-i & 2+3i & 2 \end{bmatrix}$ as P+iQ where P is a real symmetric and Q is a real skew symmetric matrix.	5
6	K3	CO1	1.3.1 2.1.3 2.4.1 2.4.4 4.3.3 4.3.4	Verify Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$.Hence compute A^{-1}. Also evaluate $A^6 - 6A^5 + 9A^4 - 2A^3 - 12A^2 + 23A - 9I$.	5
7.	K3	CO1	1.3.1 2.1.3 2.4.1 2.4.4	Show that $A = \frac{1}{\sqrt{3}}\begin{bmatrix} 1 & 1 & 1 \\ 1 & \omega & \omega^2 \\ 1 & \omega^2 & \omega \end{bmatrix}$ is a unitary matrix, where ω is complex cube root of unity.	5
8.	K3	CO1	10.1.1 10.1.3 4.3.4	Investigate, for what values of λ *and* μ do the systems of equations $x + y + z = 6, x + 2y + 3z = 10, x + 2y + \lambda z = \mu$ have (i) no solution (ii) unique solution (iii) infinite solutions ?	5
9.	K3	CO1	1.2.1 1.3.1 2.4.1	Find the eigen values & eigen vectors for the matrix: $\begin{bmatrix} 1 & 2 & 2 \\ 0 & 2 & 1 \\ -1 & 2 & 2 \end{bmatrix}$	5
10.	K2	CO1	4.3.3 4.3.4	For what values of a the following vectors $(0,1,a), (1,a,1) \& (a,1,0)$ are linearly dependent.	5

Answers:

1. $A^{-1} = \begin{bmatrix} 1/2 & -1/2 & 1/2 \\ -4 & 3 & -1 \\ 5/2 & -3/2 & 1/2 \end{bmatrix}$

2. 3

3. $\lambda = 2, 2, 8$; $X_1 = k_2\begin{bmatrix} 1 \\ 2 \\ 0 \end{bmatrix} + k_3\begin{bmatrix} -1 \\ 0 \\ 2 \end{bmatrix}$, $X_2 = k_1\begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix}$

4. 6

6. $A^{-1} = \frac{1}{4}\begin{bmatrix} 3 & 1 & -1 \\ 1 & 3 & 1 \\ -1 & 1 & 3 \end{bmatrix}$

$$A^6 - 6A^5 + 9A^4 - 2A^3 - 12A^2 + 23A - 9I = 5A - I = \begin{bmatrix} 9 & -5 & 5 \\ -5 & 9 & -5 \\ 5 & -5 & 9 \end{bmatrix}$$

8. $(i)\ \lambda = 3\ ,\ \mu \neq 10\ \ (ii)\ \lambda \neq 3\ ,\mu\ \ may\, have\, any\, value\ (iii)\, \lambda = 3\ ,\ \mu = 10$

9. $\lambda = 1,2,2\ \ \&\ \ k_1\begin{bmatrix} 1 \\ 1 \\ -1 \end{bmatrix}, k_2\begin{bmatrix} 2 \\ 1 \\ 0 \end{bmatrix}$

10. a= $0, \sqrt{2}, -\sqrt{2}$