18MAB101T-Calculus and Linear Algebra for C-Slot
Answer Key

1. The matrix of the quadratic form $x_1^2 + 3x_2^2 + x_3^2 + 2x_1x_2 + 4x_2x_3 + 6x_3x_1$
   (a) $\begin{pmatrix}1 & 2 & 3\\ 2 & 3 & 1\\ 3 & 1 & 1\end{pmatrix}$ (b) $\begin{pmatrix}1 & 1 & 3\\ 1 & 3 & 2\\ 3 & 2 & 1\end{pmatrix}$ (c) $\begin{pmatrix}3 & 1 & 1\\ 1 & 3 & 2\\ 1 & 2 & 3\end{pmatrix}$ (d) $\begin{pmatrix}1 & 2 & 6\\ 2 & 3 & 4\\ 6 & 4 & 1\end{pmatrix}$
   Answer: b
2. The number of positive terms in the canonical form is called
   (a) Signature (b) Index (c) Quadratic form (d) Positive definite
   Answer: b
3. If $\begin{pmatrix}4\\ 1\end{pmatrix}$ is an Eigen vector of the matrix $\begin{pmatrix}5 & 4\\ 1 & 2\end{pmatrix}$ then, find the corresponding Eigen value
   (a) 1 (b) 6 (c) 5 (d) 4
   Answer: b
4. Find the sum of squares of the Eigen values of $A = \begin{pmatrix}2 & 2 & 0\\ 0 & 3 & 5\\ 0 & 0 & 1\end{pmatrix}$
   (a) 14 (b) 6 (c) 0 (d) 10
   Answer: a
5. Find the sum and product of the Eigen values of $A = \begin{pmatrix}2 & 3 & 0\\ 0 & 6 & 4\\ 1 & 0 & 0\end{pmatrix}$
   (a) 8, 6 (b) 8, 12 (c) 6, 8 (d) 0, 1
   Answer: b
6. If A is an orthogonal matrix then,
   (a) $|A| = 0$ (b) A is singular (c) $A^2 = I$ (d) $A^T = A^{-1}$
   Answer: d
7. Find the Eigen values of A^3 of $A = \begin{pmatrix}-5 & 0 & 0\\ 3 & 0 & 0\\ 4 & -1 & 2\end{pmatrix}$
   (a) 25, 0, 4 (b) -5,0, 2 (c) -125, 0,8 (d) 50 ,0, 1
   Answer: c
8. Find the Eigen values of the matrix $A = \begin{bmatrix}2 & 3\\ 4 & 1\end{bmatrix}$
   (a) 2, 3 (b) 3, -1 (c) 4, 1 (d) 5, -2
   Answer: d
9. Find the Eigen values of A^{-1} if the matrix $A = \begin{bmatrix}-5 & 2\\ -9 & 6\end{bmatrix}$
   (a) 1/3, 1/4 (b) -3, 4 (c) 1/4, 1/-3 (d) 1/4, -1
   Answer: c

10. Find the characteristic equation of the matrix $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$

(a) $\lambda^2 + 5\lambda - 2 = 0$ (b) $\lambda^2 - \lambda - 6 = 0$

(c) $\lambda^2 + \lambda + 6 = 0$ (d) $\lambda^2 - 5\lambda - 2 = 0$

Answer: d

11. Find the characteristic equation of the matrix $A = \begin{pmatrix} 1 & 1 & 1 \\ 0 & 2 & 1 \\ -4 & 4 & 3 \end{pmatrix}$

(a) $\lambda^3 - 6\lambda^2 + 11\lambda - 6 = 0$ (b) $\lambda^3 + 6\lambda^2 + 11\lambda + 6 = 0$

(c) $\lambda^3 + 6\lambda^2 + 12\lambda + 5 = 0$ (d) $\lambda^3 + 3\lambda^2 + 2\lambda + 4 = 0$

Answer: a

12. Find the nature of the quadratic form $x^2 + 5y^2 + z^2 + 2zy + 6xz + 2xy$

(a) Positive definite (b) Negative definite (c) Positive semi-definite (d) Indefinite

Answer: d

13. Write the Q.F. defined by the matrix $A = \begin{pmatrix} 2 & 6 \\ 6 & 3 \end{pmatrix}$

(a) $2x^2 + 3y^2 + 6xy$ (b) $2x^2 + 3y^2 - 6xy$

(c) $2x^2 + 3y^2 + 12xy$ (d) $2x^2 + 3y^2 + 3xy$

Answer: c

14. The matrix of the quadratic form $x^2 + 2xy$ is

(a) $\begin{pmatrix} 1 & 2 \\ 2 & 0 \end{pmatrix}$ (b) $\begin{pmatrix} 1 & 1 \\ 1 & 0 \end{pmatrix}$ (c) $\begin{pmatrix} 2 & 1 \\ 1 & 0 \end{pmatrix}$ (d) $\begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$

Answer: b

15. If $A = \begin{pmatrix} 1 & 2 \\ 5 & 3 \end{pmatrix}$, then by Cayley-Hamilton Theorem A^2 is equal to

(a) $A^2 = 4A - 7I$ (b) $A^2 = 5A - I$ (c) $A^2 = 7A + 4I$ (d) $A^2 = 4A + 7I$

Answer: d

16. If $A = \begin{pmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{pmatrix}$, then by Cayley-Hamilton Theorem A^3 is equal to

(a) $A^2 + 5A + I$ (b) $A^2 - 5A - I$ (c) $5A^2 + 9A + I$ (d) $5A^2 - 9A + I$

Answer: d

17. Find the matrix from the quadratic form $2x^2 + 3y^2 + 2xy + 4xz$

(a) $\begin{pmatrix} 2 & 1 & 1 \\ 1 & 3 & 0 \\ 1 & 0 & 1 \end{pmatrix}$ (b) $\begin{pmatrix} 2 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & 0 \end{pmatrix}$ (c) $\begin{pmatrix} 4 & 1 & 1 \\ 1 & 6 & 0 \\ 1 & 0 & 1 \end{pmatrix}$ (d) $\begin{pmatrix} 2 & 2 & 4 \\ 2 & 3 & 0 \\ 4 & 0 & 0 \end{pmatrix}$

Answer: b

18. Find the nature of the quadratic form $8xy - z^2$

(a) Indefinite (b) Positive definite (c) Negative definite (d) Positive semidefinite

Answer: a

19. Find the nature of the quadratic form $12x^2 + 3y^2 + 12z^2 + 2xy$

(a) Indefinite (b) Positive definite (c) Negative definite (d) Positive semidefinite

Answer: b

20. Find rank of the Quadratic Form whose Canonical form is $3y_2^2 + 15y_3^2$

(a) 3 (b) 2 (c) 1 (d) 0

Answer: b

21. Find index of the Quadratic Form whose Canonical form is $9y_1^2 - 6y_2^2 - 3y_3^2$

(a) 1 (b) 2 (c)3 (d) 0

Answer: a

22. Find signature of the Quadratic Form whose Canonical form is $y_1^2 - 2y_2^2 + 4y_3^2$

(a) 1 (b) 2 (c)3 (d) 0

Answer: a

23. The sum and the product of the Eigen values of a 3x3 matrix are 4 and -6 respectively. If one of the Eigen value is -1 then, find the other two Eigen values.

(a) 1,1 (b) 1,2 (c) 2,3 (d) 4,3

Answer: c

24. If the sum and the product of the Eigen values of a 2x2 matrix are 8 and 7 respectively, then the Eigen values are

(a) 1,1 (b) 2,2 (c) 2,5 (d) 1,7

Answer: d

25. If $\begin{pmatrix} 1 \\ 0 \\ -1 \end{pmatrix}$ and $\begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix}$ are the two Eigen vectors of a real symmetric matrix, then the third Eigen vector is

(a) $\begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix}$ (b) $\begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$ (c) $\begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix}$ (d) $\begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix}$

Answer: d