Department Of Computer Science
MCA
Subject: Mathematical Foundation

Total Marks:40

Date:15/11/2022

Q:1 Answer any Four. (Two marks each) [8]

1) Define the below term and give one example:
   Diagonal Matrix, Proper Subset

2) Find x, y, z and t if $2\begin{bmatrix} x & z \\ y & t \end{bmatrix} + 3\begin{bmatrix} 1 & -1 \\ 0 & 0 \end{bmatrix} = 3\begin{bmatrix} 3 & 5 \\ 4 & 6 \end{bmatrix}$.

3) Find all the minors of the element in the matrix $\begin{bmatrix} 4 & 6 \\ -3 & 8 \end{bmatrix}$.

4) Describe the following sets in set-builder form.
   $A = \{2,4,6,8,10\}$ and $B = \{3,5,7,9,\dots,87,89\}$.

5) If $A = \{1,2\}, B = \{2,3\}, C = \{3,5\}$ then find $(A \times B) \cup (A \times C)$.

6) Give the power sets of following:
   $A = \{x: x \text{ is multiple of } 4, x \in \square \text{ and } x \leq 16\}$ and $B = \{x: x \text{ is a prime number and } x < 8\}$.

Q:2 Answer any Four. (Four marks each) [16]

1) Find adjoint of the matrix $\begin{bmatrix} -1 & 0 & -1 \\ 3 & 4 & 5 \\ 0 & -6 & -7 \end{bmatrix}$.

2) Find Row-Rank of a matrix $A = \begin{bmatrix} 1 & 5 & 9 \\ 4 & 8 & 12 \\ 7 & 11 & 15 \end{bmatrix}$.

3) If $A = \begin{bmatrix} 1 & 2 \\ -2 & 3 \end{bmatrix}, B = \begin{bmatrix} 2 & 1 \\ 2 & 3 \end{bmatrix}$ and $C = \begin{bmatrix} -3 & 1 \\ 2 & 0 \end{bmatrix}$, verify that
   (i) $(AB)C = A(BC)$ and (ii) $A(B + C) = AB + AC$.

4) If $A=\{1,4\}$, $B= \{4,5\}$, $C= \{5,7\}$ then verify that $A \times (B \cap C) = (A \times B) \cap (A \times C)$.

5) If $A = \begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$ then show that $A^2 - 4A + 3I = 0$ and hence find A^{-1}.

6) If $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9. 10\}$, $A = \{1, 3, 5, 7, 9\}$, $B = \{1, 5, 6, 8\}$, $C = \{1, 4, 6, 7\}$ then verify
   (a) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
   (b) $A - B = A \cap B'$
   (c) $A \triangle B = B \triangle A$
   (d) $A - C = A - (A \cap C)$.

Q:3 Answer any Two. (Eight marks each) [16]

1) If $A = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 9 & 3 \\ 1 & 4 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 & 0 \\ 2 & 3 & -1 \\ 1 & -1 & 3 \end{bmatrix}$, verify that $(AB)^{-1} = B^{-1}A^{-1}$.

2) If $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 & -1 \\ 3 & 0 & 2 \\ 4 & 5 & 0 \end{bmatrix}$, verify that $(AB)' = B'A'$.

3) Prove the following statement using Venn diagram.
   (a) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
   (b) $(A - B) \cup (B - A) = (A \cup B) - (A \cap B)$
   (c) $(A \cup B)' = A' \cap B'$
   (d) $A - (B \cup C) = (A - B) \cap (A - C)$