

Ex/ME/MATH/5/T/121/2017

**B.Mechanical(Evening) Examination, 2017**

**(1ST YR, 2ND SEM)**

**MATHEMATICS**

**PAPER - IV**

**Full Marks : 100**

**Time: Three hours**

**Part - I**

**Answer any four questions**

**12.5 × 4 = 50**

1.(a) Define Mode. State its advantages and disadvantages.

(b) From the following distribution of scores calculate the mode.

Scores:            50 - 59   60 - 69   70 - 79   80 - 89   90 - 99   100 - 109

Frequency:        6            20            40            50            30            6

2.(a) Define Mean. State its advantages and disadvantages. Also describe its uses.

(b) Find the arithmetic mean from the frequency distribution.

Weight in kg.:    50   55   60   65   70

No. of men:        15   20   25   30   10

3. What is standard deviation of a set of observations? From the following distribution of scores, calculate standard deviation :

Scores :            6 - 10   11 - 15   16 - 20   21 - 25   26 - 30

Frequency:            4            6            20            7            3

4. State the axioms of probability.

If A and B are two events which may or may not be mutually exclusive, then prove that

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

5. (a) Define independent events. Let A and B are two independent events. Show that  $A^c$  and  $B^c$  are also independent.

(b) If A and B are two events in a sample space S such that

$$P(A) = 0.3, P(B^c) = 0.4, P(A \cup B) = 0.8.$$

Find

$$(i) P(A \cap B), \quad (ii) P(A^c \cap B^c), \quad (iii) P(A^c \cup B^c)$$

[ $A^c$  is complement of A]

## Part - II

Answer any four questions

12.5 × 4 = 50

1. (a) Express

$$\begin{bmatrix} 2 & 3 & -3 \\ 4 & 5 & 6 \\ -5 & 8 & 9 \end{bmatrix}$$

as the sum of a symmetric and a skew symmetric matrix.

(b) Define orthogonal matrix. If  $A$  is an orthogonal matrix, show that  $|A| = \pm 1$ .

2. Find an orthogonal matrix which diagonalize the matrix

$$A = \begin{bmatrix} 6 & 4 & -2 \\ 4 & 12 & -4 \\ -2 & -4 & 13 \end{bmatrix}$$

Also, Diagonalise  $A$ .

3. What do you mean by subspace of a vector space? State the necessary and sufficient condition for a non empty subset  $W$  of a vector space  $V(F)$  be a subspace of  $V$ . Give an example of subspace. Show that intersection of two subspaces is also a subspace.

4. Define basis of a vector space.

Let  $S = \{(x,y,z) / 2x-y-z=0\}$ . Show that  $S$  is a subspace. Find also a basis for  $S$ .

5. What do you mean by inner product space? Define norm of a vector. Show that an orthogonal set of non null vectors in an inner product space  $V$  is linearly independent.

3. What is standard deviation of a set of observations? From the following distribution of scores, calculate standard deviation :

Scores :            6 - 10   11 - 15   16 - 20   21 - 25   26 - 30

Frequency:            4            6            20            7            3

4. State the axioms of probability.

If A and B are two events which may or may not be mutually exclusive, then prove that

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

5. (a) Define independent events. Let A and B are two independent events. Show that  $A^c$  and  $B^c$  are also independent.

(b) If A and B are two events in a sample space S such that

$$P(A) = 0.3, P(B^c) = 0.4, P(A \cup B) = 0.8.$$

Find

$$(i) P(A \cap B), (ii) P(A^c \cap B^c), (iii) P(A^c \cup B^c)$$

[ $A^c$  is complement of A]