IIITB COMET FOUNDATION

Name : Kiran Kumar Reddy L
id : cometfwc027
Date : 15th may 2025

Q.6 The minterm expansion of $f(P,Q,R) = PQ + Q\overline{R} + P\overline{R}$ is

(A) $m_2 + m_4 + m_6 + m_7$

(B) $m_0 + m_1 + m_4 + m_5$

(C) $m_0 + m_1 + m_6 + m_7$

(D) $m_2 + m_3 + m_1 + m_3$

Detailed Solution

Given function:

$$f(P,Q,R) = PQ + Q\overline{R} + P\overline{R}$$

We are to find its minterm expansion.

Step 1: Expand each term to include all variables

Term 1: PQ
This term is independent of R, so we expand it as:

$$PQ = PQ(R + \overline{R}) = PQR + PQ\overline{R}$$

Term 2: $Q\overline{R}$
This term is independent of P, so we expand it as:

$$Q\overline{R} = PQ\overline{R} + \overline{P}Q\overline{R}$$

Term 3: $P\overline{R}$
This term is independent of Q, so we expand it as:

$$P\overline{R} = PQ\overline{R} + P\overline{Q}\overline{R}$$

Step 2: Combine all terms

$$\begin{aligned} f(P,Q,R) &= PQR + PQ\overline{R} + PQ\overline{R} + \overline{P}Q\overline{R} + PQ\overline{R} + P\overline{Q}\overline{R} \\ &= PQR + PQ\overline{R} + \overline{P}Q\overline{R} + P\overline{Q}\overline{R} \end{aligned}$$

(Note: $PQ\overline{R}$ appeared multiple times but is considered only once.)

Step 3: Identify minterm indices

P	Q	R	Expression	Minterm
1	1	1	PQR	m_7
1	1	0	$PQ\overline{R}$	m_6
0	1	0	$\overline{P}Q\overline{R}$	m_2
1	0	0	$P\overline{Q}\overline{R}$	m_4

Step 4: Final Answer

Thus, the minterm expansion of the function is:

$$f(P, Q, R) = m_2 + m_4 + m_6 + m_7$$

Correct Option: (A) $m_2 + m_4 + m_6 + m_7$