

Medium

Deputy Executive Engineer (Electrician) 2026

Ports Authority of Gujarat / Assistant Engineer (Electrical)

A two-port network has $Z_{11} = 20 \, \Omega$, $Z_{22} = 10 \, \Omega$, $Z_{12} = Z_{21} = 5 \, \Omega$. Then 1. Network is reciprocal. 2. Input impedance depends on load connected. 3. Z-parameters are valid

A

2 and 3 only

B

1 and 4 only

C

1, 2 and 3 only

Correct

D

All of the above

Correct Answer: C

Full Detailed Explanation

Correct Answer: C - 1, 2 and 3 only
 Quick Concept Explanation Z-parameters express two-port terminal voltages as linear combinations of port currents. Reciprocity requires $Z_{12} = Z_{21}$; symmetry additionally requires $Z_{11} = Z_{22}$. Key relation: $V_1 = Z_{11}I_1 + Z_{12}I_2$; $V_2 = Z_{21}I_1 + Z_{22}I_2$. Exam focus: Reciprocal: $Z_{12} = Z_{21}$. Symmetric: $Z_{11} = Z_{22}$. Common trap: Do not confuse reciprocity with symmetry.
 Statement-wise Verification
 Statement 1 - Correct. Network is reciprocal. $V_1 = Z_{11}I_1 + Z_{12}I_2$; $V_2 = Z_{21}I_1 + Z_{22}I_2$.
 Statement 2 - Correct. Input impedance depends on load connected. They are conveniently measured with open-circuit conditions because setting one port current to zero exposes the relevant impedance coefficient.
 Statement 3 - Correct. Z-parameters are valid for open-circuit conditions. Z-parameters express two-port terminal voltages as linear combinations of port currents.
 Statement 4 - Incorrect. Z_{12} equals Z_{21} for symmetric networks only. The correct principle is: Reciprocal: $Z_{12} = Z_{21}$. Symmetric: $Z_{11} = Z_{22}$.
 Core Concept Z-parameters express two-port terminal voltages as linear combinations of port currents. They are conveniently measured with open-circuit conditions because setting one port current to zero exposes the relevant impedance coefficient. Reciprocity requires $Z_{12} = Z_{21}$; symmetry additionally requires $Z_{11} = Z_{22}$.
 Formula / Key Relationship $V_1 = Z_{11}I_1 + Z_{12}I_2$; $V_2 = Z_{21}I_1 + Z_{22}I_2$. Why the Other Options Are