

Medium Deputy Executive Engineer (Electricity) 2026 Gujarat Public Service Commission / Assistant Engineer (Electrical)

$$Z_{11} = 20 \Omega$$
$$Z_{22} = 10 \Omega, Z_{12} = Z_{21} = 5 \Omega$$

A $Z_{11} = 20 \Omega, Z_{22} = 10 \Omega, Z_{12} = Z_{21} = 5 \Omega$

B $Z_{11} = 10 \Omega, Z_{22} = 20 \Omega, Z_{12} = Z_{21} = 5 \Omega$

C $Z_{11} = 20 \Omega, Z_{22} = 10 \Omega, Z_{12} = Z_{21} = 5 \Omega$ Correct

D $Z_{11} = 10 \Omega, Z_{22} = 20 \Omega, Z_{12} = Z_{21} = 10 \Omega$

Correct Answer: C

Full Detailed Explanation

Given: $Z_{11} = 20 \Omega, Z_{22} = 10 \Omega, Z_{12} = Z_{21} = 5 \Omega$

Let V_1, I_1 and V_2, I_2 be the voltage and current at the two ports respectively.

For port 1, $V_1 = Z_{11}I_1 + Z_{12}I_2$ and $V_2 = Z_{21}I_1 + Z_{22}I_2$

Since $Z_{12} = Z_{21} = 5 \Omega$, we have $V_1 = 20I_1 + 5I_2$ and $V_2 = 5I_1 + 10I_2$

Dividing the second equation by 5, we get $V_2/5 = I_1 + 2I_2$

Substituting $I_1 = V_2/5 - 2I_2$ in the first equation, we get $V_1 = 20(V_2/5 - 2I_2) + 5I_2$

$V_1 = 4V_2 - 40I_2 + 5I_2$

$V_1 = 4V_2 - 35I_2$

Since $V_2 = 5I_1 + 10I_2$, we have $I_2 = (V_2 - 5I_1)/10$

Substituting $I_2 = (V_2 - 5I_1)/10$ in the equation $V_1 = 4V_2 - 35I_2$, we get $V_1 = 4V_2 - 35(V_2 - 5I_1)/10$

$V_1 = 4V_2 - 3.5V_2 + 17.5I_1$

$V_1 = 0.5V_2 + 17.5I_1$

Dividing the equation by 0.5, we get $2V_1 = V_2 + 35I_1$

$V_2 = 2V_1 - 35I_1$

Since $V_2 = 5I_1 + 10I_2$, we have $5I_1 + 10I_2 = 2V_1 - 35I_1$

$40I_1 + 10I_2 = 2V_1$

$20I_1 + 5I_2 = V_1$

Which is the same as the first equation.