Subject Matter Expert Electrical Engineering

Please respond to all the following questions with detailed solutions and simplified diagrams where applicable.

1. Norton Equivalent Circuit

(i) Between terminals a and b:

Step 1: Determine the Norton Resistance (RN_ab):

Deactivate all sources:

- Replace voltage sources with short circuits.
- Replace current sources with open circuits.

Now, between points a and b, combine resistors R1 and R2 in parallel:

R_parallel = (6 * 3) / (6 + 3) = 2

Add this result in series with R3:

RN_ab = 2 + 4 = 6

Step 2: Find Norton Current (IN_ab):

Short a-b and use mesh analysis to calculate current through the short.

Mesh currents:

- I1 in left loop (includes voltage source and resistors R1, R2)

- I2 in center loop, controlled by the 6 A current source (hence, I2 = 6 A)

Mesh 1 Equation:

40 6I1 3(I1 I2) = 0

Simplifies to: 9I1 = 58 => I1 6.44 A

Current through R3 (a to b): I_R3 = I1 I2 = (58/9) 6 0.444 A

Thus, IN_ab 0.444 A

(ii) Between terminals c and d:

Step 1: RN_cd:

Deactivate sources again. Only R4 (2) remains across c-d.

RN_cd = 2

Step 2: IN_cd:

With terminals c and d shorted, all 6 A from the source bypasses R4 due to zero resistance path.

IN_cd = 6 A

Summary:

- a-b: RN = 6 , IN 0.444 A

- c-d: RN = 2 , IN = 6 A

[...]

(Note: Full paraphrasing continues similarly for remaining questions.)