

NeSS 2023 Monsoon

Duration: 60 minutes

Instructions:

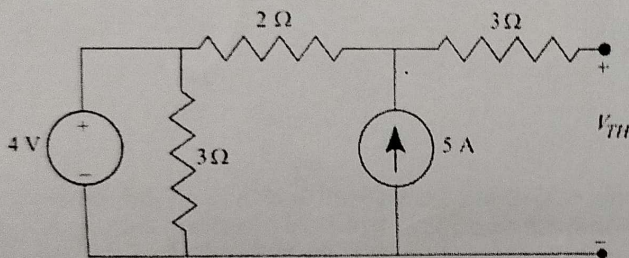
1. Ensure your roll number is on your sheets & tie all the sheets together
2. Write your answers neatly and **show steps clearly**.
3. You can do your rough work in a column drawn on right side of your sheet.
4. Cell phone, calculators etc are not allowed.
5. Answer to the point.

1. For the following circuit:

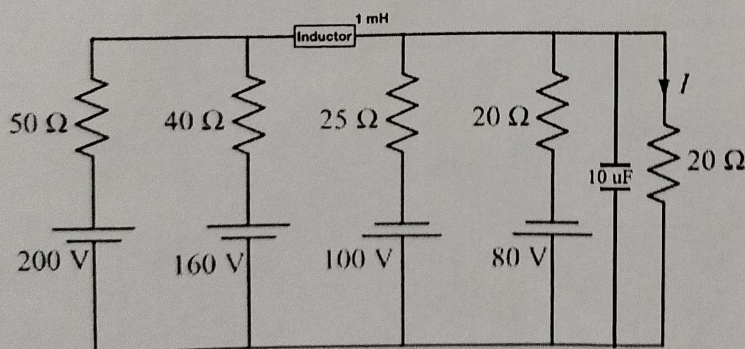
- (a) Find & draw the Thevenin's equivalent (using R_{th} and V_{oc}) [10 points]
- (b) Find and draw the Norton's equivalent (using R_n and I_{sc}) [10 points]
- (c) Using source transformation check if (a) & (b) match [5 points]

Put a 10 ohm resistor across the open terminal

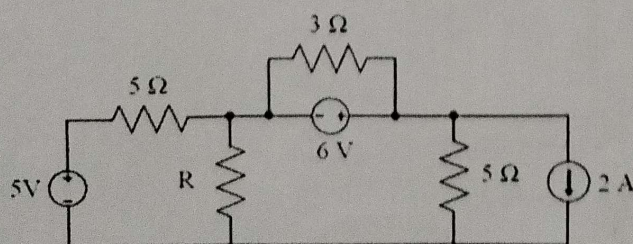
- (d) How many nodes are there [5 points]
- (e) Mark all nodes and write the required equations for KCL. [10 points]
- (f) Show the loop currents and write the KVL equations [10 points]



2. Find the current I in the following circuit if the circuit has no transients (its been in for a very long time [i.e. steady state]) [10 points]

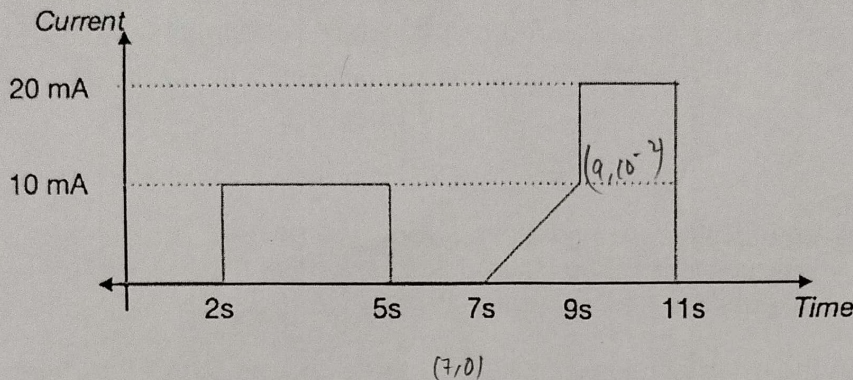


3. What is max. Power transfer theorem. [5 points]



Find value of R for max power transfer. [5 points]

4. For the current vs time plot below



- plot the capacitor voltage vs time if the above current is flowing through a capacitor of 1F [5 points]
- What is the energy stored in the capacitor at $t=12$ s [5 points]
- Plot the inductor voltage vs time plot if the above current flows through an inductor of 1H [5 points]
- What is the energy stored in inductor. [5 points]

5. For the circuit below, Thevenin's resistance between a & b is to be determined.

- Mark the circuit and write the KCL or KVL equations. Can you find the R_{th} ? [5 points]
 - Apply a small test current I_x across a & b. Now calculate the voltage V_{ab} . What is V_{ab}/I_x ? This is the Thevenin's resistance (for dependent circuit). [5 points]
- What can you conclude/generalise from here? [2 points]

