Indian Institute of Technology Patna
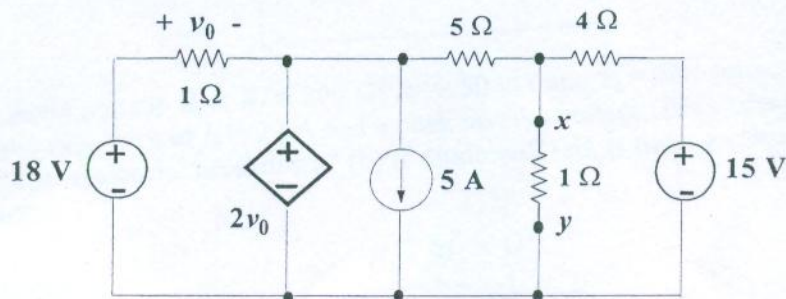## Mid-Semester Examination, Autumn Semester 2012-2013
Electrical Sciences (EE101)

**Full Marks: 40**   **Time: 2 hours**

Answer All Questions

1. (a) State Thevenin's theorem.
   (b) Determine current through the $1\,\Omega$ resistor connected between nodes x and y in the following circuit using Thevenin's theorem. $[1 + 5 = 6]$


2. Find the expressions for complete response, natural response, forced response, transient response and steady-state response for a *RC* circuit when a step input voltage is applied to the circuit. Assume that an initial voltage of magnitude V_0 is stored in the capacitor.   [6]

3. The switch in the following circuit is moved from position a to b at $t = 0$. Determine $i(t)$ for $t > 0$.   [6]
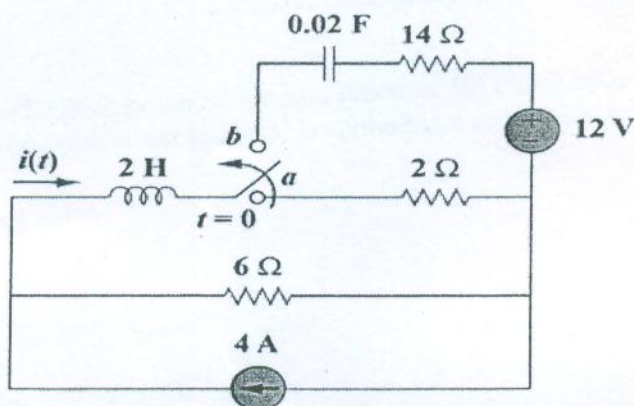
4. Determine voltage v (between the nodes x and y) in the following figure by using superposition principle.   [6]

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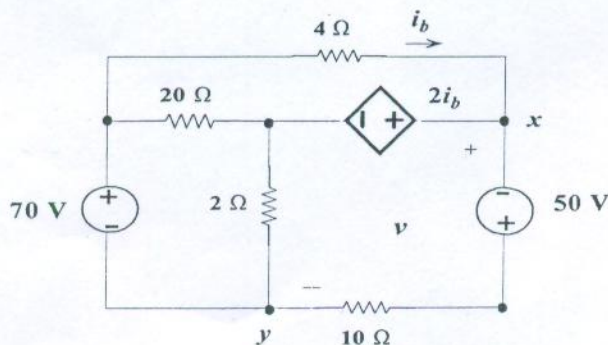
5. Assuming 10 Ω resistance as load, find Norton's equivalent circuit across terminal *ab*. Hence find current through the load. [6]
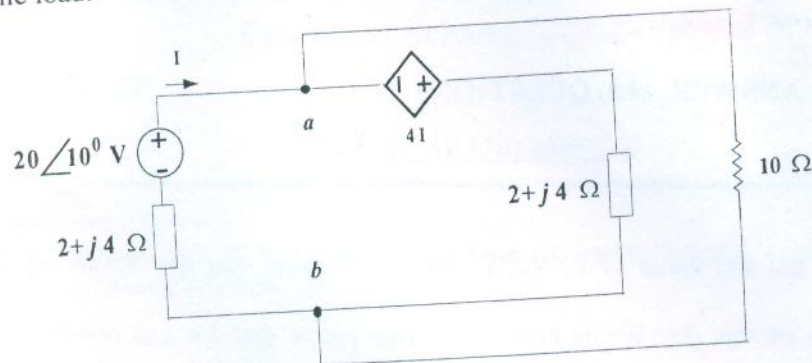
6. In the following circuit assume $R_s = R_1 = 200\ \Omega$, $R_L = 50\ k\Omega$ and $v_s = 400 \sin \omega t$ V. The diode is ideal with reverse saturation current $I_0 = 2\ \mu A$ and a peak inverse voltage (PIV) rating of $V_R = 100$ V. (a) Will the diode fail in avalanche breakdown? (b) If diode will fail, is there a value of R_L for which failure will not occur? [6]
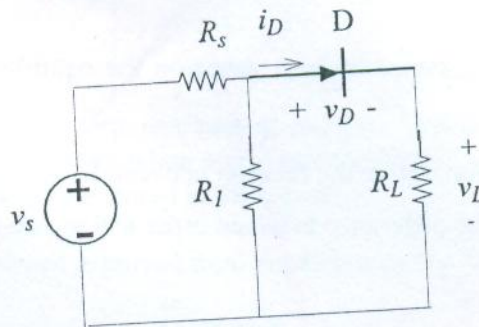
7. (a) Explain the origin of Built-in potential for a *pn* junction. (b) Using circuit diagram and graphical plot show the Quiescent (Q) point when ac signal is applied in a properly biased diode circuit. [2+2 = 4]