ELL 100

Minor-1 (Closed Book)

Total: 60   Time: 1 hr

1. Answer the following questions with reference to the circuit shown in Fig. 1.
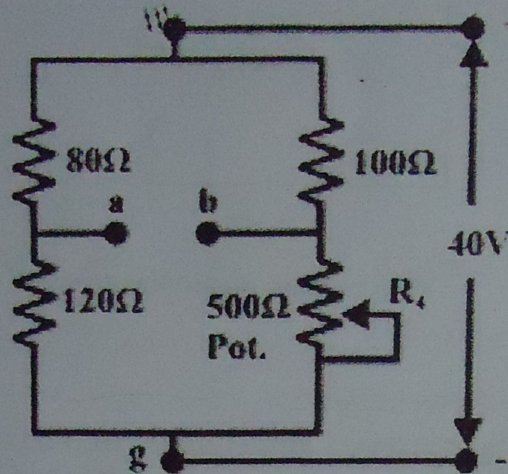

Figure 1 Circuit for question-1

(a) What value of R4 will balance the bridge (i.e., $V_{ab} = 0.0$)

(b) At balanced condition, find the values of V_{ag} & V_{bg} .

(c) Does the value of V_{ag} depend on whether or not the bridge is balanced? Explain this.

(d) Repeat part (c) for V_{bg} . Explain

(e) If the source voltage is changed to 50 V will the answer to part (a) change? Explain this.   (2 x 5)

2. The diode in the circuit of Fig. 2. is ideal. The inductor draws 100 mA from the voltage source. A 2-mF capacitor with zero initial charge is also connected in parallel with the inductor through an ideal diode such that the diode is reversed biased (i.e., it blocks charging of the capacitor). The switch suddenly disconnects with the rest of the circuit, forcing the inductor current to pass through the diode and establishing 200 V at the capacitor's terminals. Find the value of the inductor.   (10)
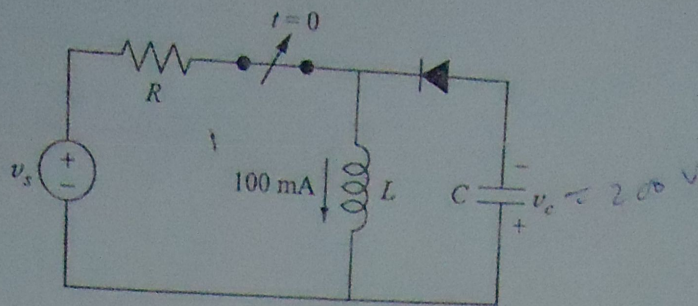
Figure 2 Circuit for Problem-2

3. Answer following questions briefly:

(a)   Suppose we have given a box with two terminals and want to measure the Thevenin equivalent of the circuit inside the box. Design an experimental procedure to obtain R_T. Provide justification for your answer.

(b)   Prove the maximum power transfer theorem, which states that: "For maximum power transfer from a source to load, the resistance of the load should be made equal to the Thevenin equivalent resistance of the source."
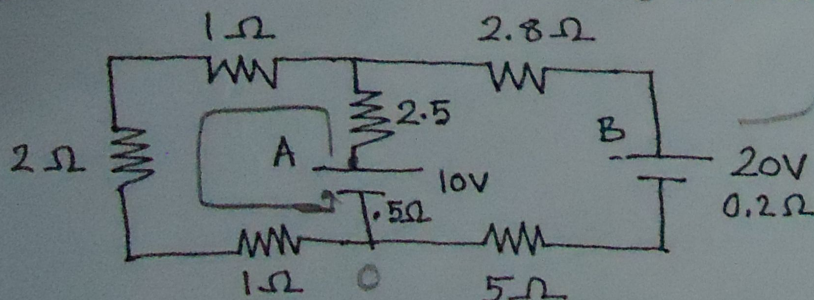
(5 +5)

4. Solve these problems:

(a) The open-circuit voltage of an audio oscillator is 5V. The terminal voltage drops to 4V when an 8000 ohm resistor is connected across the terminals. Determine the internal resistance of the oscillator.
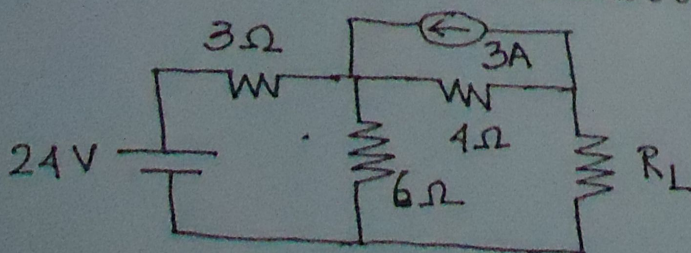
(3)

(b) Find the current in all resistors of the given circuit.

(7)

Battery A has internal resistance $0.5\,\Omega$
Battery B has internal resistance $0.2\,\Omega$

5. Find the current through R_L if its value is 6 ohm.

(10)

6. Find currents in the given circuit. in all the branches (10)