EE101:Electrical Sciences, Tutorial-11

DEPARTMENT OF ELECTRONICS & ELECTRICAL ENGINEERING

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[Q-1 is for pre-tutorial. Solve it in the space provided and submit at beginning of tutorial]

Name: Roll No.: Tutorial Group:

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1. Fig. Q1 shows three coils. Two pairs of coils, $L_1 - L_2$ and $L_2 - L_3$ are magnetically coupled. Find the equivalent inductance seen from the terminals a-b in terms of self and mutual inductances L_1, L_2, L_3, M_1 and M_2.

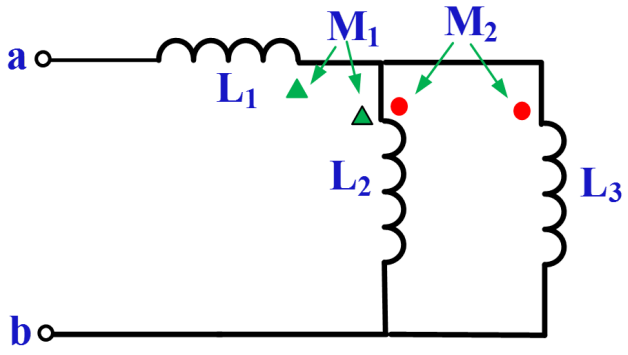

Fig. Q1

2. Find the equivalent inductances seen at terminals 1 and 2 in the network of Fig. Q2 if the following terminals are connected together: (a) none and (b) A to B.

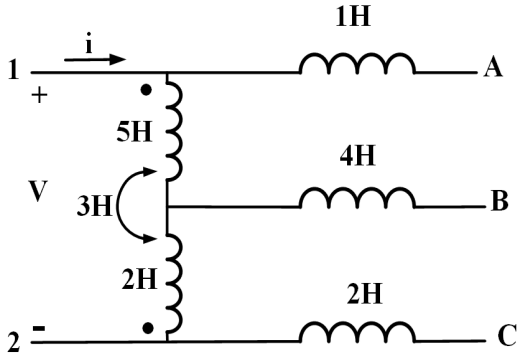

Fig. Q2

3. For the circuit shown in Fig. Q3, find $i_c(t)$ for $t > 0$. The input voltage $v_s(t)$ is given as $v_s(t) = \frac{10t^2u(t)}{(t^2+0.01)}$V.

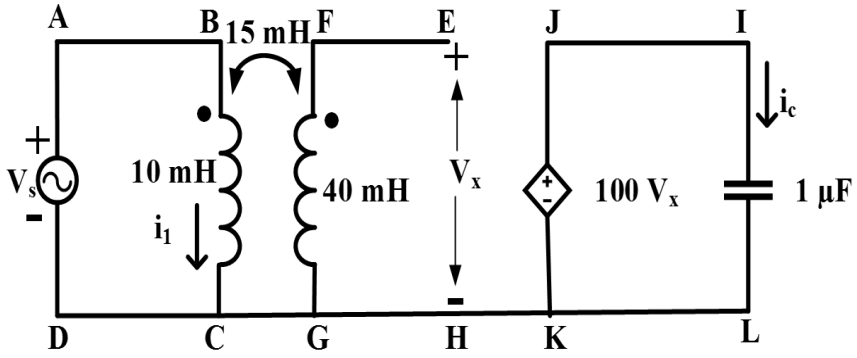

Fig. Q3

4. The I-V relation in a forward biased junction diode is given by

$$I_D \approx I_s e^{\frac{V_D}{V_T}}.$$

For a given current I_D, the voltage across the diode decreases at the rate of -2mV/°C. Typical dependence of the diode current on temperature is shown in Fig. Q4(a). Assuming identical diodes, and temperature independent resistors and current sources, find out $\frac{\partial V_{OUT}}{\partial T}$ in the circuit shown in Fig. Q4(b). Write your inference.

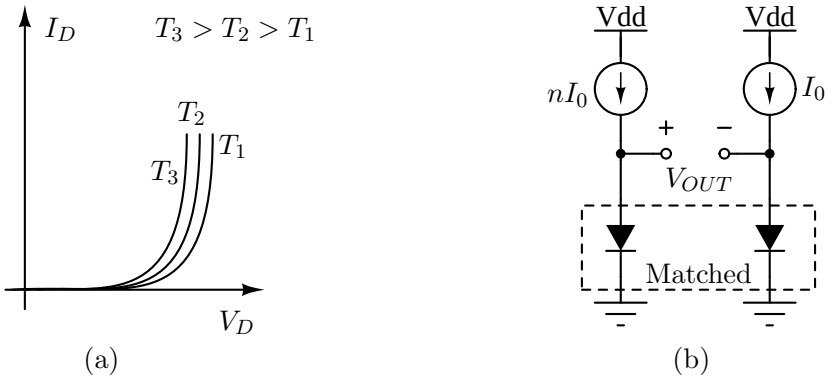

Fig. Q4 (a) Dependence of the diode current on temperature. (b) Circuit -1.

5. If you have identified the functionality of the above circuit correctly, can you think of a way of generating a reference voltage which is independent of temperature (i.e., zero temperature coefficient)?