

EE1001 Electrical and Magnetic Circuits

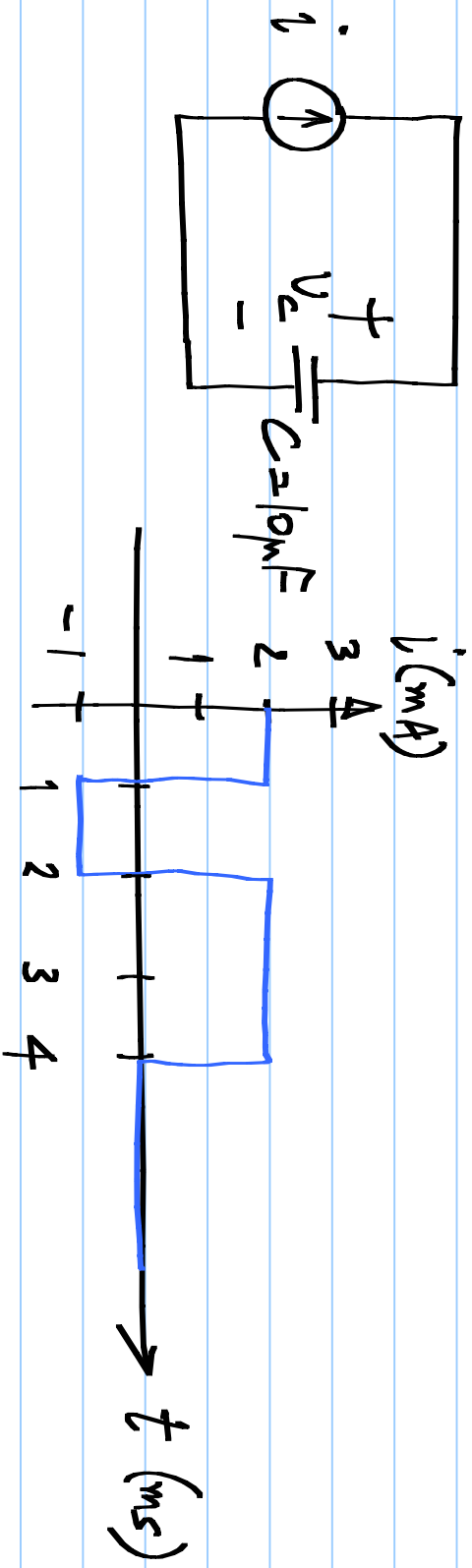
Problem set #1 (Due on 23rd January 2015)

HKD: Hayt, Kemmerly, and Durbin

Engineering circuit analysis, 7th Edition

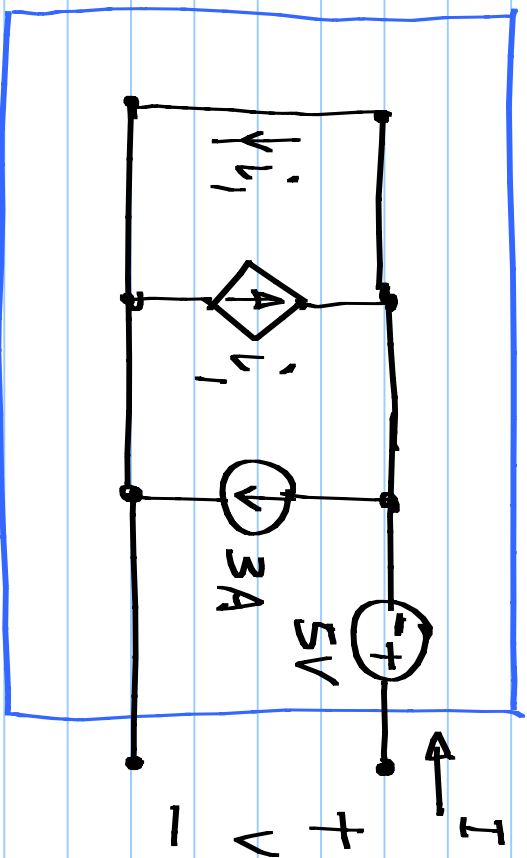
Tata McGraw Hill 2010, 2006

①

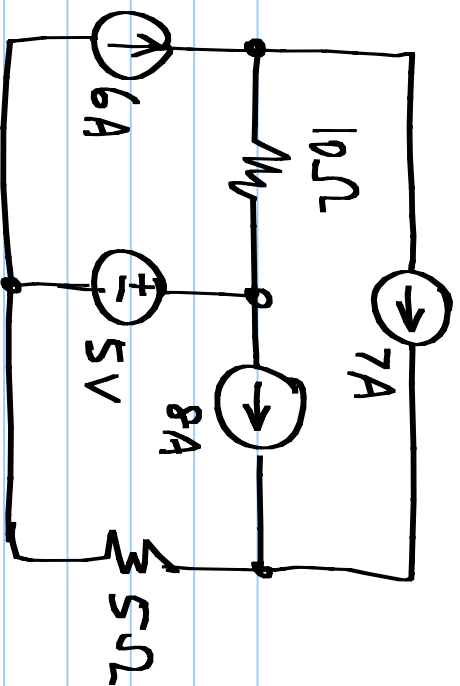


Sketch the voltage V_c across the capacitor.

② Sketch the I-V characteristics of the box shown below

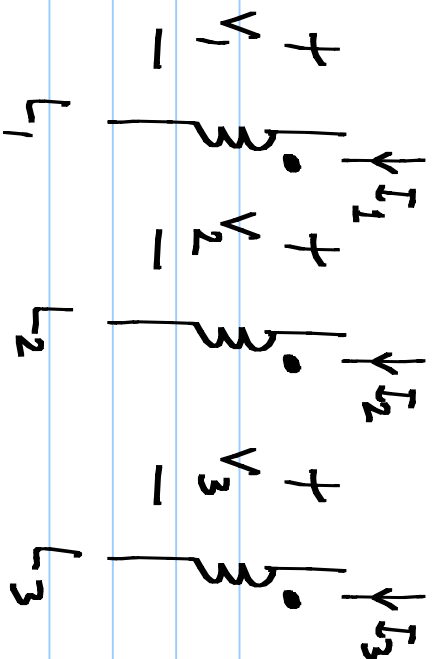


③



Calculate the power dissipated
or generated in each element.
(state clearly whether it is
dissipated or generated)

④



The figure shows three mutually coupled coils.

The voltages are given by

equations similar to the two coil case.

$$V_1 = L_1 \frac{dI_1}{dt} + M_{12} \frac{dI_2}{dt} + M_{13} \frac{dI_3}{dt} \quad \text{and so on.} \quad M_{ij} = M_{ji}$$

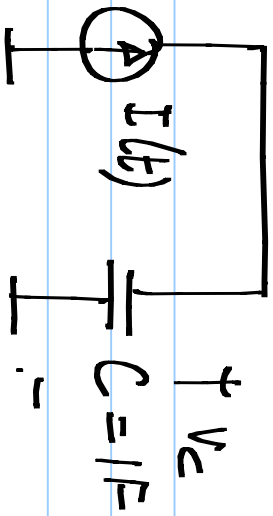
$$M_{ij}^2 = K_{ij} \cdot L_i \cdot L_j$$

If M_{13} is given to be zero, find the constraint on K_{12} & K_{13}

(Assume symmetry: $L_1 = L_2 = L_3$; $M_{12} = M_{23}$)

Additionally, assume $L_1 = L_3$

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$$(a) \quad I(t) = 0 \quad t < 0$$

$$1A \cdot \cos(2\pi t) \quad t \geq 0$$

(initially discharged)

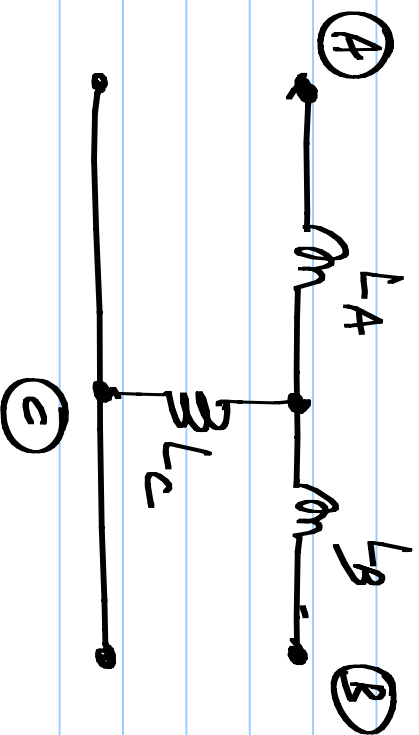
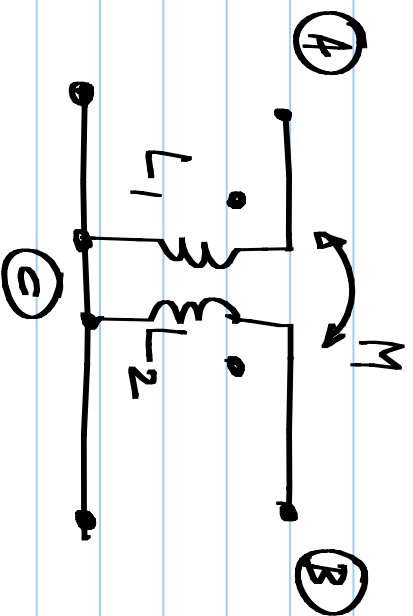
$$(b) \quad I(t) = 0 \quad t < 0$$

$$1A \cdot \sin(2\pi t) \quad t \geq 0$$

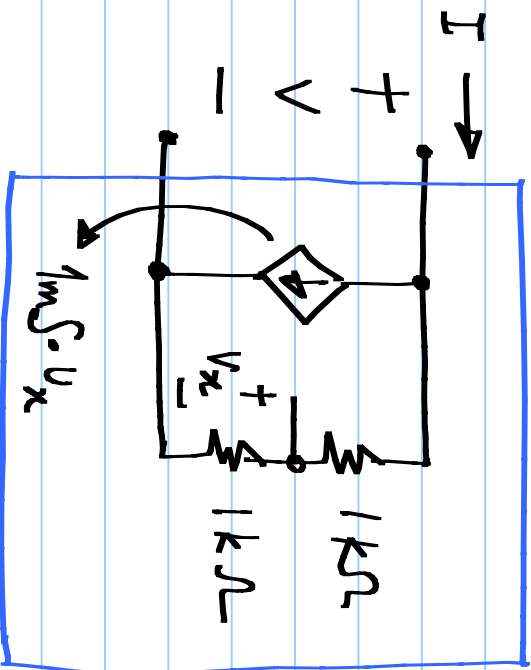
Determine $V_c(t)$ in the two cases

6 The following two networks are equivalent.

Determine L_A , L_B , L_C in terms of L_1 , L_2 , M



7



Draw the I-V characteristics of the box shown in blue at the external terminals shown. Mark the axes and key quantities clearly.