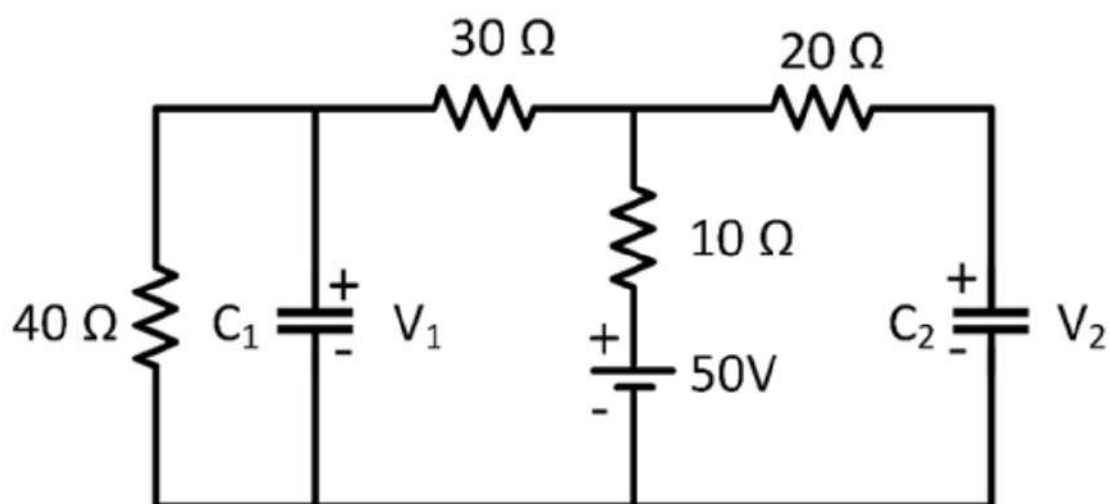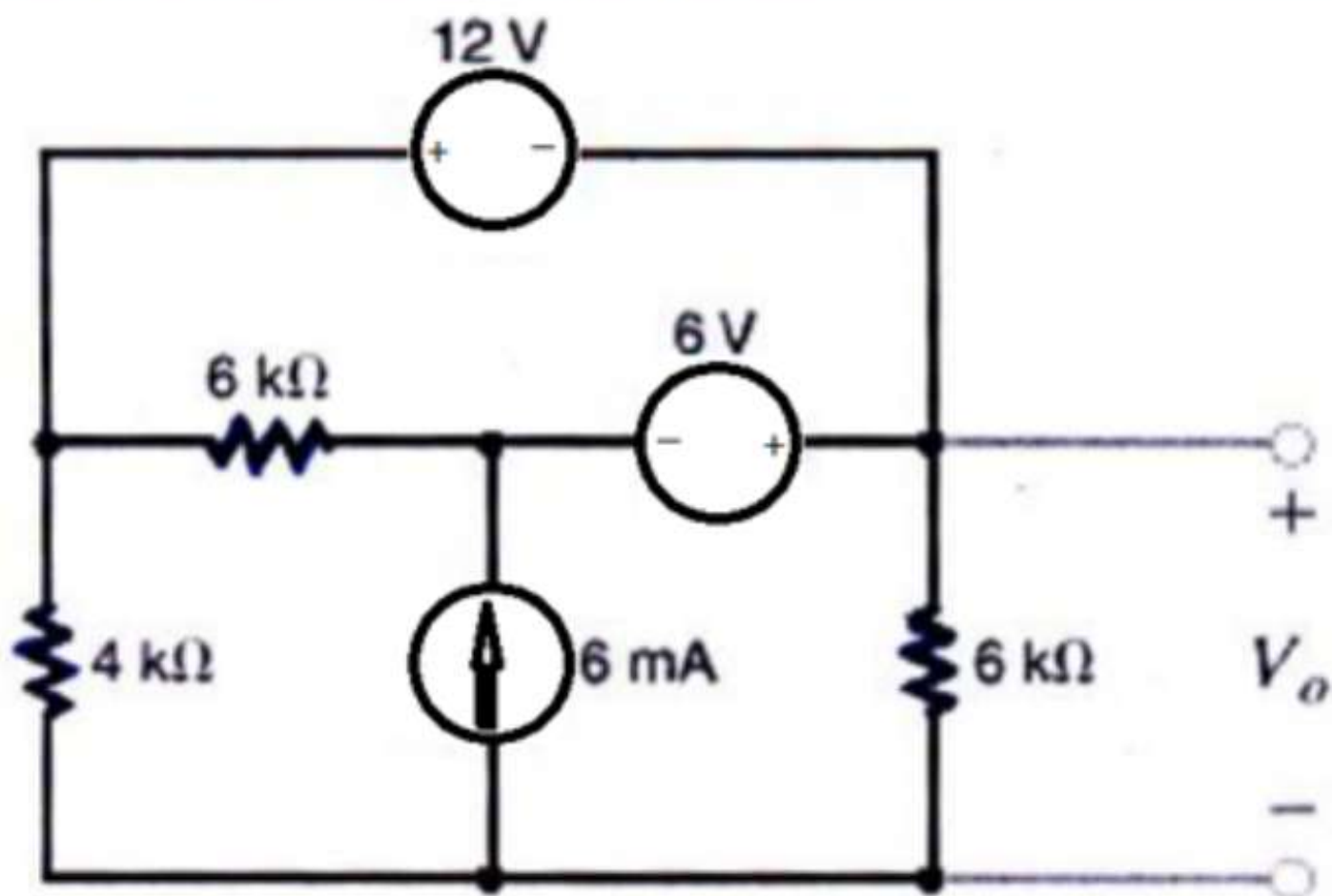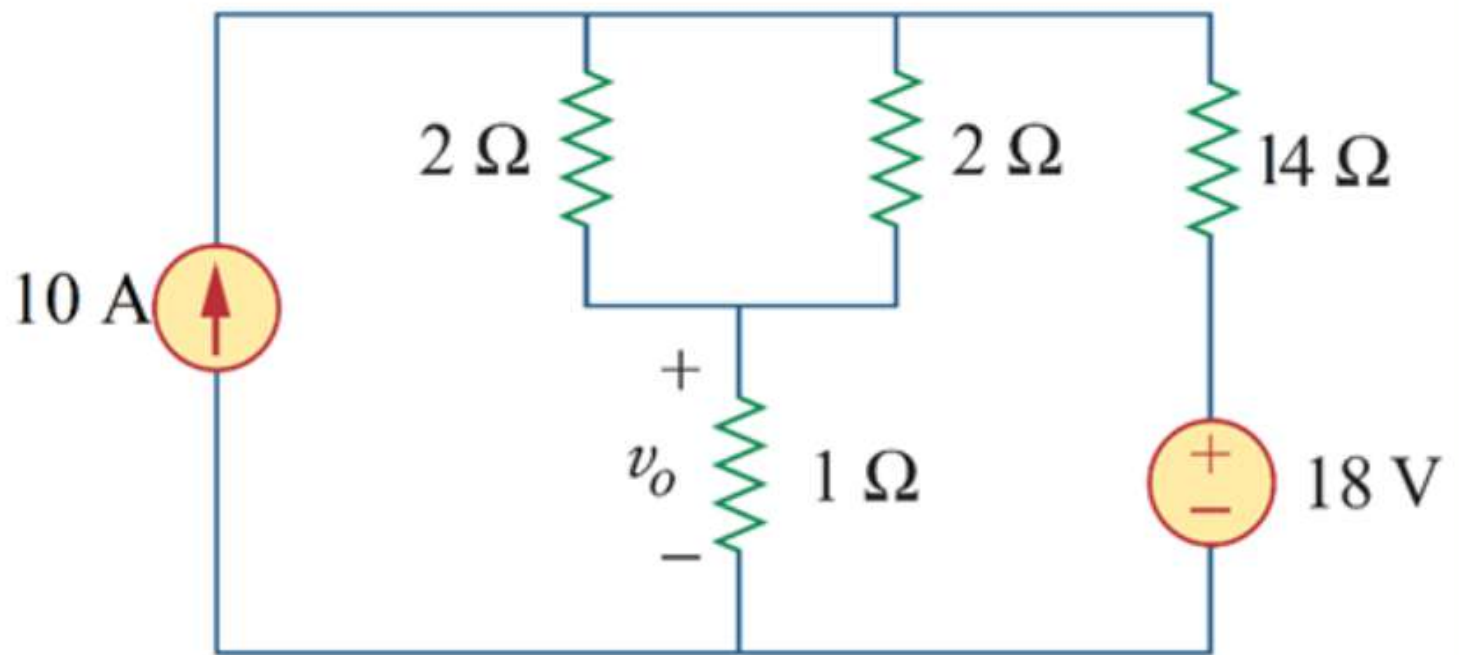Find the voltage across the capacitors (V_1 & V_2) in the below circuit under dc conditions.
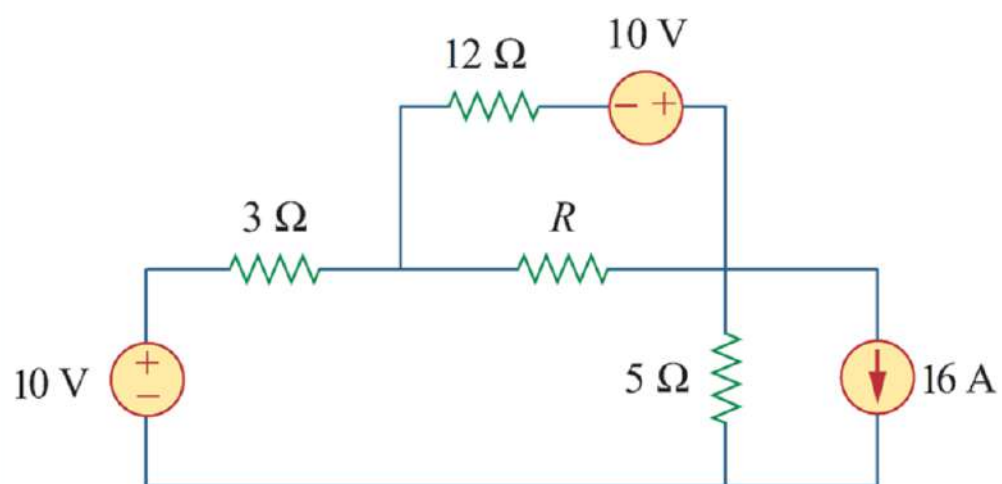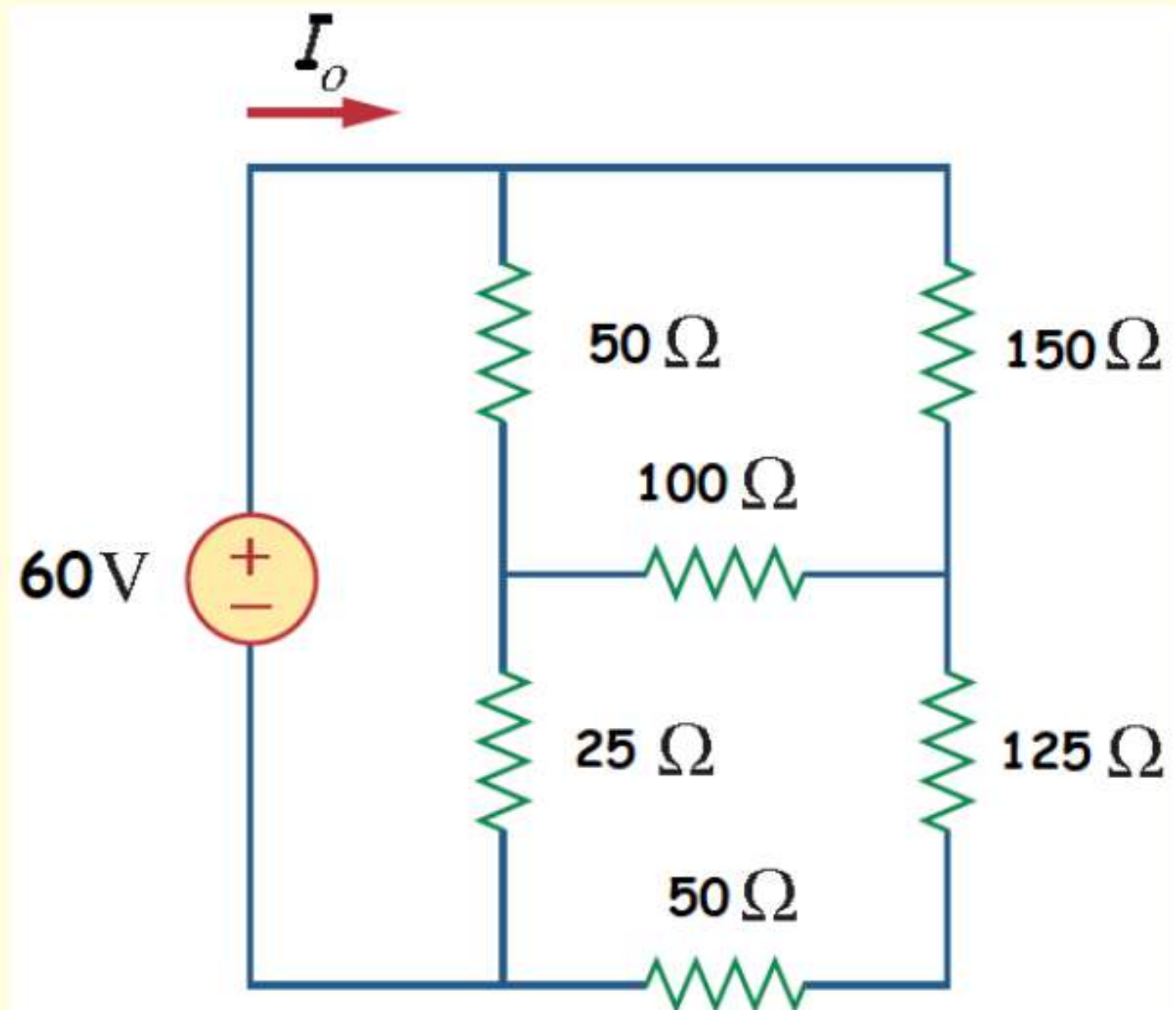
Find Vo for the circuit shown.

Find the V_O in the circuit by using superposition principle.

Calculate the maximum power delivered to the variable resistor R shown in the circuit. Also find the value of R.

12 Ω   10 V

3 Ω   R

10 V

5 Ω   16 A

Calculate Io in the circuit.

Solution

Label the nodes. Let the source positive terminal (top node) be $T = 60\text{ V}$ and the bottom node (source negative) be $D = 0\text{ V}$.

Resistor connections:
- $50\,\Omega$: $T \to A$
- $150\,\Omega$: $T \to C$
- $100\,\Omega$: $A \to C$
- $25\,\Omega$: $A \to D$
- $125\,\Omega$: $C \to E$
- $50\,\Omega$: $D \to E$

Node equations

Node E:
$$\frac{E-C}{125} + \frac{E}{50} = 0 \;\Rightarrow\; 7E = 2C \;\Rightarrow\; E = \frac{2C}{7}$$

Node A:
$$\frac{A-60}{50} + \frac{A-C}{100} + \frac{A}{25} = 0 \;\Rightarrow\; 7A - C = 120$$

Node C:
$$\frac{C-60}{150} + \frac{C-A}{100} + \frac{C-E}{125} = 0 \;\Rightarrow\; 47C - 21A - 840 = 0$$

Solving

$$A = \frac{1620}{77} = 21.04\ \text{V}, \quad C = \frac{2100}{77} = 27.27\ \text{V}, \quad E = 7.79\ \text{V}$$

Current I_o (total current leaving the source into node T):

$$I_o = \frac{T-A}{50} + \frac{T-C}{150} = \frac{3000/77}{50} + \frac{2520/77}{150}$$

$$I_o = 0.779 + 0.218 = 0.997\ \text{A} \approx 1\ \text{A}$$

8. a) A 50 mH inductor is connected in parallel with a 2.5 kΩ resistor. The current through the inductor is $i(t) = 50\,e^{-100t}$ mA.
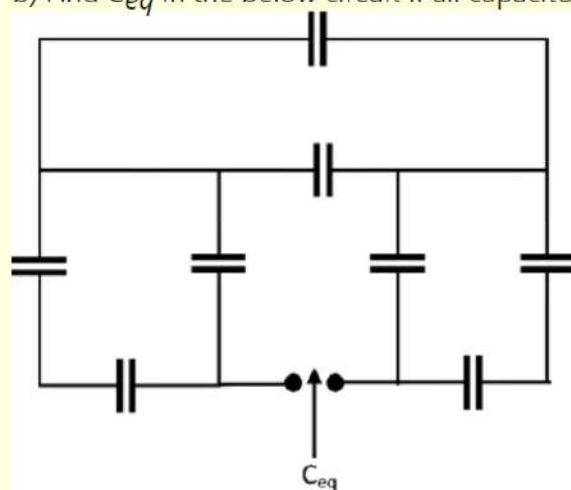
(i) Find the voltage across the inductor (V_L).
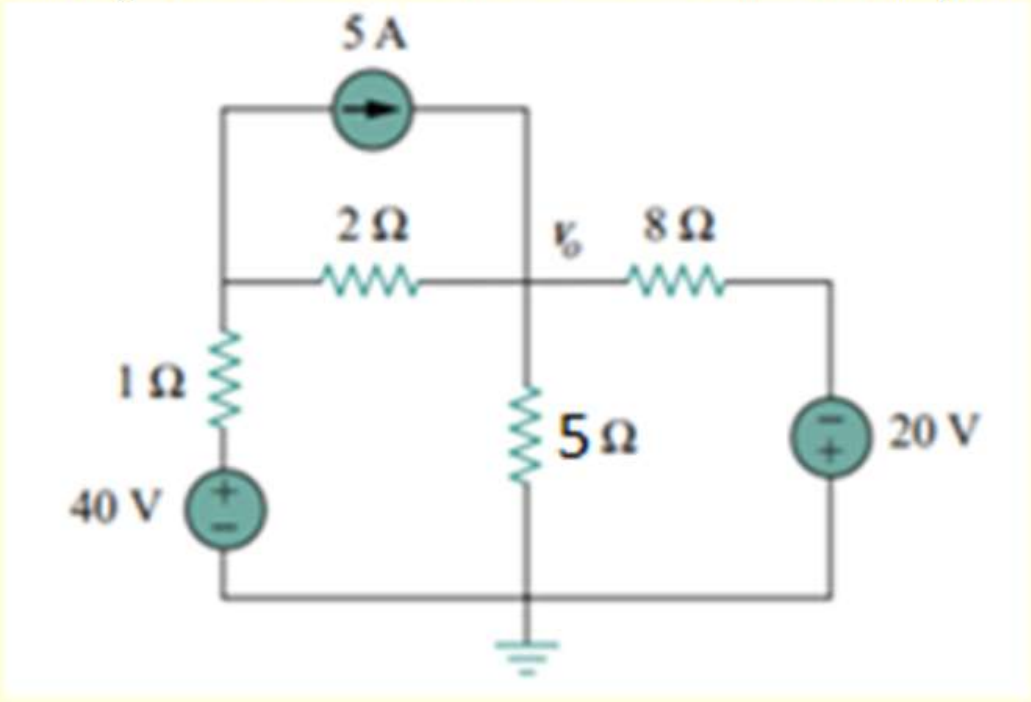(ii) Find the voltage across the resistor (V_R).
(iii) Calculate the energy in the inductor at $t=0$.   (3 marks)

b) Find C_{eq} in the below circuit if all capacitors are 10 μF. (2 marks)

Find V_O in the circuit shown below. Also calculate the power dissipated in the 5 Ω resistor.

Find equivalent resistance R_{ab} in the circuit.