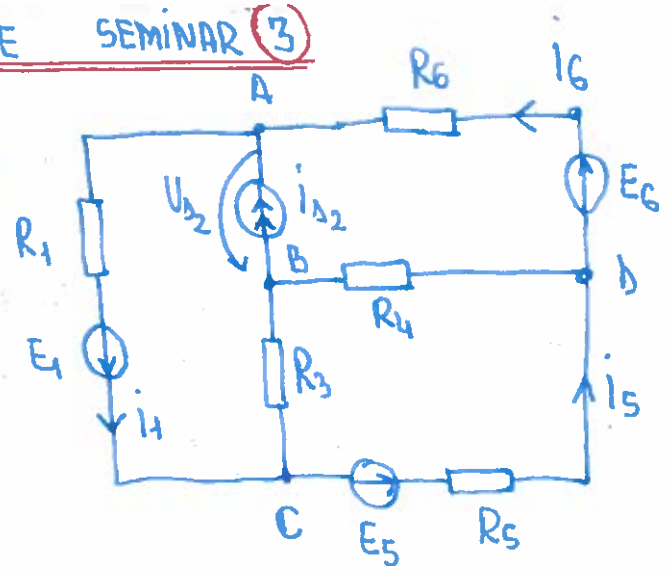
BE SEMINAR 3

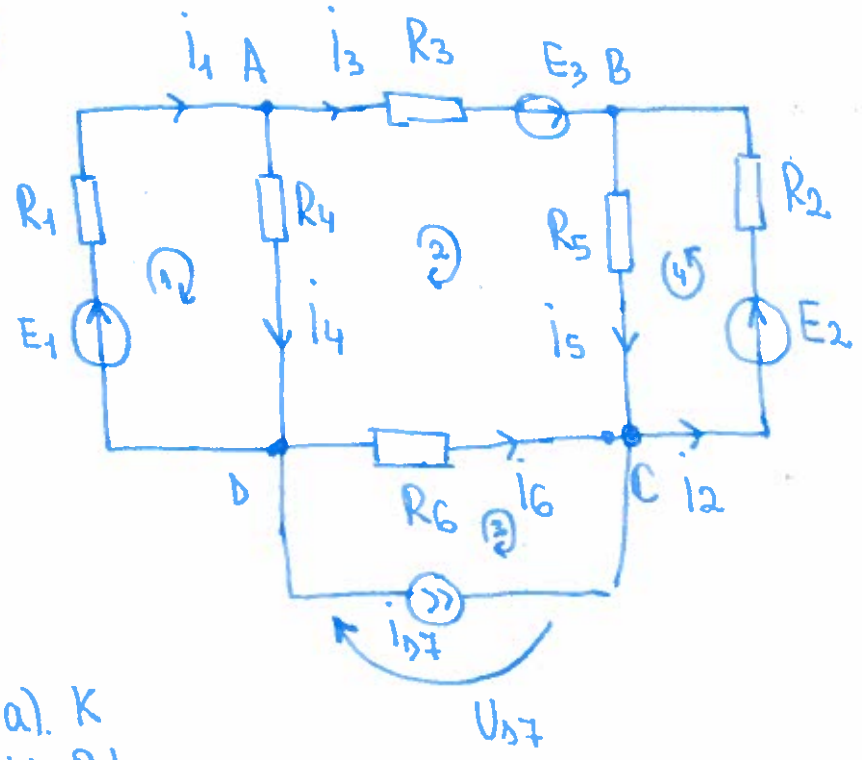
18.10.2016

1.



R(Ω)	i(A)	E(V)
$R_1 = 5$		$E_1 = 8$
	$i_{J2} = 1$	
$R_3 = 4$		
$R_4 = 4$		
$R_5 = 3$		$E_5 = 24$
$R_6 = 5$		$E_6 = 5$

②



$R(\Omega)$	$I(A)$	$E(V)$
$R_1 = 4$	$i_1 = 5/4$	$E_1 = 8$
$R_2 = 3$	$i_2 = 0$	$E_2 = 6$
$R_3 = 3$	$i_3 = 1$	$E_3 = 18$
$R_4 = 12$	$i_4 = 1/4$	
$R_5 = 6$	$i_5 = 1$	
$R_6 = 4$	$i_6 = 3$	
	$i_{57} = 2$	$U_{57} = 12$

a). K

b). P.b.

c). AB, BC, CD, AC, BD

N: 4 => 3 eq K_1

B-N+1 = 7-4+1 = 4 loops => 4 eq K_2

$$\begin{cases} ①: & i_1R_1 + i_4R_4 = E_1 \\ ②: & -i_6R_6 - i_4R_4 + i_3R_3 + i_5R_5 = E_3 \\ ③: & i_6R_6 + U_{57} = 0 \\ ④: & i_2R_2 + i_5R_5 = E_2 \\ Ⓐ: & i_1 = i_3 + i_4 \\ Ⓑ: & i_5 = i_2 + i_3 \\ Ⓓ: & i_4 = i_1 + i_6 + i_{57} \Rightarrow i_6 = i_4 - i_1 - i_{57} = -i_3 - 2 \end{cases}$$

$$\begin{cases} (i_3+i_4)\cdot 4 + i_4 \cdot 12 = 8 \\ -4(-i_3-2) - 12i_4 + 3i_3 + 6(i_5+i_2) = 18 \\ +4(-i_3-2) + U_{57} = 0 \\ 3i_2 + 6(i_2+i_3) = 6 \end{cases} \Leftrightarrow \begin{cases} 4i_3 + 16i_4 = 8 \quad \cdot +6i_2 \\ 7i_3 - 12i_4 + 6i_5 = 10 \\ -4i_3 + U_{57} = 8 \\ 9i_2 + 6i_3 = 6 \end{cases}$$

$$\begin{cases} I_3 + 4I_4 = 2 \\ 9I_3 + 13I_3 - 2I_4 = 10 \\ -4I_3 + U_{17} = 8 \\ 3I_2 + 2I_3 = 2 \quad |\cdot 2 \end{cases} \Rightarrow \begin{cases} I_3 + 4I_4 = 2 \quad |\cdot 3 \\ 9I_3 - 12I_4 = 6 \quad |+ \\ -4I_3 + U_{17} = 8 \end{cases}$$

$$12I_3 = 12 \Rightarrow I_3 = 1A \Rightarrow U_{17} = 12V$$

$$I_4 = \frac{3}{12} = = \frac{1}{4} A$$

$$I_2 = 0 A$$

b). P. balance:

$P_{gen} = P_{received} \Leftrightarrow I_1E_1 + I_2E_2 + I_3E_3 + U_{17} \cdot I_{17} = 10 + 0 + 18 + 24 = 52$

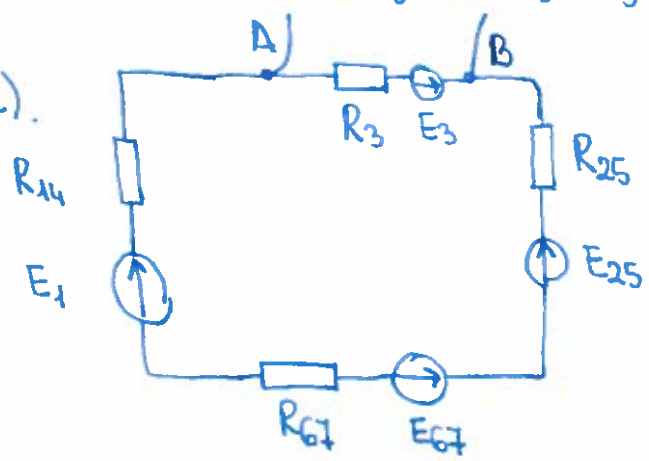
$$P_{rec} = I_1^2R_1 + R_3I_3^2 + R_4I_4^2 + R_5I_5^2 + R_6I_6^2$$

$$= \frac{25}{9} \cdot 4 + 1 \cdot 3 + \frac{1}{16} \cdot 12 + 6 \cdot 1 + 4 \cdot 9$$

$$= {}^{4)}\frac{100}{9} + 3 + {}^{9)}\frac{3}{4} + 6 + 36 = 45 + \frac{427}{36} = 52 W$$

$$U_{AB_0} = R_3 \cdot I_3 - E_5$$

c).



$$R_{14} = \frac{R_1R_4}{R_1+R_4} = \frac{4 \cdot 12}{16} = 3\Omega$$

$$E_{14} = \frac{E_1R_4}{R_1+R_4} = \frac{8 \cdot 12}{16} = 6V$$

$$R_{67} = R_6 = 4\Omega \qquad E_{25} = \frac{E_2 \cdot R_5}{R_2+R_5} = 4V$$

$$E_{67} = R_6 \cdot I_{17} = 8V$$

$$R_{25} = \frac{R_2R_5}{R_2+R_5} = \frac{18}{9} = 2\Omega$$

$E_3 = E_{67} + E_{25} - E_{14} = 6V$

$R_3 = R_{14} + R_{67} + R_{25} = 3 + 4 + 2 = 9\,\Omega$

$$R_{eq} = \frac{R_3 \cdot R_3}{R_3 + R_3} = \frac{9 \cdot 3}{12} = \frac{9}{4}\,\Omega$$

$$E_{eq} = \frac{\frac{E_3}{R_3} + \frac{E_3}{R_3}}{\frac{1}{R_3} + \frac{1}{R_3}} = \frac{E_3 R_3 + E_3 R_3}{R_3 + R_3} = 15\,V$$

Homework: find out for the rest of the cases