

```

"Elektrijada 2012, oblast I, zadatak 1, maj 2012";
"Oznake: Konvertor impedanse N1 (U3,I3) + napona uz saglasni kraj, smer struje";
"s leva na desno, N2 (U3/m,mI3) + napona uz saglasni kraj, smer struje s leva na";
"desno, VNC ulazni napon U5/k + sa donje strane, izlaz napon U5 + sa gornje strane,";
"struja kroz strujni generator k*I3 smer prema gore, struja kroz vertikalni otpornik blizu";
"ulaza (U3-U5/k)/R smer odozgo prema dole, I1 ulazna struja, smer s leva na desno,";
"struja kroz vertikalni otpornik blizu izlaza k*I3-m*I3 smer odozgo prema dole,";
"struja kroz otpornike R i R/4 I1-I3-(U3-U5/k)/R smer s leva na desno";
EQU1 = U1 - (R*I1 + U3 -  $\frac{U5}{k}$ );
EQU2 = U2 - (R*(k*I3 - m*I3) +  $\frac{U3}{m}$ );
EQU3 = U1 - (R*(k*I3 - m*I3) + R*( $I1 - I3 - \frac{U3 - \frac{U5}{k}}{R}$ ) + R*I1);
EQU4 = U2 - ( $-\frac{1}{4} * R * (I1 - I3 - \frac{U3 - \frac{U5}{k}}{R}) + R*(k*I3 - m*I3)$ );
EQU5 = U5 - (R*k*I3 + R*(k*I3 - m*I3));
k =  $\frac{4}{5} * m$ ;
Rez11 = Flatten[Solve[EQU1 == 0, U5]];
Print["U5 = ", U5 = U5 /. Rez11]
Rez55 = Flatten[Solve[EQU5 == 0, I3]];
Print["I3 = ", I3 = I3 /. Rez55]
U5 =  $\frac{4}{5} m (I1 R - U1 + U3)$ 
I3 =  $\frac{4 (I1 R - U1 + U3)}{3 R}$ 
EQU2 = Expand[Apart[U2 - (R*(k*I3 - m*I3) +  $\frac{U3}{m}$ )]];
Print["EQU2 = ", EQU2 = U2 + Simplify[ $\frac{\text{Coefficient}[EQU2, I1]}{\text{Coefficient}[EQU2, U2]}$ ] * I1 +
Simplify[ $\frac{\text{Coefficient}[EQU2, U1]}{\text{Coefficient}[EQU2, U2]}$ ] * U1 + Together[Simplify[ $\frac{\text{Coefficient}[EQU2, U3]}{\text{Coefficient}[EQU2, U2]}$ ]] * U3]
EQU3 = Expand[Apart[U1 - (R*(k*I3 - m*I3) + R*( $I1 - I3 - \frac{U3 - \frac{U5}{k}}{R}$ ) + R*I1)]];
Print["EQU3 = ", EQU3 = U1 + Simplify[ $\frac{\text{Coefficient}[EQU3, I1]}{\text{Coefficient}[EQU3, U1]}$ ] * I1 +
Simplify[ $\frac{\text{Coefficient}[EQU3, U3]}{\text{Coefficient}[EQU3, U1]}$ ] * U3]
EQU4 = Expand[Apart[U2 - ( $-\frac{1}{4} * R * (I1 - I3 - \frac{U3 - \frac{U5}{k}}{R}) + R*(k*I3 - m*I3)$ )]];
Print["EQU4 = ", EQU4 = U2 + Simplify[ $\frac{\text{Coefficient}[EQU4, I1]}{\text{Coefficient}[EQU4, U2]}$ ] * I1 +
Simplify[ $\frac{\text{Coefficient}[EQU4, U1]}{\text{Coefficient}[EQU4, U2]}$ ] * U1 + Simplify[ $\frac{\text{Coefficient}[EQU4, U3]}{\text{Coefficient}[EQU4, U2]}$ ] * U3]
EQU2 =  $\frac{4 I1 m R}{15} - \frac{4 m U1}{15} + U2 + \frac{(-15 + 4 m^2) U3}{15 m}$ 
EQU3 =  $\frac{I1 (25 - 4 m) R}{-10 + 4 m} + U1 - \frac{2 (5 + m) U3}{-5 + 2 m}$ 
EQU4 =  $\frac{1}{30} I1 (5 + 8 m) R + \frac{1}{60} (5 - 16 m) U1 + U2 + \frac{1}{15} (-5 + 4 m) U3$ 
Rez33 = Flatten[Solve[EQU3 == 0, I1]];
Print["I1 = ", Expand[I1 = I1 /. Rez33]]

```

```

I1 = -  $\frac{10 U1}{(-25 + 4 m) R}$  +  $\frac{4 m U1}{(-25 + 4 m) R}$  -  $\frac{20 U3}{(-25 + 4 m) R}$  -  $\frac{4 m U3}{(-25 + 4 m) R}$ 
EQU2 = Expand[EQU2];
Print["EQU2 = ", EQU2 = U2 + Together[Simplify[ $\frac{\text{Coefficient}[EQU2, U1]}{\text{Coefficient}[EQU2, U2]}$ ]] * U1 +
    Together[Simplify[ $\frac{\text{Coefficient}[EQU2, U3]}{\text{Coefficient}[EQU2, U2]}$ ]] * U3]
EQU4 = Expand[Apart[EQU4]];
Print["EQU4 = ", EQU4 = U2 + Simplify[ $\frac{\text{Coefficient}[EQU4, U1]}{\text{Coefficient}[EQU4, U2]}$ ] * U1 +
    Together[Simplify[ $\frac{\text{Coefficient}[EQU4, U3]}{\text{Coefficient}[EQU4, U2]}$ ]] * U3]
EQU2 =  $\frac{4 m U1}{-25 + 4 m}$  + U2 +  $\frac{(25 - 4 m - 12 m^2) U3}{m (-25 + 4 m)}$ 
EQU4 =  $\frac{5 (-3 + 4 m) U1}{4 (-25 + 4 m)}$  + U2 +  $\frac{(5 - 14 m) U3}{-25 + 4 m}$ 
Rez44 = Flatten[Solve[EQU4 == 0, U3]];
Print["U3 = ", Expand[U3 = U3 /. Rez44]]
U3 = -  $\frac{15 U1}{4 (-5 + 14 m)}$  +  $\frac{5 m U1}{-5 + 14 m}$  -  $\frac{25 U2}{-5 + 14 m}$  +  $\frac{4 m U2}{-5 + 14 m}$ 
EQU2 = Expand[Apart[EQU2]];
Print["EQU2 = ", EQU2 = U2 + Simplify[ $\frac{\text{Coefficient}[EQU2, U1]}{\text{Coefficient}[EQU2, U2]}$ ] * U1]
EQU2 =  $\frac{(15 - 20 m - 4 m^2) U1}{100 - 36 m + 8 m^2}$  + U2
Print["U2 = ", U2 =  $\frac{4 m^2 + 20 m - 15}{8 m^2 - 36 m + 100}$  * U1, " [V]."]
Print["U2 = ", U2 /. {U1 -> 2.4, m -> 5}, " [V]."]
U2 =  $\frac{(-15 + 20 m + 4 m^2) U1}{100 - 36 m + 8 m^2}$  [V].
U2 = 3.7 [V].
Print["U3 = ", U3 = U3 /. {U1 -> 2.4, m -> 5}, " V."]
Print["I1 = ", I1 = I1 /. {U1 -> 2.4, m -> 5}, " A."]
Print["U5 = ", U5 = U5 /. {U1 -> 2.4, m -> 5}, " V."]
Print["I3 = ", I3 = I3 /. {U1 -> 2.4, m -> 5}, " A."]
U3 = 0.5 V.
I1 = -  $\frac{0.8}{R}$  A.
U5 = -10.8 V.
I3 = -  $\frac{3.6}{R}$  A.

```