University of Kasdi Merbah Ouargla
Faculty of New Technologies for the Information and Communication
Department of Electronics and Communications

Module: *Fundamental Electrical Engineering 1*

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Exam (1h :30 min)

اللقب: .....

الاسم: .....

الشعبة: ..... الفوج: .....

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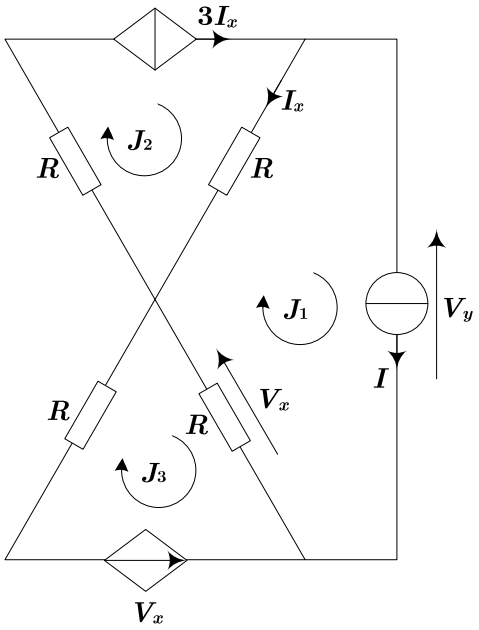
Exercise 1 (6 pts)

Using the mesh analysis, find J_1, J_2 and J_3.

Deduce the voltage V_y.

$I = 12$ A, $R = 10\ \Omega$.



Solution

Mesh (1): *0.75 pt*

……

Mesh (2): …… *0.75 pt*

Mesh (3): …… *0.75 pt*

I_x = …… *0.5 pt* V_x = …… *0.5 pt* V_y = …… *0.75 pt*

0.5 pt J_1=…… A

0.5 pt J_2=…… A

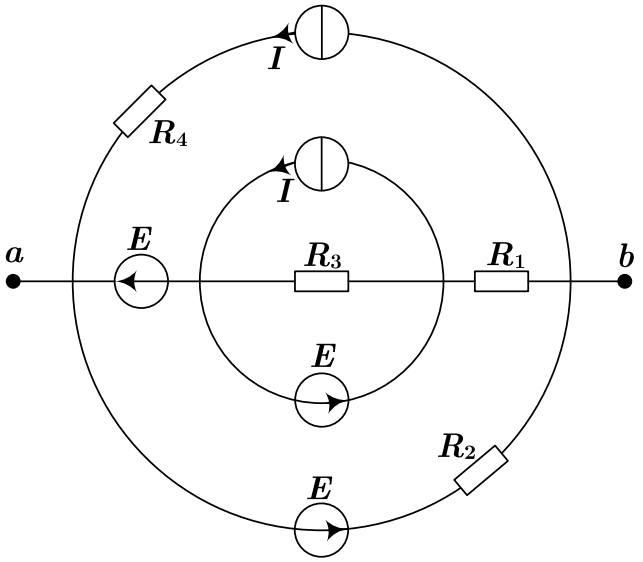
0.5 pt J_3=…… A

0.5 pt V_y=…… V

Exercise 2 (2 pts)

Find the Thevenin's resistor between ***a*** and ***b***.

R_1=10Ω, R_2=15, R_3=20Ω, R_4=15Ω.



Solution

R_{Th}=…… 1 pt

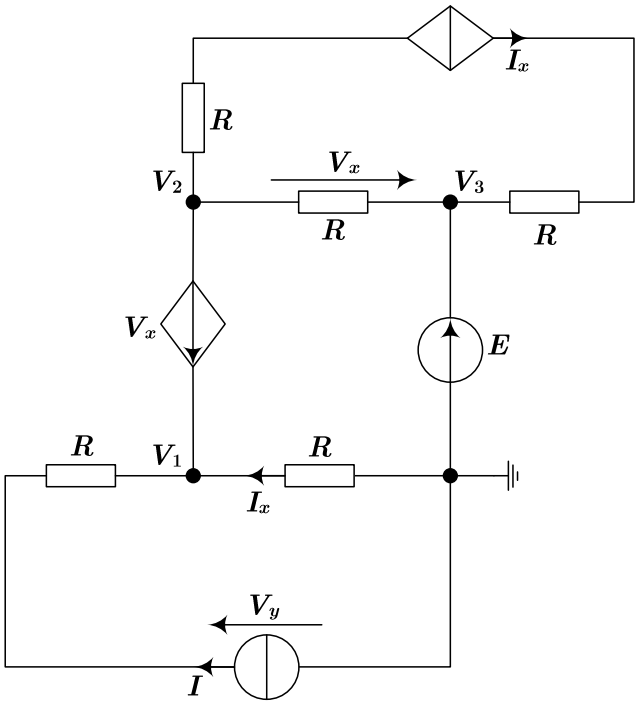
R_{Th}=…… Ω 1 pt

Exercise 3 (6 pts)

Using the nodal analysis, find V_1, V_2 and V_3.

Deduce the voltage V_y.

E =120V, I=10A, R=10Ω.



Solution

***Node* (1,2):** 0.75 pt

……

***Node* (1,2):** …… 0.75 pt

***Node* (3):** …… 0.75 pt

I_x = …… 0.5 pt V_x = …… 0.5 pt V_y = …… 0.75 pt

V_1=…… V 0.5 pt

V_2=…… V 0.5 pt

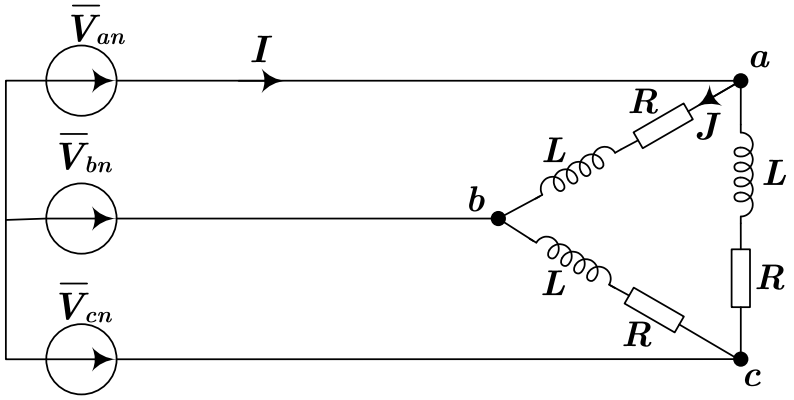
V_3=…… V 0.5 pt

V_y=…… V 0.5 pt

Exercise 3 (6 pts)

The three-phase balanced system 220/380V 50Hz in the figure below supplies a three inductive impedances $\overline{Z} = 50\angle 45^{\circ}\Omega$ contains R=?, L=100 mH.

1- What is the type of connection?
2- What the voltage across each impedance.
3- Calculate the value of the resistance R.
4- Calculate the phase current $\boldsymbol{J}$, the line current $\boldsymbol{I}$, and the power factor.
5- Calculate the active power $\boldsymbol{P}$, reactive $\mathbf{Q}$, and apparent power $\boldsymbol{S}$.
6- Calculate the capacitor coupled in delta that raises the power factor to $\boldsymbol{1}$.
7- In the phasor diagram showing below, represent the vectors : $\boldsymbol{U_{ab}}$, $\boldsymbol{U_{bc}}$, $\boldsymbol{U_{ca}}$, $\boldsymbol{J_{ab}}$, $\boldsymbol{J_{bc}}$, $\boldsymbol{J_{ca}}$.



Solution

1- The type of connection is : ..... *0.25 pt*

2- The voltage across each impedance is ..... V *0.25 pt*

3- Calculation of resistance $\boldsymbol{R}$:

R = ..., $\boxed{R = \text{.....}\Omega}$,

0.25 pt *0.25 pt*

4- Calculation of the phase current $\boldsymbol{J}$, line current $\boldsymbol{I}$, and the power factor $\boldsymbol{PF}$.

J = ..., $\boxed{J = \text{.....}A}$, I = ..., $\boxed{I = \text{.....}A}$, PF = ..., $\boxed{PF = \text{.....}}$

0.25 pt *0.25 pt* *0.25 pt* *0.25 pt* *0.25 pt* *0.25 pt*

5- Powers calculation

- P = ..., P = ...W (0.25 pt) (0.25 pt)
- Q = ..., Q = ...Var (0.25 pt) (0.25 pt)
- S = ..., S = ...VA (0.25 pt) (0.25 pt)

6- Capacitor calculation

- C = ..., C = ...F (0.25 pt) (0.25 pt)

7- Phasor diagram, Representation of the vectors: $\boldsymbol{U_{ab}}$, $\boldsymbol{U_{bc}}$, $\boldsymbol{U_{ca}}$, $\boldsymbol{J_{ab}}$, $\boldsymbol{J_{bc}}$, $\boldsymbol{J_{ca}}$