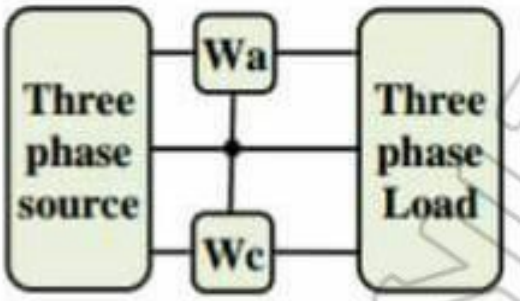
Switch **off** your mobile. **No** advanced calculators, Tablets or mobile phones are allowed.
Hand over your exam sheets with your scratch paper.
Show **work** and **write** the **final** answer & **units** inside the **box**, to **get credit** on problems.
Answer **all** problems directly on the exam sheet **only**.
Feel free to use the blank space on the exam sheets for scratch work.
Please keep ☺, 👍 & 👂 . **Don't** 👁, 🗣, ?, 🎧 & ☹. Take your ⏳ & enjoy yourself.

Q1-(16Pts) **Solve** each part separately. **(ABET outcome (a) Assessment)**

- The readings of the shown wattmeters are:
- **Wa = 1500 W.**
- **Wc = 2200 W.** - **Determine** the:
  - **Total** active power.
  - **Total** reactive power.
  - Power **F**actor.
  - **Type** of the load, Resistive, Inductive or Capacitive.



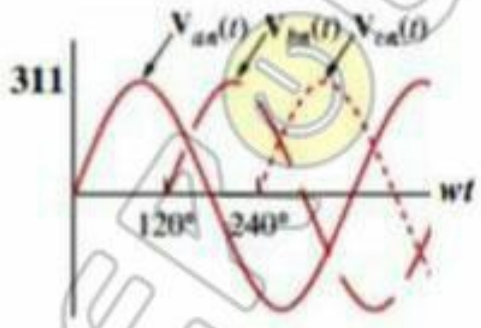
$P_T =$

$Q_T =$

$P.F =$

$Type =$

- The shown signals for a three-phase system **Y-Y** connection.
$i_a(t) = 7.071\ sin(314t - 60°)$ A.
a- Write time-varying $v_{an}(t)$.
b- Write time-varying $v_{ab}(t)$.
Then **Determine** the:
c- Total instantaneous power $p(t)$.
d- Total average power P.
e- Total pulsating (time varying) power $p_{puls}(t)$.



$v_{an}(t) =$

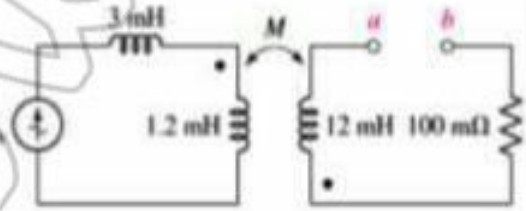
$v_{ab}(t) =$

$p(t) =$

$P =$

$P_{puls}(t) =$

- In the circuit, $k = 0.75$, *if* $i_s(t) = 10\ cos(200t)$ A.
Determine the:
a- Mutual Inductance M.
b- V_{ab} voltage $v_{ab}(t)$.
c- Max. stored energy W.

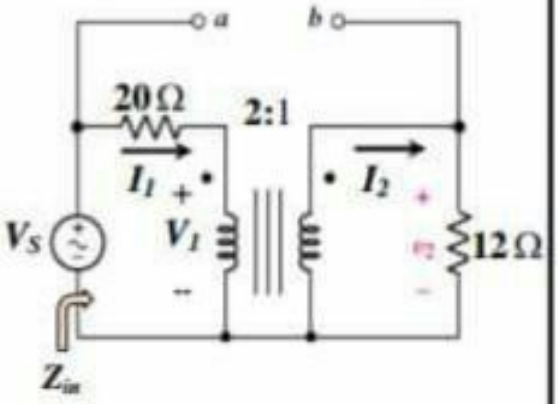


$M =$

$v_{ab}(t) =$

$W =$

- In the circuit, $V_s = 220$ Vrms.
Find the:
Input impedance seen by the source Z_{in}, I_1, V_1, I_2, V_2, V_{ab}, and the total dissipated power P_T.



$Z_{in} =$

$I_1 =$

$V_1 =$

$I_2 =$

$V_2 =$

$V_{ab} =$

$P_T =$

Q2-(8Pts) **I-** In the circuit shown, consider a balanced 3-phase system, given voltage in **rms**, $Z_1=Z_2=Z_3=R$.

Determine the:

a- R.

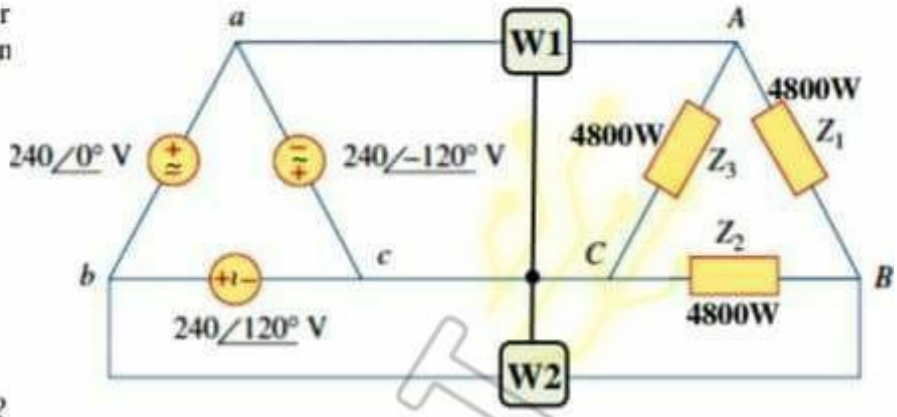
b- I_{AB}, I_{BC}, and I_{CA}.

c- I_{aA}, I_{bB}, I_{cC}.

d- Wattmeter reading of: **W1**, **W2**.

e- The **PF** can be corrected, if yes what is the type of element.

f- **Is** the reading of (**W1** + **W2**) **equals** to the **total** power? **Why**?



R =

I_{AB} =

I_{BC} =

I_{CA} =

I_{aA} =

I_{bB} =

I_{cC} =

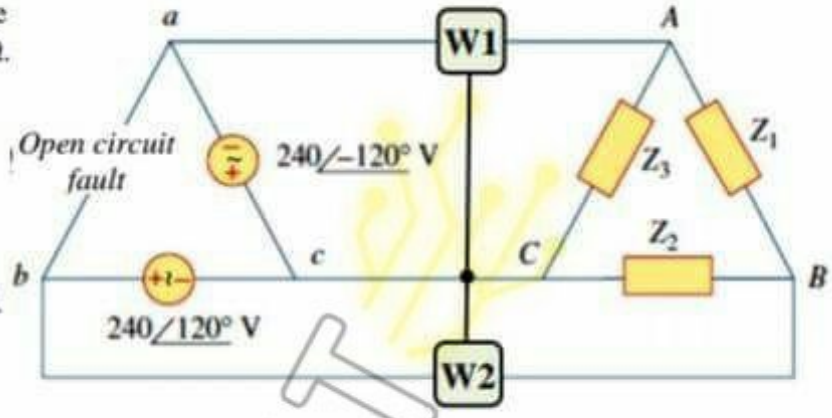
W1=

W2=

Type:

f-

Q2-(8Pts) **II-** In the circuit shown, the voltage in **rms**, assume $Z_1=Z_2=Z_3=R=12\Omega$.
Consider an ***open circuit fault*** at source ***ab*** (V_{ab} opened).
Determine the:
a- I_{AB}, I_{BC}, and I_{CA}.
b- I_{aA}, I_{bB}, and I_{cC}.
c- Wattmeter reading of: **W1**, **W2**.
d- System is balanced or Unbalanced.
e- What is the advantage of the DELTA connection source?



I_{AB} =

I_{BC} =

I_{CA} =

I_{aA} =

I_{bB} =

I_{cC} =

W1=

W2=

d-

e-

Q3-(12Pts) In the shown circuit, **Vs = 100** Vrms.

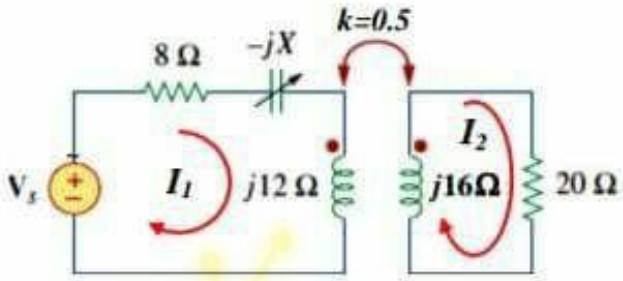
a- Find the mutual impedance ($j\omega M$).

b- Write the mesh current equations in **matrix** form.

c- Draw and **label** the **T** equivalent circuit **only** for the coupled coils.

d- Find the value of X that will give maximum power transfer to the **20** Ω load.

e- Find I_1 and I_2.



a-

$j\omega M =$

b-

c-

d-

$X =$

e-

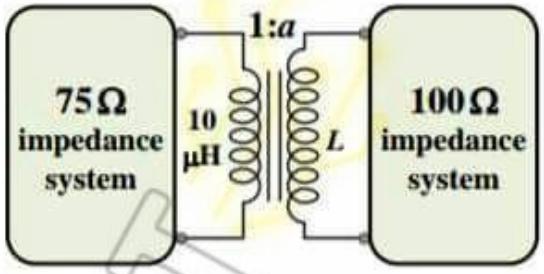
$I_1 =$

$I_2 =$

1-(6Pts) **I-** A transformer is used to match the different impedance systems with each others, A computer/electrical/mechatronics engineer want to couple a coaxial cable with BNC socket to UTP cable with RJ-45 socket as shown in the figure, the used transformer is an **ideal**, **determine** the:

a- Required turns ratio (a) for maximum energy power transfer.

b- Inductance L value in **100**-ohm side.



a-

$a =$

b-

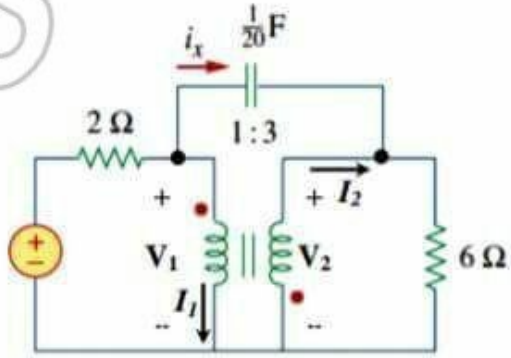
$L =$

1-(10Pts) **II-** In the shown circuit, the transformer is an **ideal**, $v_s(t) = 10\cos(2t)$ V. **determine** the following:

a- Primary voltage and current V_1, I_1.

b- Secondary voltage and current V_2, I_2.

c- Feedback current i_x.



a-

$V_1 =$

$I_1 =$

b-

$V_2 =$

$I_2 =$

c-

$i_x =$