Fundamental of E.E. Final exam, 2019

Fundamental of Electrical Engineering (Final Examination)

Part I

1. Define the following terms: **(05pts)**

   i. Resonance

   ii. Power factor correction

   iii. Angular velocity

   iv. Phase difference

   v. Peak to peak value

Part II

1. For the circuit shown in Fig.1, find **(06pts)**

   i. $i(0^+)$ and $v(0^+)$

   ii. $di(0^+)/dt$ and $dv(0^+)/dt$

   iii. $i(\infty)$ and $v(\infty)$

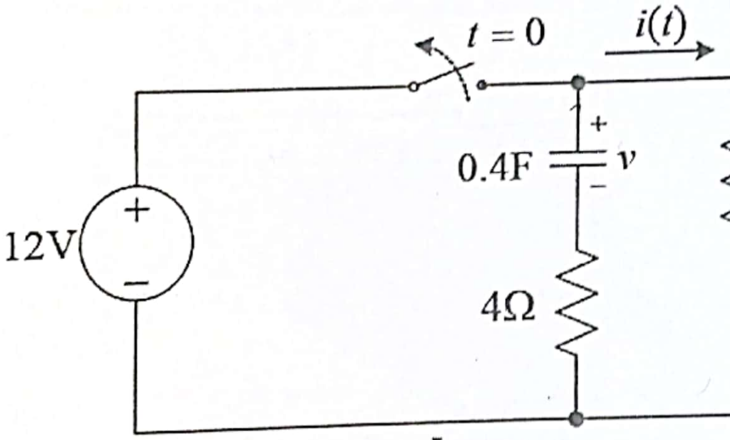


Fig.1.

2. An alternating current 'i' is given by; $i(t) = 141{\cdot}4 \sin(314\,t)$. Find **(05pts)**

   i. the maximum value

   ii. frequency

   iii. time period

   iv. the instantaneous value when t is 3ms.

   v. Phase angle with respect to i(t)

Fundamental of Electrical Engineering (Final Examination)

3. A 5Ω resistor,60mH inductor and 10μF capacitor are connected in parallel to a 300V, 50Hz AC supply. Calculate **(8pts)**
   - i. the current flowing,
   - ii. the phase difference between the supply voltage and current,
   - iii. the voltage across the circuit elements,
   - iv. draw the phasor and admitance diagram.

4. An R-L-C series Ac circuit consists of resistance 1000Ω, Q-factor of the circuit **10** and the bandwidth of 1000Hz. If a voltage of 100V is applied across the combination. Find
   - i. the resonant frequency
   - ii. inductance of the circuit
   - iii. capacitance of the circuit
   - iv. the half power frequencies

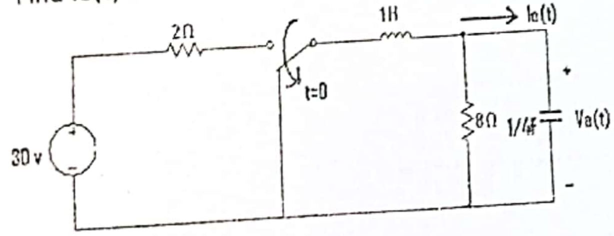
   (8pts)

5. A 4kVAR ,300-V (peak value), 50-Hz load has a power factor of 0.95 lagging. What value of capacitance have to be removed from the load, where the power factor falls to 0.8?

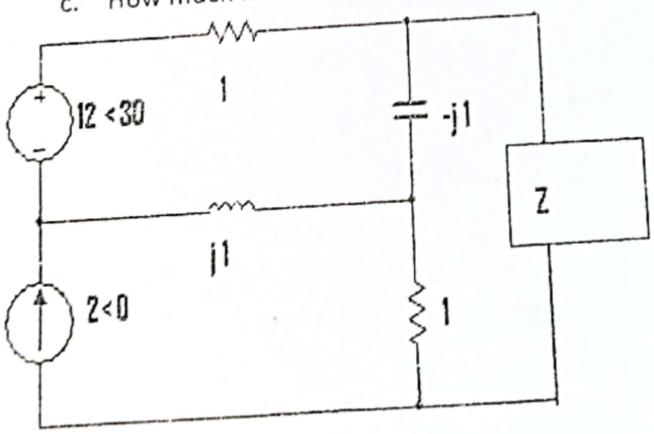
   (8pts)

****

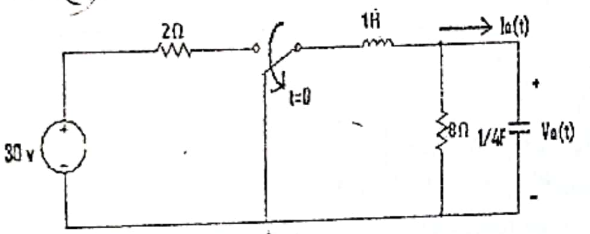
1. A 4Ω resistor, 125mH inductor and 10μF capacitor are connected in series to a 230V, 50Hz AC supply. Calculate
   a. The current flowing, **(2pts)**
   b. The phase difference between the supply voltage and current, **(2pts)** ....(3pts)
   c. The voltage across each circuit element,..(4pts)
   d. Draw the phasor and impedance diagram..
2. When connected to a 230 V (peak), 60-Hz power line, a load absorbs 10 kW at a lagging power factor of 0.8. Find the value of capacitance necessary to raise the pf to 0.9. **(6pt)**
3. A240-Vpeak 60Hz supply serves a load that is 20kw, 15Kvar(capacitive) and 20kVAR(inductive).find: ....(3pts)
   a. Apparent power ....(3pts)
   b. The current drawn from the supply..
   c. The kVAR rating and capacitance required to improve the power factor to ....(5pts)
   0.98 0.95lagging.. ....(7pts)
4. Find Io(t) and Vo(t) for t > 0..



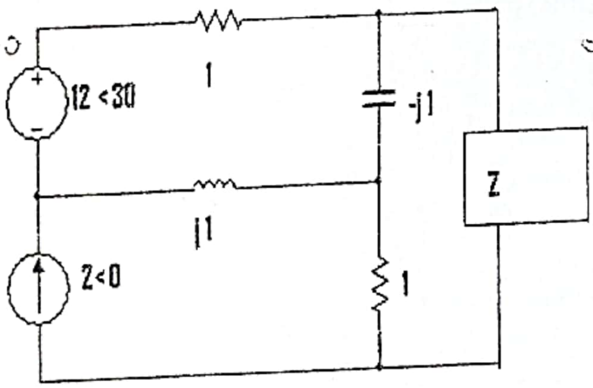
5.
   a. What must be the value of **Z** for maximum power transfer to it?...................(4pts)
   b. What is amount of the average power absorbed by the impedance?..............(4pts)
   c. How much is the maximum power?..(2pts)



1. A 4Ω resistor, 125mH inductor and 10μF capacitor are connected in series to a 230V, 50Hz AC supply. Calculate
   a. The current flowing, **(2pts)**
   b. The phase difference between the supply voltage and current, **(2pts)**
   c. The voltage across each circuit element,……………………………………**(3pts)**
   d. Draw the phasor and impedance diagram…………………………………**(4pts)**
2. When connected to a 230 V (peak), 60-Hz power line, a load absorbs 10 kW at a lagging power factor of 0.8. Find the value of capacitance necessary to raise the pf to 0.9. **(6pt)**
3. A240-Vpeak 60Hz supply serves a load that is 20kw, 15Kvar(capacitive) and 20kVAR(inductive).find:
   a. Apparent power ……………………………………………………………**(3pts)**
   b. The current drawn from the supply……………………………………………**(3pts)**
   c. The kVAR rating and capacitance required to improve the power factor to 0.9 lagging..______________________________**(5pts)**
4. Find Io(t) and Vo(t) for t > 0……………………………………………………**(7pts)**



5.
   a. What must be the value of Z for maximum power transfer to it?…………………**(4pts)**
   b. What is amount of the average power absorbed by the impedance?……………**(4pts)**
   c. How much is the maximum power?……………………………………………**(2pts)**



Fundamental of electrical engineering final exam (40%)

1. A certain load has voltage and current variation of a form given by: **(6 points)**

$$v(t) = 12\sin(50t + 30^\circ)\ V\ and$$

$$i(t) = 5\sin(50t - 45^\circ)A$$

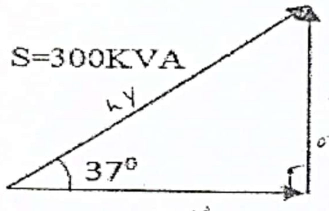
Find:

a. The phase relation between the current and voltage.

b. The instantaneous power at t=1sec.

c. The average power consumed by the load.

2. A 600V, 300KVA small electrical utility supplies a factory with the power triangle shown in the figure here under. **(6 points)**



Determine:

a. Total reactive power and real (true) power.

b. Total current.

3. Referring to figure 1 determine: **(12 points)**

a. Total impedance seen by the source (Z_T).

b. Total current supplied by the source (I_T).

c. The output voltage (Vo).

d. Draw the phasor diagram and impedance diagram.

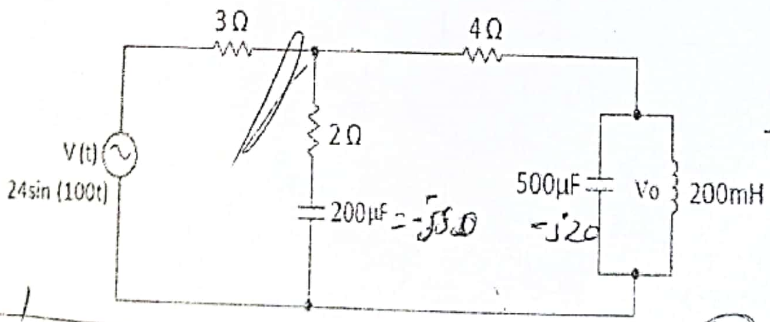


Fig 1

300

4. Referring to fig 2 Determine: **(6 points)**

a. The value of ZL to transfer maximum power to the load.
b. Maximum power transfer to the load under this condition.

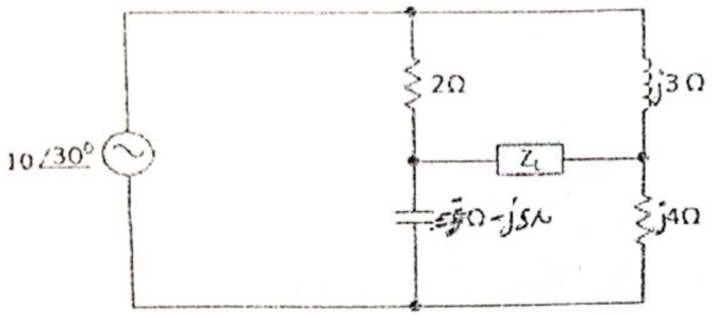


Fig. 2

5. Referring to figure 3 determine V_C (t) for t>0 and draw the response graph (use the appropriate method). **(10 points)**

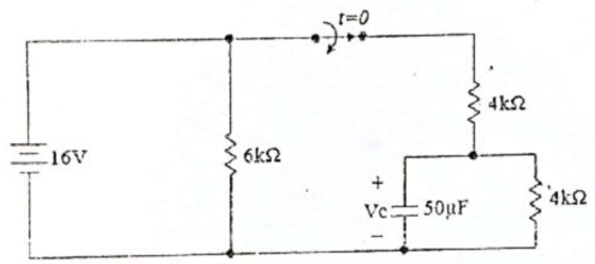


Fig.3

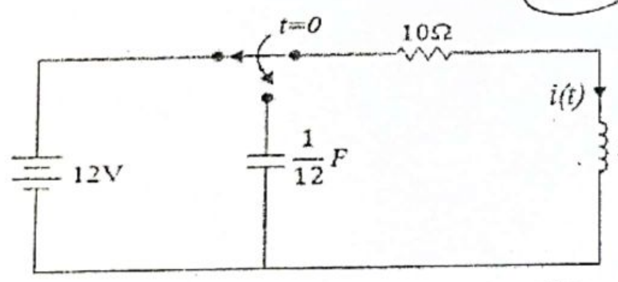
R_{Th} τ_C =

$R_{Th} = 2\ k\Omega$
$\tau_C = R_T C$
$2\times10^3 \times 50\times10^{-6}$
$= 0.1$

Bonus question

6. Referring to figure 4 find **i(t)** for t>0 **(5points)**

Step 6 from previous analysis
$k_1 = V_C(\infty)$
$k_2 = V_C(0^+) - k_1$
$= 8V$
$V_C(t) = 8e^{-t/0.1} = 8e^{-10t}$



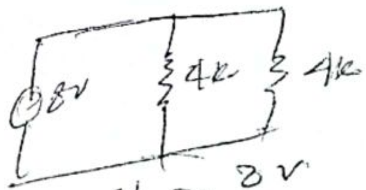
7

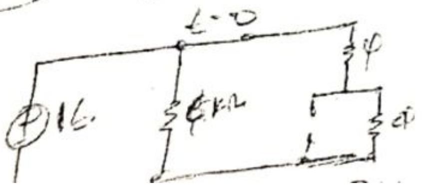
Fig 4

V(t) for t>0 step 3

step ① $V_C(t) = k_1 + k_2 e^{-t/\tau_C}$

step ② at steady state $t = 0^-$





$V_C(0^-) = V_C(0^+) = 8V$

step ④ $V_C(\infty) = 0$

5