Name: **Student ID:**

ELEC0431 — **Electromagnetic Energy Conversion**

Test on phasors in the sinusoidal steady state and three-phase systems

You have 30 minutes to complete this test.   March 2024
Read carefully each question and answer them directly on the questionnaire.
You may answer in English or in French.   Bon travail !

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1. A 50-Hz sinusoidal power generator delivers a current $\bar{I} = 15\angle -30°$ to a load composed of a resistor ($R = 4\ \Omega$) in series with an inductor ($L = 9.55$ mH). What are the voltages (amplitude and phase) across the resistor and the inductor? (./1)

   Answer:
   $\bar{V}_R = 60\angle -30°$
   $\bar{V}_L = 45\angle 60°$

2. The active power dissipated in a resistive-inductive load is 20 W. If the power factor $\cos\varphi$ is $\sqrt{2}/2$, what is the reactive power consumed by the load ? (./1)
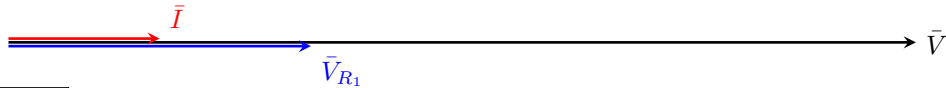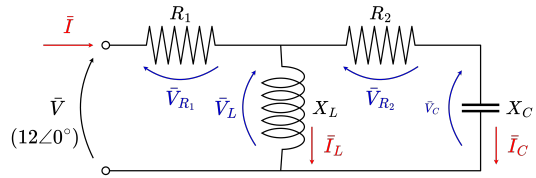
   Answer:
   $Q = 20$ var

3. Consider a load composed of a resistor in series with an inductor ($L = 4$ mH). This load is connected to a single-phase voltage generator of 10 V with a pulsation ω of 1000 rad/s. What are the possible values of the resistance R if the resistor dissipates an active power P equal to 10 W? (./2)
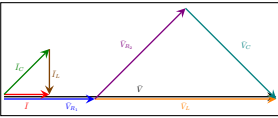
   Answer:
   $R = 2\ \Omega$ or $R = 8\ \Omega$

4. Consider the load showed on the right connected to a single-phase voltage generator of 12 V ($R_1 = R_2 = 2 \ \Omega$, $X_L = 4 \ \Omega$ and $X_C = 2 \ \Omega$).
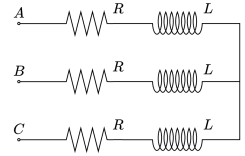
Complete the phasor diagram hereunder by adding $\bar{V}_L$, $\bar{I}_L$, $\bar{I}_C$, $\bar{V}_{R_2}$ and $\bar{V}_C$. (./2.5)
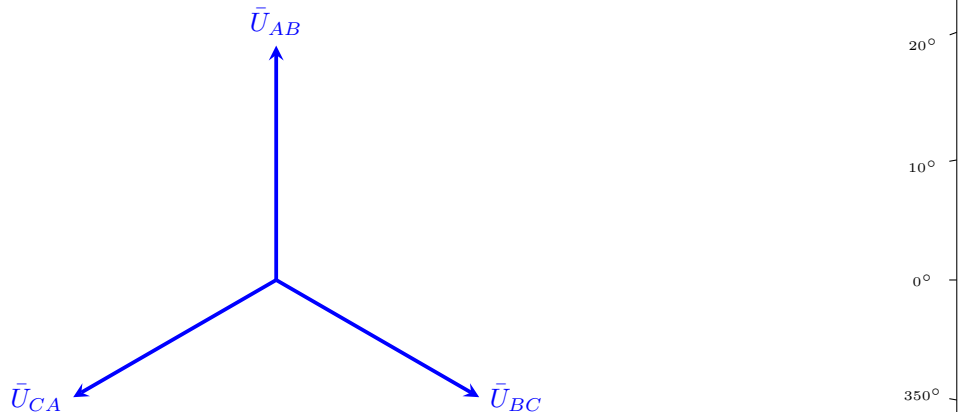

Answer:

5. The balanced three-phase load showed on the right is connected in A, B, C to a balanced three-phase power supply working at 50 Hz. The line current amplitude is 3.5 A, the line voltage amplitude is 3.1 V and the total three-phase active power is 14.4 W. What is the phase voltage amplitude V, the phase current amplitude J and the phase shift φ? (./1.5)

Answer:

$V = 1.79$ V
$J = 3.5$ A
$\varphi = 40°$

Complete the phasor diagram hereunder by adding the phase currents and the phase voltages. (./2)

Answer: