# Tutorial #02.

## EE 100

Q1. The current 'i' is represented in exponential form as $\mathring{i} = 20e^{-j2\pi/3}$. Write its equivalent in.

(i) Rectangular (complex) form $\mathring{i} = (-10 - j17.32)\ A$.

(ii) Trigonometric form $\mathring{i} = 20\left[\cos(-2\pi/3) - j\sin(2\pi/3)\right] A$

(iii) Polar form. $\mathring{i} = 20\angle -120^\circ\ A$

Q2. Find the sum of two currents $\mathring{i}_1 = 5\angle 30^\circ$ and $\mathring{i}_2 = 8\angle -30^\circ$. Express the sum into $\mathring{i} = \mathring{i}_1 + \mathring{i}_2 = 11.26 - j1.5 = 11.35\angle -7.6^\circ$.

(i) Rectangular form $i = 11.26 - j1.5$

(ii) Trigonometric form $i = 11.35\left[\cos 7.6 + j\sin 7.6\right]$

(iii) Exponential form. $i = 11.35\angle 7.6^\circ$.

Q3. A 60-Hz voltage of 115 V (rms) is connected to 100 Ω resistance

(i) Write the time equations for the voltage and the resulting current.

(ii) Show the voltage and current on a time diagram & phasor diagram.

(i) $v(t) = \sqrt{2}\cdot(115\,V)\sin\left[2\pi\cdot 60_{Hz}\, t\right] = 115\sqrt{2}\sin(377t)\,V$

$i(t) = v(t)/100\,\Omega$

Q4. A 60Hz voltage of 230V (rms) is connected to 0.265H inductor.

(i) Write the time equations for the voltage and current.

(ii) Show the voltage and current on a time & phasor diagram.

$v(t) = 230\sqrt{2}\sin(377t)\ V$

$i(t) = \frac{230\sqrt{2}}{\omega L}\cdot\sin(377t - \pi/2)\ A$

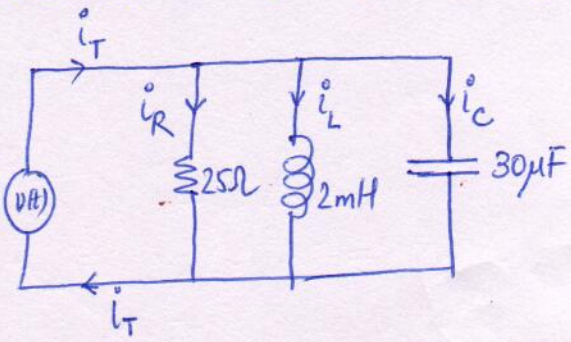
Q5. A 50Hz voltage of 230V (rms) is connected to a 26.5μF capacitor.

(i) Write the time equations for the voltage and the resultant current. $v(t) = 230\sqrt{2}\sin(314t)$

$i(t) = 2.71\sin(314t + \pi/2)$

(ii) Show the voltage and current on a time & phasor diagram.

Q6. The voltage applied across 3-branched circuit is given by $v(t) = 100\sin(5000t + \pi/4)$. Calculate the branch currents and the total current.




$i_R = \frac{v(t)}{R} = 4\sin(5000t + \pi/4)$

$i_L = \frac{1}{L}\int v\,dt = -10\cos(5000t + \pi/4)$

$i_C = C\frac{dv}{dt} = 15\cos(5000t + \pi/4)$

$i_T = i_R + i_L + i_C$

Q7. In an alternating circuit, the voltage is given by $V = (100 - j50)V$ and current is given by $I = (3 - j4)A$. Determine the real and reactive power in the circuit. $P = 500W$, $Q = 250VAR$

Q8. An inductive circuit draws 10A and 1kW from a 200V, 50Hz a.c. supply. Determine

(i) The impedance of the circuit in cartesian form $(a + jb)$; $Z = (10 + j17.32)\Omega$

(ii) The impedance in polar form $Z\angle\theta$; $Z = 20\angle 60°$

(iii) The power factor; pf = 0.5 lagging

(iv) The reactive power; $Q = 1732VAR$

(v) The apparent power. $S = 2000VA$

Q9. Two coils 'A' and 'B' are connected in series across a 240V, 50Hz ac supply. The resistance of coil 'A' is 5Ω and the inductance of coil 'B' is 15mH. If the ~~input~~ real and reactive power supply are 3kW and 2k VAR respectively, determine the inductance of coil 'A' and resistance of coil B. Also determine the voltage across each coil.

$L_A = 13.2mH$ (approx.) ; $R_B = 8.3\Omega$

$V_A = 97.5V$ ; $V_B = 143.5V$

Q10. Assume that the voltage applied to a load is $V = 208\angle -30^\circ V$ and the current flowing through the load is $I = 5\angle 15^\circ A$.

(i) Calculate the complex power S consumed by this load. $S = 1040\angle -45^\circ VA$ or $S = 735(1-j)\ VA$

(ii) Is this load inductive or capacitive? Capacitive (Since I is leading V)

(iii) Calculate the power factor of this load. $\frac{1}{\sqrt{2}}$

(iv) Calculate the reactive power consumed or supplied by this load. Does the load consume reactive power from the source or supply it to the source? $Q = -735.5\ VAR$ Supply to the source. (Since the load is capacitive)