Tutorial # 01

(Week: 29 Jan - 02 Feb, 2024)

Single Phase AC Power System

1. The ac voltage v is represented in the exponential form as $v = 220V\, e^{-j2\pi/3}$. Write down its equivalent (*i*) Rectangular (complex) form, (*ii*) Trigonometric form, (*iii*) Polar form.

2. Determine the sum of two ac voltages: $v_1 = 220V \angle 30^o$ and $v_2 = 220V \angle -30^o$. Express the resultant voltage in(*i*) Rectangular (complex) form, (*ii*) Trigonometric form, (*iii*) Polar form.

3. A single phase voltage supply 220V(rms), 50Hz is connected to the load impedance $Z = 10\Omega \angle 30^o$. (*i*) Write down time equations for both the voltage supply and the resulting current in the circuit. (*ii*) Represent the voltage and current in phasor diagram.

4. In a single phase ac circuit, the supply voltage is $V = 100 - j50\, V$ and the resulting current is $I = 3 - j4\, A$. Determine (*i*) Real Power, (*ii*) Reactive Power, (*iii*) Apparent Power and (*iv*) Power Factor.

5. An electrical load is connected to a supply voltage $v = 208V \angle -30^o$ and the current flowing through the load is $i = 5A \angle 15^o$.

   (i) Determine the impedance and the impedance angle.
   (ii) Calculate the power factor.
   (iii) What is the nature of the load? Inductive or Capacitive?
   (iv) Determine the real and reactive power.
   (v) Is the reactive power positive or negative?
   (vi) Does the load consume the reactive power or supply it to the source?
   (vii) Calculate the complex power consumed by the load.

Three Phase AC Power System

1. A 3-phase, Y-connected generators are supplying electrical power to a 3-phase, delta connected balanced load whose impedance per-phase is $8 + j6\ \Omega$. The line voltage of the supply is 230 V. Determine: ***(i)*** current in each phase of the load, ***(ii)*** power consumed by the load, ***(iii)*** power factor of the load and ***(iv)*** reactive power of the load.

2. A 220-V, 3-phase voltage is applied to a balanced delta-connected load of phase impedance $15 + j20\ \Omega$. ***(i)*** Find the phasor current in each line. ***(ii)*** What is the power consumed per phase? ***(iii)*** What is the phasor sum of the three line currents? Why does it have this value?

3. Three similar copper coils, each having a resistance of 20 Ω and an induction of 0.05 H, are connected in Y to a 3-phase, 50 Hz supply with 400-V between lines. Calculate the total power absorbed and the line current. Draw the phase diagram of voltage and current.

4. For a 208-V, 3-phase ideally balanced power system shown below, determine the following: **(*i*)** the magnitude of line current I_L, **(*ii*)** the magnitude of load's line and phase voltages, **(*iii*)** the real, reactive and apparent power consumed by the load, **(*iv*)** the power factor of the load.