PROBLEM SHEET 6

Parallel a.c. circuits

1. Two impedances are connected in parallel to the supply, the first takes a current of 40 A at a lagging phase angle of 30^0, and the second a current of 30 A at a leading phase angle of 45^0. Draw a phasor diagram to scale to represent the supply voltage and these currents. From this diagram, determine the total current taken from the supply and its phase angle.
2. For the frequency 100Hz, the reactances of a capacitor and an inductor are 15 Ω each. The resistance of a resistor is 150 Ω. The power supply produces 150V at 100Hz. Plot the phasor diagram and determine the impedance, the overall current and the phase angle for the circuit which consists of:
   a) The resistor and the capacitor connected in parallel to the power supply.
   b) The resistor and the inductor connected in parallel to the power supply.
   c) The resistor, the capacitor and the inductor connected in parallel to the power supply.
3. A circuit consists of a resistor $R = 2$ kΩ and a coil $L = 0.2$ H which are connected in series. Determine the impedance Z, reactance X, admittance Y, conductance G and susceptance B of the circuit
   a) at frequency $f = 500$ Hz;
   b) at angular frequency $\omega = 12570$ rad/sec
4. Three lamps are rated 110 V, 60 W. They are connected in parallel, and a capacitor is connected in series with the group. The circuit is then connected to a 230 V, 50 Hz power supply. Determine:
   a) The capacitance which is required to provide the correct voltage across the lamps.
   b) The active and reactive currents.
   c) The impedance, resistance and reactance of the circuit.
   d) The admittance, conductance and susceptance of the circuit.
   e) The power factor.
   f) The active power.
5. A circuit consists of a resistor $R_0 = 2$ kΩ and a capacitor $C = 40$ nF which are connected in parallel to a power supply of 100 V at frequency $f = 1000$ Hz. Determine:
   a) The reactance X_0 of the capacitor;
   b) The active and reactive currents;
   c) The conductance G, susceptance B and admittance Y of the circuit;
   d) The resistance R, reactance X and impedance Z of the circuit.
   e) The apparent power
   f) The active power

6. **ASSIGNMENT.** A single-phase circuit consists of three parallel branches, the currents in which are, respectively, in amperes: $i_1 = 20 \sin(314t)$, $i_2 = 30 \sin(314t-\pi/4)$, and $i_3 = 18 \sin(314t+\pi/2)$. The supply voltage is $u = 200 \sin(314t)$ volts.
   a) What is the frequency of the current?
   b) Using the graph paper and a scale of 1 cm per 5 A, plot a phasor diagram and determine the overall current taken from the supply (r.m.s. value) and it phase angle.
   c) Determine the active and reactive currents.
   d) Express the total current in the trigonometric form similar to that for the branch currents.
   e) Find the impedance, resistance and reactance of the circuit.
   f) Find the conductance, admittance and susceptance of the circuit.
7. A parallel circuit consists of two branches A and B. Branch A has a resistance of 10 Ω and an inductance of 0.1 H in series. Branch B has a resistance of 20 Ω and a capacitance of 100 μF in series. The circuit is connected to a supply of 230 V at 50 Hz. By means of plotting the phasor diagrams, determine the overall current taken from the supply and its phase.
8. A circuit consists of three blocks connected in series. The first block consists of a resistor of 31 Ω and a capacitance of 100 μF connected in parallel. The second block consists of a resistor of 50 Ω. The third block consists of a resistor of 20 Ω and an inductance of 0.11 H connected in parallel. The circuit is connected to a supply of 230 V at 50 Hz. By means of plotting the phasor diagrams, determine the overall current taken from the supply and its phase.
9. A circuit consists of a resistor $R = 2$ kΩ and a capacitor $C = 10$ nF which are connected in parallel. Determine the impedance Z, reactance X, admittance Y, conductance G and susceptance B of the circuit
   a) at frequency $f = 1000$ Hz;
   b) at angular frequency $\omega = 1.257*10^5$ rad/sec
10. A circuit consists of a resistor $R = 2$ kΩ and a coil $L = 0.2$ H which are connected in series. Determine the impedance Z, reactance X, admittance Y, conductance G and susceptance B of the circuit
    a) at frequency $f = 500$ Hz;
    b) at angular frequency $\omega = 25100$ rad/sec