Numerical Problems on Ch2: AC Fundamentals

1. At t=0, the instantaneous value of a 50Hz, sinusoidal current is 5 A and increases in magnitude further. Its R.M.S. value is 10 A.
   a) Write the expression for its instantaneous value.
   b) Find the current at t=0.01 and t=0.015 sec
   c) Sketch the waveform indicating these values

2. A coil takes a current of 2A when connected to a 240 V, 50 Hz sinusoidal supply and consumes 200 W. Calculate the resistance, impedance and inductance of the coil.

3. The equation of an alternating current is i =62.35 sin (323 t) A. Determine its
   i. Maximum value
   ii. Frequency
   iii. R.M.S. value
   iv. Average value, and
   v. Form factor

4. A circuit takes a current of 3 A at a power factor of 0.6 lagging when connected to a 115 V, 50 Hz supply. Another one circuit takes a current of 5 A at a power factor of 0.707 leading when connected to same supply after the first circuit is removed. If the two circuits are connected in series across a 230 V, 50 Hz supply, Calculate
   a) The current drawn from the source
   b) The power consumed
   c) The power factor of the circuit

5. A coil of resistance 30Ω and inductance 320mH is connected in parallel to circuit consisting of 75Ω is series with 150µF capacitor. The circuit is connected to a 200V, 50Hz supply. Determine supply current and circuit power factor.

6. A circuit consisting of series combination of elements as resistance of 6Ω, inductance of 0.4H and a variable capacitor is connected across a 100V, 50Hz supply. Calculate (i) value of capacitance at resonance, (ii) voltage drop across capacitor and (iii) Q-factor of coil.

7. A 20 Ω resistor, a choke coil having some inductance and some resistance and a capacitor are connected in series across a 25V variable frequency source. When the frequency is 400 Hz, the current is maximum and its value is 0.5 A and the potential difference across the capacitor is 150 V. Calculate the resistance and the inductance of the choke and the capacitance of the capacitor.

8. A coil of resistance 2 ohms and inductance 0.01H is connected in series with a capacitor across 200V mains. What must be the capacitance for maximum current at 25Hz? Find also the current and voltage in the capacitor.

9. A resistance of 100 ohms is connected with an inductance of 1.2 Henry and capacitance of 10 microfarad in series. The combination is connected across 100 volts and 50 Hz supply. Find...
   a. Current in the resistance
   b. Voltage across the capacitor
   c. Power consumed
   d. Draw the phasor diagram.

Answers:

1. **(a) i = 10√2sin(314t+0.361)   (b) -5 A, -13.2 A** 2.153 A
2. **R = 50 Ω, Z = 120 Ω, L = 0.347 H**
3. **(i) 62.35 A (ii) 51.4 Hz (iii) 44.1 A (iv) 39.7 A (v) 1.11**
4. **(a) 5.5 A (b) 1.1890 kW (c) 0.94 (lag)**
5. **3.24 A, 0.935 (lag)**
6. **(i) 25.33 µF (ii) 2094.4 V (iii) 20.9**
7. **r = 30 Ω, L = 0.119 H, C = 1.33 µF**
8. **C = 4.05 mF, Vc = 157 V**
9. **(a) I = 0.86 A, (b) Vc = 274 V, (c) P = 74.1 W**