

### Question 3

The following three impedances are connected in series across a 120 V, 60 kHz supply: (1) an  $8 \Omega$  resistance, (2) a coil of  $120 \mu\text{H}$  inductance and  $5 \Omega$  resistance and (3) a  $230 \text{ nF}$  capacitor in series with a  $15 \Omega$  resistor. Sketch the circuit diagram, impedance diagram and phasor diagram; take the supply voltage  $\underline{V}$  as the reference phasor.

- Calculate the magnitude of the supply current.
- Calculate the phase angle of the current with respect to the supply voltage.
- Calculate the magnitude of the voltage  $\underline{V}_1$  across the first impedance.
- Calculate the magnitude of the voltage  $\underline{V}_2$  across the second impedance.
- Calculate the magnitude of the voltage  $\underline{V}_3$  across the third impedance.

### Question 4

A circuit has resistance  $R = 10 \Omega$ , inductance  $L = 250 \text{ mH}$  and capacitance  $C = 3.8 \mu\text{F}$  connected in series across a sinusoidal voltage  $\underline{V}_s = 50 \text{ V}$ . Sketch the circuit diagram and phasor diagram.

- To what frequency in hertz should the supply be varied to achieve series resonance?
- To what frequency in rad/s should the supply be varied to achieve series resonance?
- Calculate the magnitude of the voltage  $\underline{V}_R$  across the resistor at resonance.
- Calculate the magnitude of the voltage  $\underline{V}_L$  across the inductor at resonance.
- Calculate the active power  $P$  dissipated by the resistor at resonance.

### Question 5

A  $47 \mu\text{F}$  capacitor  $C$  is connected in parallel with a  $680 \Omega$  resistor  $R$  across a 110 V, 60 Hz supply voltage  $\underline{V}$ . Sketch the circuit and phasor diagrams and determine:

- the magnitude of the circuit impedance.
- the phase angle  $\Phi$  of the supply current with respect to the supply voltage.
- the apparent power  $S$  supplied to the circuit.
- the reactive power  $Q$  supplied to the circuit.

### Question 6

Three impedances of  $(10 + j6) \Omega$ ,  $(5 - j20) \Omega$  and  $(15 + j5) \Omega$  are connected in parallel across a 220 V, 50 Hz supply voltage  $\underline{V}$ . Sketch the circuit diagram, as well as the phasor diagram and determine:

- the total current supplied by the source
- the power factor of the combined load
- the active power supplied by the source.