CHAPTER 7 POWER IN AC CIRCUITS

Exercises

7.1 If a sinusoidal voltage with a frequency of 50Hz is applied across a resistor, at what frequency does the instantaneous power supplied to the resistor vary?

7.2 A sinusoidal voltage $v = 10 \sin 377t$ is applied to a resistor of 50 Ω. Calculate the average power dissipated in it.

7.3 If a sinusoidal voltage with a frequency of 50Hz is applied across a capacitor, at what frequency does the instantaneous power supplied to the capacitor vary?

7.4 A sinusoidal voltage $v = 10 \sin 377t$ is applied across a capacitor of 1 μF. Calculate the average power dissipated in it.

7.5 If a sinusoidal voltage with a frequency of 50Hz is applied across an inductor, at what frequency does the instantaneous power supplied to the inductor vary?

7.6 A sinusoidal voltage $v = 10 \sin 377t$ is applied across an inductor of 1 mH. Calculate the average power dissipated in it.

7.7 Explain the meanings of the terms active power, apparent power and power factor.

7.8 The voltage across a component is 100 V r.m.s. and the current is 7 A r.m.s. If the current lags the voltage by 60°, calculate the apparent power, the power factor and the active power.

7.9 Explain the difference between the units of watts, VA and var.

7.10 A sinusoidal voltage of 100 V r.m.s. at 50 Hz is applied across a series combination of a 40 Ω resistor and an inductor of 100 mH. Determine the r.m.s. current, the apparent power, the power factor, the active power and the reactive power.

7.11 A machine operates on a 250 V supply at 60 Hz; it is rated at 500 VA and has a power factor of 0.8. Determine the apparent power, the active power, the reactive power and the current in the machine.

7.12 Explain what is meant by power factor correction and explain why this is of importance in high-power systems.

7.13 Calculate the value of capacitor required to be added in parallel with the machine of Exercise 7.11 to achieve a power factor of 1.0.

7.14 Calculate the value of capacitor required to be added in parallel with the machine of Exercise 7.11 to achieve a power factor of 0.9.

7.15 A sinusoidal signal of 20 V peak at 50 Hz is applied to a load consisting of a 10 Ω resistor and a 16 mH inductor connected in series. Calculate the power factor of this arrangement and the active power dissipated in the load.

7.16 Determine the value of capacitor needed to be added in series with the circuit of Exercise 7.11 to produce a power factor of 1.0. Calculate the active power that would be dissipated in the circuit with the addition of such a capacitor.

7.17 Explain the difference between three- and four-conductor arrangements of three-phase power supplies.

7.18 Explain why it is not possible to calculate the power dissipated in an AC network by multiplying the readings of a voltmeter and an ammeter.

7.19 Explain how it is possible to measure power directly in a single-phase system.