## Answers for Tutorial 5

The marks to be awarded for each question are indicated in square brackets.

Problem 1 [5]

I = 5 A, so Irms = 5/√2 = 3.54 A. [2]

Average power P = Irms2R = 52/2 × 10 = 125 W. [3]

Problem 2 [10]

E = 30 V.

f = 1 kHz, so  = 2f = 6.28 × 103 rad/sec

a) I = E/R = 30/50 = 0.6 A. [1]

P = Irms2R = (0.6/√2)2 × 50 = 9 W. [1]

b) For inductor, I = E/L = 30/(6.28 × 103 × 0.25) = 0.0191 A. [2]

No power dissipated in inductor. [2]

c) For capacitor, I = E/(1/C) = 30 × 6.28 × 103 × 1.5 × 10-6 = 0.283 A. [2]

No power dissipated in capacitor. [2]

Problem 3 [5]

a) The current leads the voltage, i.e. the current peaks before the voltage. [1]

b) As the current leads the voltage, the phase  in the expression i = I sin (t – ) is negative. As this phase is given by , the capacitive reactance 1/C is larger than the inductive reactance L: the circuit is predominantly capacitive. (Alternatively, i leads v, so from the mnemonic CiviL the circuit is capacitively dominated, the same conclusion is reached from the mnemonic ELi is positively the iCE man!) [2]

c) The phase is negative below the resonant frequency and positive above, so from the above, the frequency is below the resonant frequency. [2]

Problem 4 [15]

a) XC = 1/dC = 1/(2 × 106 1 × 10-9) = 500 . [2]

XL = dL = 2 × 106 × 10 × 10-6 = 20 . [2]

b) . [2]  
Phase is negative, so current leads voltage by 88.8o

c)  (contribution of resistance negligible). [2]

d) Sketch of shape of resonance.

(rad)

(A)

(rad sec-1)

[3]

The current i has a maximum value of I = E/R = 10/10 = 1 A, [2]  
at the resonant frequency . [2]

Maximum possible number of marks for this tutorial is 35.