**Chapter 33. Alternating Current Circuits**

St. ID: , Name:

1. The current in the circuit shown in Figure P32.3 equals 60.0% of the peak current at *t* = 7.00 ms. What is the lowest source frequency that gives this current.

Ans: f = 14.6 Hz

The current as a function of time is



Given the value of *t*, we want to identify a point with

 

Or = sin–1 0.600

To find the lowest frequency we choose the smallest angle satisfying this relation:



Thus,  so 

1. In the AC circuit shown in Figure P32.3, *R* = 70.0 V and the output voltage of the AC source is ∆*V*max sin *ωt.* (a) If ∆*VR* = 0.250 ∆*V*max for the first time at *t* = 0.010 0 s, what is the angular frequency of the source? (b) What is the next value of *t* for which ∆*VR* = 0.250 ∆*V*max?

Ans: (a) ω= 25.3 rad/s (b) t= 0.114 s

1. From Equation 32.5,  To find the angular frequency, we write



so 

or 

The smallest angle for which this is true is . Thus, if *t* = 0.010 0 s,



1. The second time when ,  again. For this occurrence,  (to understand why this is true, recall the identity  from trigonometry). Thus,



1. What is the maximum current in a 2.20-*m*F capacitor when it is connected across (a) a North American electrical outlet having ∆*V*rms = 120 V and *f* = 60.0 Hz and (b) a European electrical outlet having ∆*V*rms = 240 V and *f* = 50.0 Hz?

Ans: (a) Imax = 141mA (b) Imax = 235 mA

The maximum current in the capacitor is given by



1. For the North American electrical outlet,



(b) For the European electrical outlet,



1. An AC source with ∆*V*max = 150 V and *f* = 50.0 Hz is connected between points *a* and *d* in Figure P32.16. Calculate the maximum voltages between (a) points *a* and *b*, (b) points *b* and *c*, (c) points *c* and *d*, and (d) points *b* and *d.*

Ans: (a) 146V (b) 212V (c) 179V (d) 33.4V

We first determine the reactances of the circuit. The capacitive reactance is



 the inductive reactance is,

 

 and the impedance Z of the circuit is

 

 The current in the circuit is then

 



**ANS. FIG. P32.16**

 (a) The maximum voltage between points *a* and *b* is the potential drop across the resistor:

 

 (b) The maximum voltage between points *b* and *c* is the potential drop across the coil:

 

 (c) The maximum voltage between points *c* and *d* is the potential drop across the capacitor:

 

 (d) The potential drop between points *b* and *d* is

 