EEET-121 AC Circuits Lecture **Exam #1 (2185)**

FULL NAME (Printed): * SOLUTIONS *

RIT Program: _____

You have 50 minutes to complete this examination. You are allowed your calculator and the provided Formula Sheet from the text. If you brought a 3x5 card with additional formulas, please submit it with your exam.

- M/C Questions
  - Place the best alternative that answers the question in the blank space
  - NO partial credit will be awarded
- Work the Problem Questions
  - SHOW ALL your work in the space provided
  - BOX-IN your final answer
  - Partial credit may be awarded

$10V_{pk}\left(\frac{1}{\sqrt{2}}\right) = 7.07V_{RMS}$

1) What is the effective (or RMS) voltage for $v(t) = 10\sin(wt - 50°)$? 1) A

A) 7.07 V B) 20 V C) 14.14 V D) 10 V

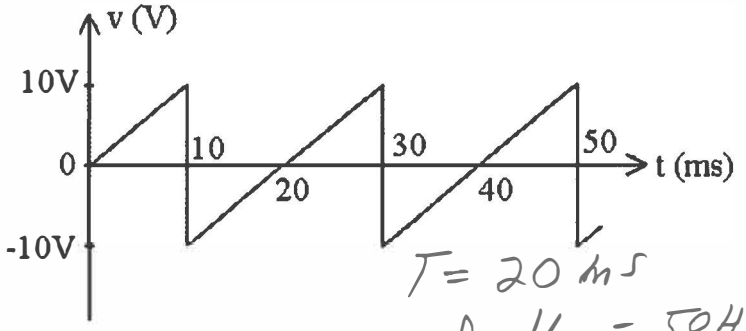


Figure 13.1

$T = 20\ ms$

$f = 1/T = 50Hz$

2) See Figure 13.1. What is the frequency of this waveform? 2) D

A) 33 Hz B) 100 Hz C) 20 Hz D) 50 Hz

3) See Figure 13.1. What is the average value of this waveform? 3) D

A) +5 V B) +10 V C) +7.07 V D) 0 V

4) See Figure 13.1. What is the period of this waveform? 4) D

A) 10 ms B) 50 ms C) 30 ms D) 20 ms

5) What is the frequency of $v(t) = 35\sin(5000t)$? $w = 5000\ r/s = 2\pi f$, $f = 795.8Hz$ 5) A

A) 796 Hz B) 35 r/s C) 15,700 r/s D) 5000 Hz

6) If $i(t) = 4\sin(wt + 50°)$ and $v(t) = 7\sin(wt - 30°)$, which one of these statements is TRUE? 6) C

$50° - (-30°) = 80°$

A) i lags v by 80°.
B) i lags v by 20°.
C) i leads v by 80°. ✓
D) i leads v by 20°.

7) Which one of the following phasor domain expressions is equivalent to the time domain expression $50 \sin(wt + 15°)$? PEAK $50V_{pk} \angle 15°$ or $35.4V_{RMS} \angle 15°$ 7) B

A) 70.7Vpk ∠-15° B) 50Vpk ∠15° C) 35VRMS ∠-15° D) 70.7VRMS ∠15°

8) Which one of the following polar values is equivalent to 30 + *j*40? 8) B

A) 70 ∠36.9° B) 50 ∠53.1° C) 70 ∠53.1° D) 50 ∠36.9°

9) Which one of the following rectangular values is equivalent to the polar form 20 ∠55°? 9) C

A) 16.38 - *j* 11.47 B) 16.38 + *j* 11.47 C) 11.47 + *j* 16.38 D) 11.17 - *j* 16.38

10) The voltage across a 100 mH coil is $v(t) = 100 \sin 50t$. Which of these expressions describes the current? $I_m = \frac{V_m}{X_L} = \frac{100V}{\omega L} = \frac{100V}{(50r/s)(0.1H)} = 20$ 10) A

A) 20 sin(50*t* - 90°)
B) 20 sin 50*t*
C) 2000 sin(50*t* - 90°)
D) 20 sin(50*t* + 90°)

∴ VOLTS LEADS CURRENT BY 90°

$\therefore i(t) = 20 \sin(50t - 90°)$

11) At what frequency does a 10 μF capacitor have a reactance of 100 Ω? $X_C = \frac{1}{2\pi fC}$ 11) B

A) 1.59 kHz B) 159 Hz C) 1.59 MHz D) 15.9 kHz

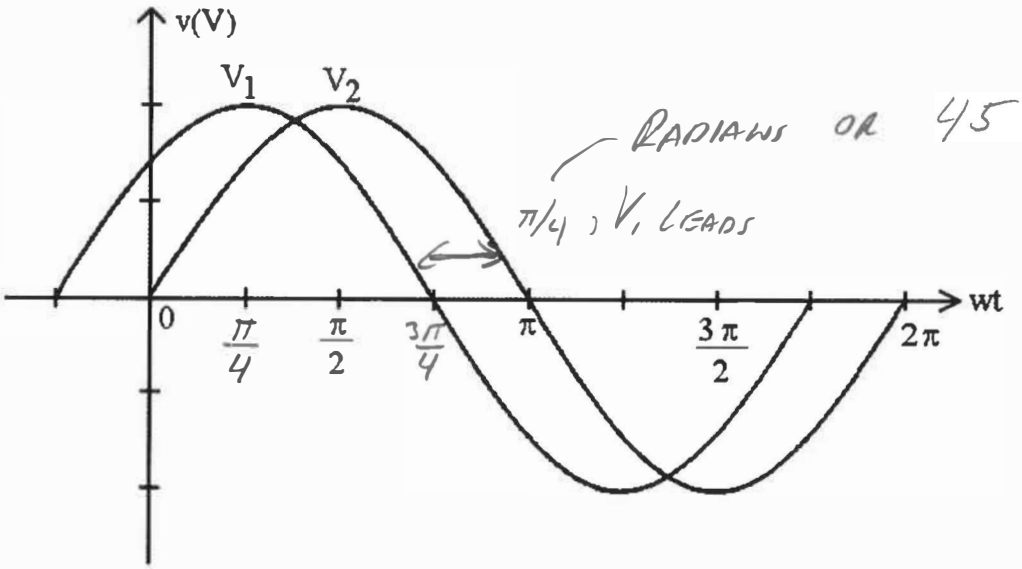
$f = \frac{1}{2\pi X_C C} = 159.2Hz$

12) What is the inductive reactance at 800 Hz of a 1 mH inductor ~~with an internal resistance of 20 Ω~~? 12) C

A) 0.2 Ω B) 12 Ω C) 5.0 Ω D) 20 Ω

$X_L = 2\pi fL = 2\pi(800Hz)(1mH)$

13) See Figure 14.2. What relationship exists between voltages v_1 and v_2? 13) D



RADIANS OR 45°

π/4 ; V1 LEADS

Figure 14.2

A) v_1 leads v_2 by (π/4)°. X B) v_1 lags v_2 by 45°.

C) v_1 lags v_2 by (π/4)°. D) v_1 leads v_2 by 45°. ✓

14) Which one of the following values is equivalent to $(5 - j\,3)(4 + j\,6)$? 14) C

A) $2 + j\,18$ B) $2 - j\,18$ C) $38 + j\,18$ D) $38 - j\,18$

15) What is the power factor in a system if $v(t) = 120 \sin(377t + 35°)$ and $i(t) = 60 \sin(377t - 35°)$? 15) D

A) 0.423 lagging B) 1.0 C) 0.906 leading D) 0.342 lagging

$F = \cos(\theta_V - \theta_I) = \cos(35° - (-35°)) = \cos(70°) = 0.324$ LAGGING (I LAGS V)

*** Show your work and box in your answers for the remaining questions. Partial credit may be awarded ***

16) See Figure 13.2. What is the average value of this waveform?

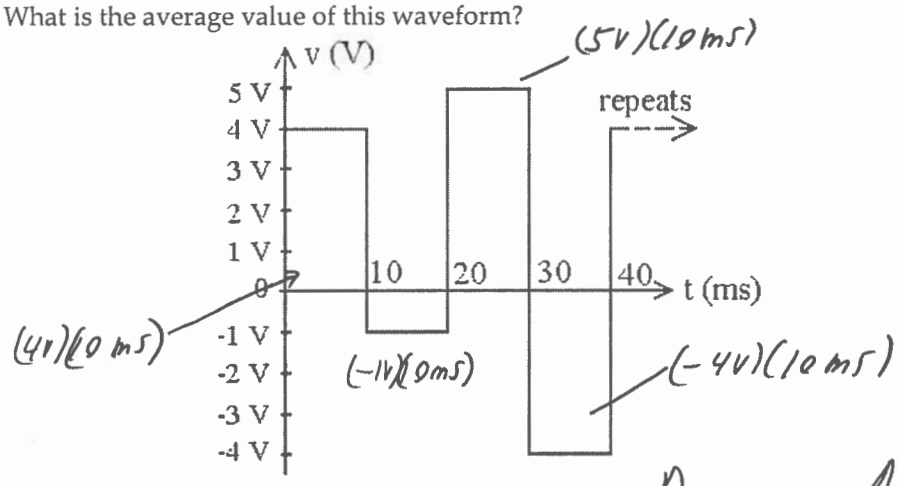


Figure 13.2

$$\text{AVE VALUE} = \frac{\text{AREA UNDER CURVE}}{\text{LENGTH UNDER CURVE}}$$

$$\text{AVE VALUE} = \frac{(40\,mS\cdot V) + (-10\,mS\cdot V) + (50\,mS\cdot V) + (-40\,mS\cdot V)}{40\,mS}$$

$$= \frac{40\,mS\cdot V}{40\,mS} = \boxed{1V}$$

17) Determine x in degrees if $(10 \angle x°)(4 \angle -50°) =$ [illegible] $(25.71 + j\,30.64)$ R→P CONV

$(10)(4) \angle (X + -50)° = 39.96 \angle 49.97°$

$\therefore X - 50° = 49.97°$

OR

$X = 99.97 \sim \boxed{100°}$

18) Express 100 sin(wt – 34°) V in phasor form:

$100 V_{pk} \angle -34°$ OR $70.71 V_{RMS} \angle -34°$

19) How much power is dissipated by a resistor if the current through it is $i(t) = 12 \sin(wt + 30°)$ and the voltage across it is $v(t) = 32 \sin(wt + 30°)$?

$$P = V_{RMS} I_{RMS} \cos(\theta) = \left(\frac{32V}{\sqrt{2}}\right)\left(\frac{12V}{\sqrt{2}}\right)\cos(0°)$$

$\cos(0°) = 1$

$192 W$

20) Find $v_a(t)$ in Figure 14.82 (below), given that $e_{in}(t) = 60 \sin(377t)$ and $v_b(t) = 20 \sin(377t - 45°)$:

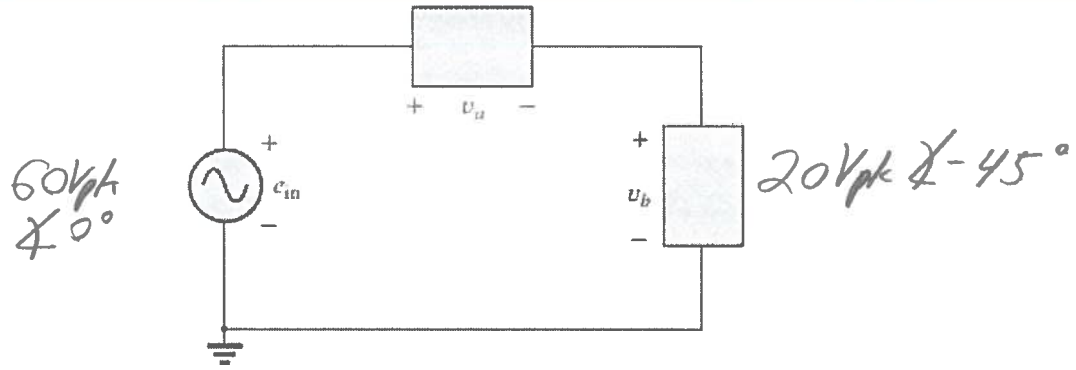


FIG. 14.82

$$\vec{E}_{IN} = \vec{V}_a + \vec{V}_b \text{ , KVL}$$

$$\therefore \vec{V}_a = \vec{E}_{IN} - \vec{V}_b$$

$$= 60 V_{pk} \angle 0° - 20 V_{pk} \angle -45°$$

$$\vec{V}_a = 47.99 V_{pk} \angle 17.14°$$

$$\therefore v_a(t) = 48 \sin(377t + 17.1°) \text{ V}$$