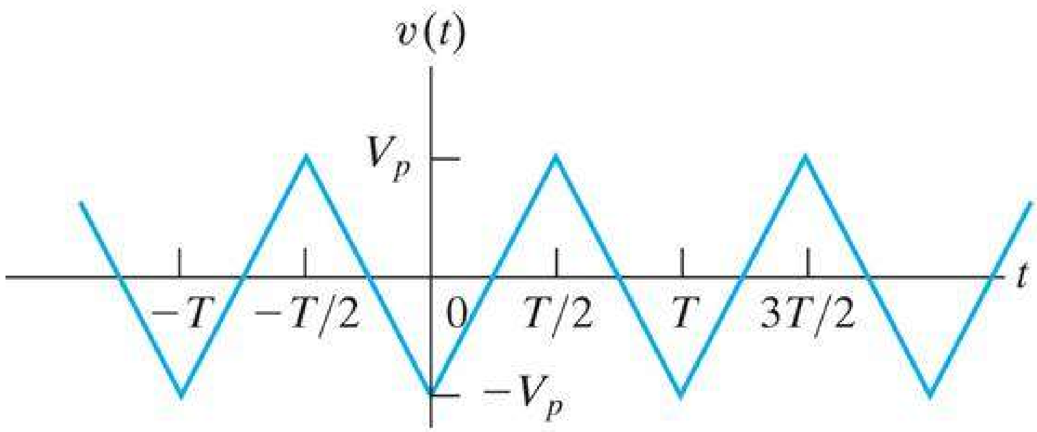
Started on	Sunday, 7 May 2017, 7:27 PM
State	Finished
Completed on	Sunday, 7 May 2017, 10:34 PM
Time taken	3 hours 6 mins
Grade	**100.00** out of 100.00

Question 1

Correct

Mark 11.00 out of 11.00



P16.13b_10ed

Use waveform symmetry and find the Fourier series coefficients for this periodic waveform.

Given over the time range zero to T/2.

a) Find a_v.

a_v = 0 Volts

b) Find a_k.

a_k = (-8 Vm / $(k\pi)^2$) Volts for k odd

c) Find b_k.

b_k = 0 for all k

a) a_v = 0 V

b) a_k =-8V_p /$(k\pi)^2$ Volts for k odd

c) b_k = 0 for all k

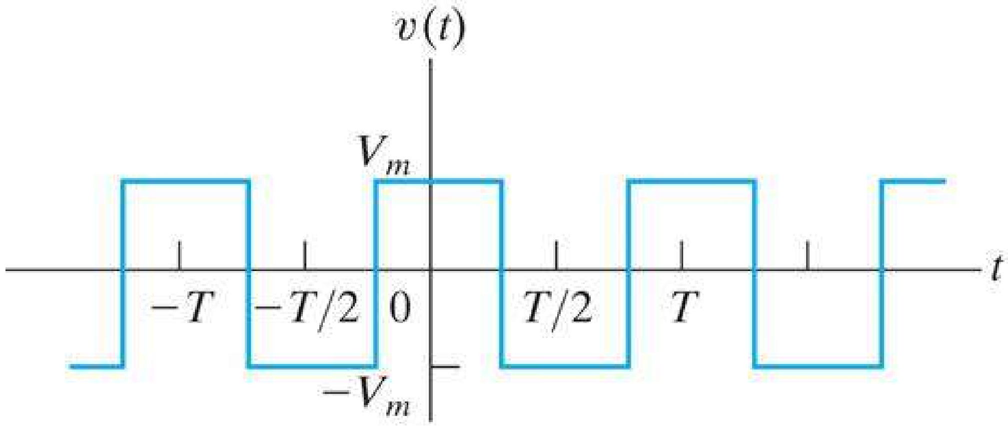
Correct

Marks for this submission: 11.00/11.00.

Question 2

Correct

Mark 11.00 out of 11.00



P16.13a_10ed

Use waveform symmetry and find the Fourier series coefficients for this periodic waveform.

a) Find a_v.

a_v = 0 Volts

b) Find a_k.

a_k = (4 V_m /π) sin(kπ/ 2) Volts for k odd

c) Find b_k.

b_k = 0 for all k

a) a_v = 0 V

b) a_k = (4V_m/π) sin(kπ/2) Volts for k odd

c) b_k = 0 for all k

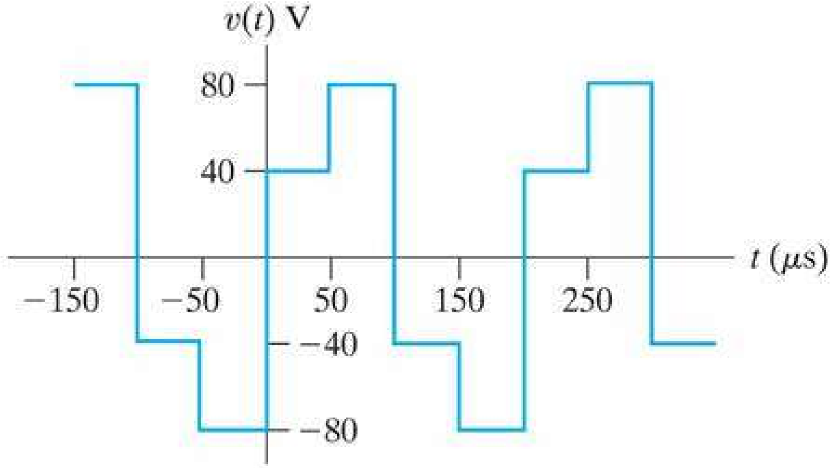
Correct

Marks for this submission: 11.00/11.00.

Question 3

Correct

Mark 11.00 out of 11.00



P16.19a_9ed

Given:

$$v(t)=\frac{-80}{\pi}\sum_{n=1,3,5,...}^{\infty}\frac{1}{n}\sin\left(\frac{\pi n}{2}\right)\cos(n\omega_0 t)+\frac{240}{\pi}\sum_{n=1,3,5,...}^{\infty}\frac{1}{n}\sin(n\omega_0 t)$$

Rewrite the Fourier Series for this waveform using the Alternative Trigonometric Form given by

$$f(t)=a_v+\sum_{n=1}^{\infty}A_n\cos(n\omega_0 t-\theta_n)$$

The alternate form is

For n = 1, 5, 9, … A_n = 252.96 / nπ

angle θ_n = -108.44 ° (Degrees, CW from the origin)

For n = 3, 7, 11,…A_n = 252.98 / nπ

and angle θ_n = -71.56 ° (Degrees, CW from the origin)

CW = Clock-wise

$$v(t)=\frac{-80}{\pi}\sum_{n=1,3,5,...}^{\infty}\frac{1}{n}\sin\left(\frac{\pi n}{2}\right)\cos(n\omega_0 t)+\frac{240}{\pi}\sum_{n=1,3,5,...}^{\infty}\frac{1}{n}\sin(n\omega_0 t)$$

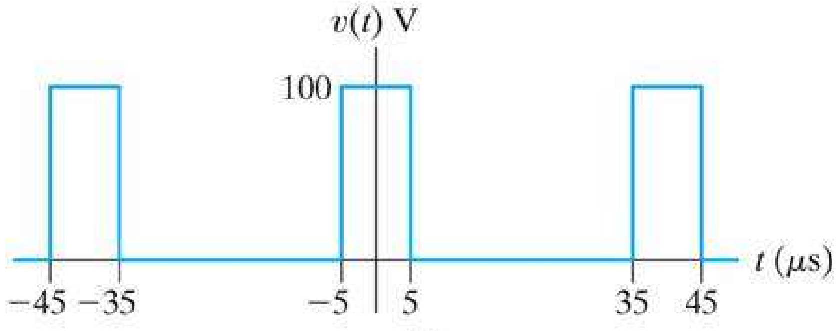
Correct

Marks for this submission: 11.00/11.00.

Question 4

Correct

Mark 11.00 out of 11.00



P16.19b_9ed

Given:

$$v(t)=25+\frac{200}{\pi}\sum_{n=1}^{\infty}\frac{1}{n}\sin\left(\frac{\pi n}{4}\right)\cos(n\omega_0 t)Volts$$

The Fourier Series for this waveform using the Alternative Trigonometric Form given by

$$f(t)=a_v+\sum_{n=1}^{\infty}A_n\cos(n\omega_0 t-\theta_n)$$

Determine:

The average value a_v = 25 Volts

A_1 = 45.01 Volts and θ_1 = 0 ° (Degrees)

A_2 = 31.83 Volts and θ_2 = 0 ° (Degrees)

A_3 = 15 Volts and θ_3 = 0 ° (Degrees)

A_4 = 0 Volts and θ_4 = 0 ° (Degrees)

A_5 = -9.003 Volts and θ_5 = 0 ° (Degrees)

$$v(t)=25+\frac{200}{\pi}\sum_{n=1}^{\infty}\frac{1}{n}\sin\left(\frac{\pi n}{4}\right)\cos(n\omega_0 t-0^\circ)Volts$$

A_1 = 45.0158 Volts and θ_1 = 0°

A_2 = 31.8310 Volts and θ_2 = 0°

A_3 = 15.0053 Volts and θ_3 = 0°

A_4 = 0 (zero) Volts and θ_4 = 0°

A_5 = -9.0032 Volts and θ_5 = 0°

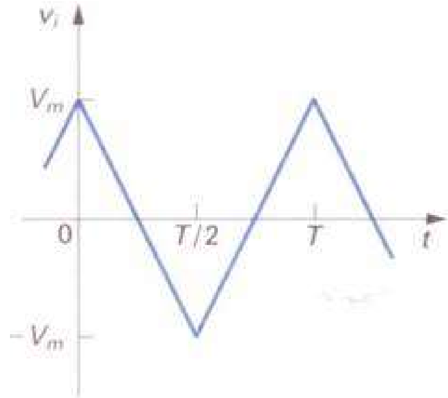
Correct

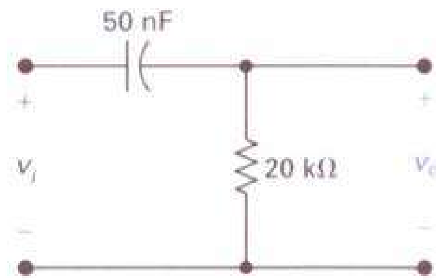
Marks for this submission: 11.00/11.00.

Question 5

Correct

Mark 11.00 out of 11.00





P16.23_6ed

Given: $v(t) = 450\ \pi^2$ mV (milli V) with a period T = 2π ms (milli sec) (π = pi).

The periodic triangular –wave voltage is applied to the circuit shown.

Find the circuit's response $v_0(t)$ by using the first three nonzero Fourier series terms.

You should be able to simplify the Fourier series to

$v_{0',1}(t) =$ 2.545 cos(1000 t + 45 °) Volts

$v_{0',3}(t) =$ .38 cos(3000 t + 18.43 °) Volts

$v_{0',5}(t) =$ .141 cos(5000 t + 11.31 °) Volts

$v_{0',1}(t) = 2.5456\cos(1{,}000t + 45.0°)$

$v_{0',3}(t) = 0.3795\cos(3{,}000t + 18.43°)$ Volts

$v_{0',5}(t) = 0.1412\cos(5{,}000t + 11.31°)$ Volts

$v(t) = 2.5456\cos(1{,}000t + 45.0°) + 0.3795\cos(3{,}000t + 18.43°) + 0.1412\cos(5{,}000t + 11.31°)$ Volts

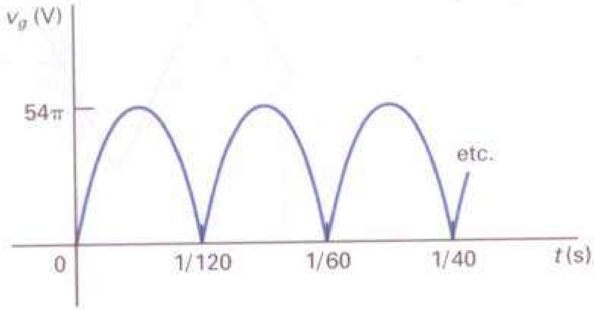
Correct

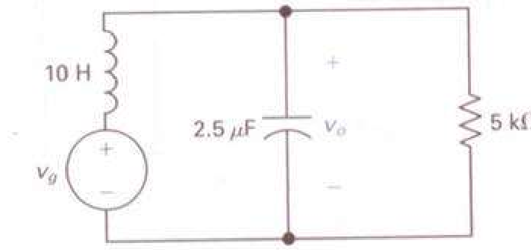
Marks for this submission: 11.00/11.00.

Question 6

Correct

Mark 11.00 out of 11.00





P16.27_6ed

The full-wave rectified sine-wave voltage is applied to the circuit shown.

Find the circuit's response $v_0(t)$ by using the first four nonzero Fourier series terms.

$v_{0\text{'avg}}(t) =$ 108 ✓ Volts

$v_{0\text{'}1}(t) =$ 5.41 ✓ cos(240 ✓ π t + 6.51 ✓ °) Volts

$v_{0\text{'}2}(t) =$ .2575 ✓ cos(480 ✓ π t + 3.08 ✓ °) Volts

$v_{0\text{'}3}(t) =$ .049 ✓ cos(720 ✓ π t + 2 ✓ °) Volts

$v_{0\text{'avg}}(t)$ = 108 Volts

$v_{0\text{'}1}(t) = 5.4143 \cos(240\pi t + 6.51°)$ Volts

$v_{0\text{'}2}(t) = 0.2575 \cos(480\pi t + 3.09°)$ Volts

$v_{0\text{'}3}(t) = 0.0486 \cos(720\pi t + 2.04°)$ Volts

$v(t) = 108+5.4143 \cos(240\pi t + 6.51°) + 0.2575 \cos(480\pi t + 3.09°) + 0.0486 \cos(720\pi t + 2.04°)$ Volts

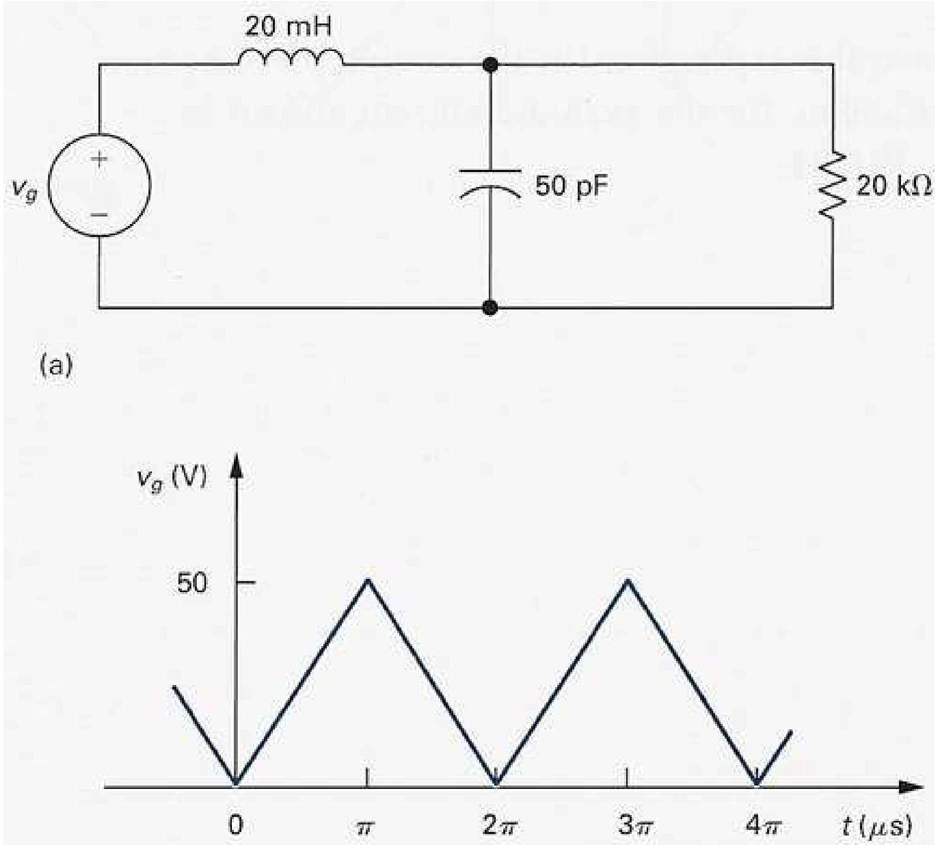
Correct

Marks for this submission: 11.00/11.00.

Question 7

Correct

Mark 11.00 out of 11.00



P16.38_6ed

The triangular-wave voltage source is applied to this circuit.

The equation for the function = $50 \times 10^{6}\, t/\pi$ for $0 \le t \le \pi$ μs (micro sec)

Estimate the average power delivered to the 20 kΩ (kilo (Ohm) resistor when the circuit is in steady-state operation.

$P_{20\Omega,\text{steady-state}}$ = 41.64 mW (milli W)

$P_{20\Omega}$,steady-state = 41.532 mW

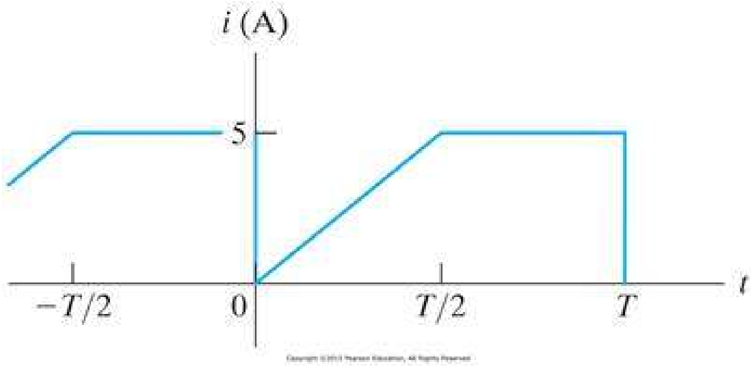
Correct

Marks for this submission: 11.00/11.00.

Question 8

Correct

Mark 11.00 out of 11.00



P16.33_10ed

The periodic current waveform is applied to a 2.5 kΩ (kilo Ohm) resistor.

Given: $i(t) = \frac{I_m}{\frac{T}{2}} t$ for $0 \le t \le T/2$ and $i(t) = I_m$ for $T/2 \le t \le T$ where $I_m = 5$ A

a) Use the first three nonzero terms in the Fourier Series representation of i(t) to estimate the average power dissipated in the 2.5 kW (kilo Ohm) resistor.

$P_{2.5\ k\Omega,estimate}$ = 40.4 kW (kilo Watt)

b) Calculate the exact value of the average power dissipated in the 2.5 kΩ (kilo Ohm) resistor. Hint: You must use the rms integral for the current waveform.

$P_{2.5\ k\Omega,exact}$ = 41.67 kW (kilo Watt)

b) Calculate the exact value of the average power dissipated in the 2.5 kΩ (kilo Ohm) resistor.

% Error = -3.05   “-” under estimate   “+” = over estimate

a) $P_{2.5\ kW,estimate}$ = 40.3974 kW

b) $P_{2.5\ kW,exact}$ = 41.6667 kW

c) % error = -3.046%

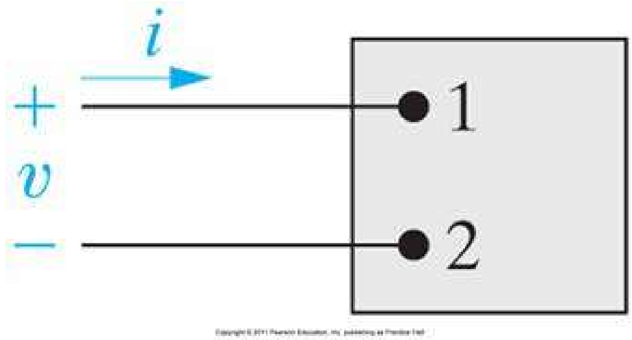
Correct

Marks for this submission: 11.00/11.00.

Question 9

Correct

Mark 12.00 out of 12.00



P16.35_6ed

The voltage and current at the terminals of this network are

$v(t) = 80 + 200\cos(500t + 45°) + 60\sin(1{,}500t)$ Volts

$i(t) = 10 + 6\sin(500t + 75°) + 3\cos(1{,}500t - 30°)$ Amps

a) What is the average power at element's terminals?

$P =$ 1145 W

b) What is the rms value of the voltage?

$V_{rms} =$ 167.93 V_{rms}

c) What is the rms value of the current?

$I_{rms} =$ 11.06 A_{rms}

a) $P = 1{,}145$ W

b) $V_{rms} = 167.9286\ V_{rms}$

c) $I_{rms} = 11.0680\ \ I_{rms}$

Correct

Marks for this submission: 12.00/12.00.