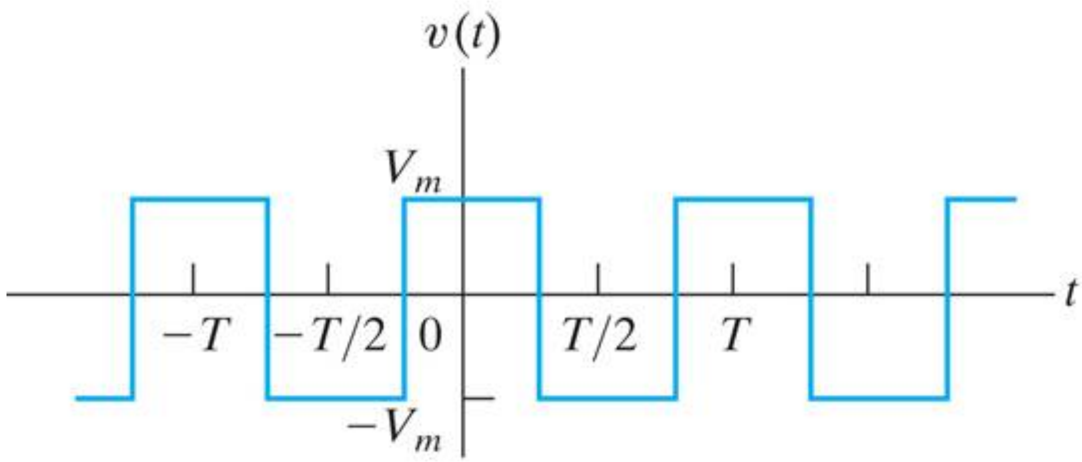
Started on	Wednesday, 19 April 2017, 10:41 AM
State	Finished
Completed on	Sunday, 7 May 2017, 3:11 PM
Time taken	18 days 4 hours
Grade	**81.82** out of 100.00

Question 1

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) $a_k = (4V_m/\pi)\ \sin(k\pi/2)$ Volts for k odd

c) $b_k = 0$ for all k

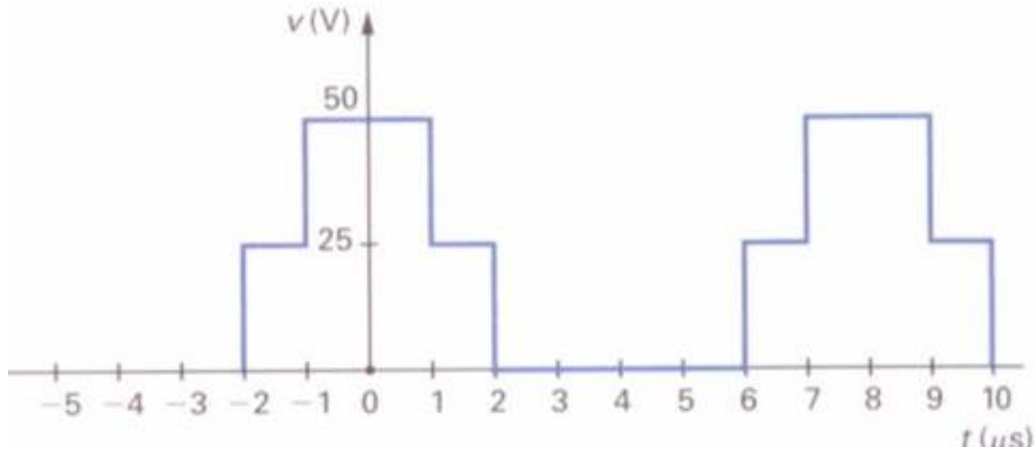
Correct

Marks for this submission: 11.00/11.00.

Question 2

Correct

Mark 11.00 out of 11.00



P16.08b_6ed

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

a) Find ω_0 in radians per second.

ω_0 = 785398.16 rad/sec

b) Find f_0 in Hertz.

f_0 = 125000 Hz

c) Find a_v.

a_v = 18.75 Volts

d) Find a_k.

a_k = 50 /(kπ) [sin(kπ/2) + sin(kπ/4)] Volts

e) Find b_k.

b_k = 0 for all k

a) ω_0 = 785,398.1634 rad/sec

b) f_0 = 125,000 Hz

c) a_v = 18.750 V

d) a_k = 50/(kπ) [sin(kπ/2) + sin(kπ/4)] Volts

e) b_k = 0 for all k

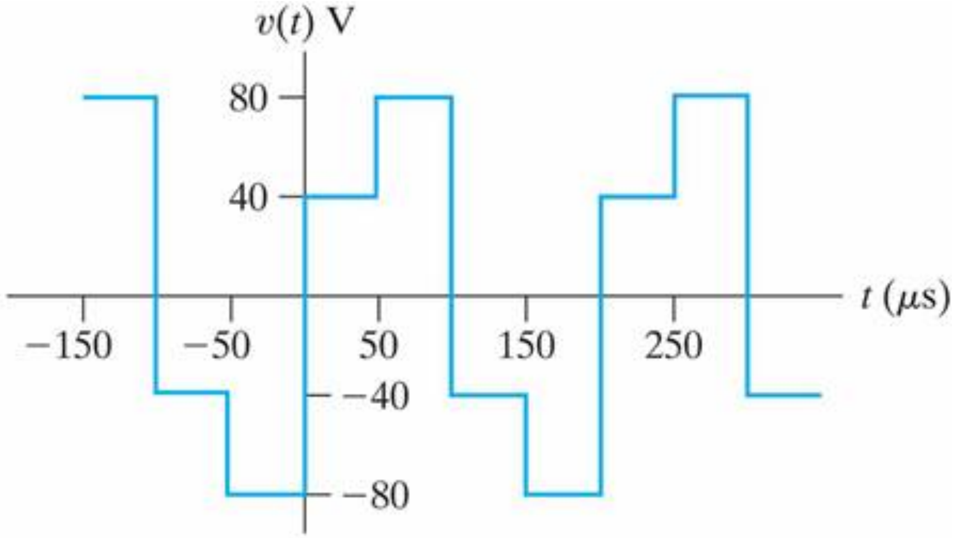
Correct

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 = 252.98 / nπ

angle θ_n = -108.43 ° (Degrees, CW from the origin)

For n = 3, 7, 11,… A_n = 252.98 / nπ

and angle θ_n = -71.565 ° (Degrees, CW from the origin)

CW = Clock-wise

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

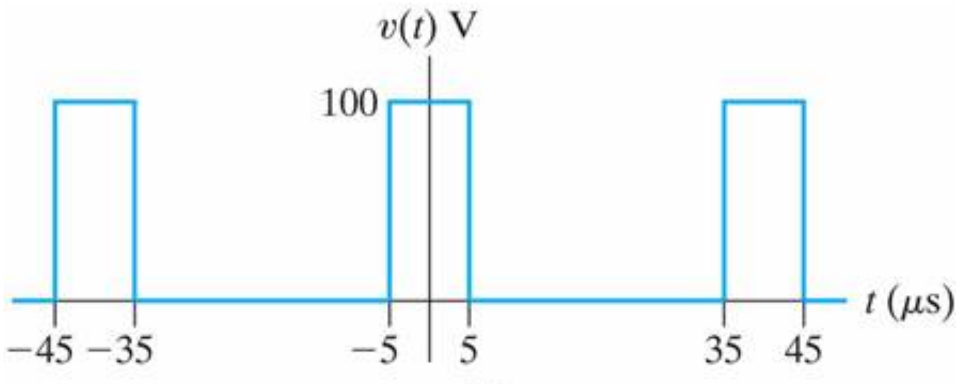
Correct

Marks for this submission: 11.00/11.00.

Question 4

Partially 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 = 200 Volts and θ_1 = 0 ° (Degrees)

A_2 = Volts and θ_2 = ° (Degrees)

A_3 = Volts and θ_3 = ° (Degrees)

A_4 = Volts and θ_4 = ° (Degrees)

A_5 = Volts and θ_5 = ° (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 $\theta_1 = 0°$

A_2 = 31.8310 Volts and $\theta_2 = 0°$

A_3 = 15.0053 Volts and $\theta_3 = 0°$

A_4 = 0 (zero) Volts and $\theta_4 = 0°$

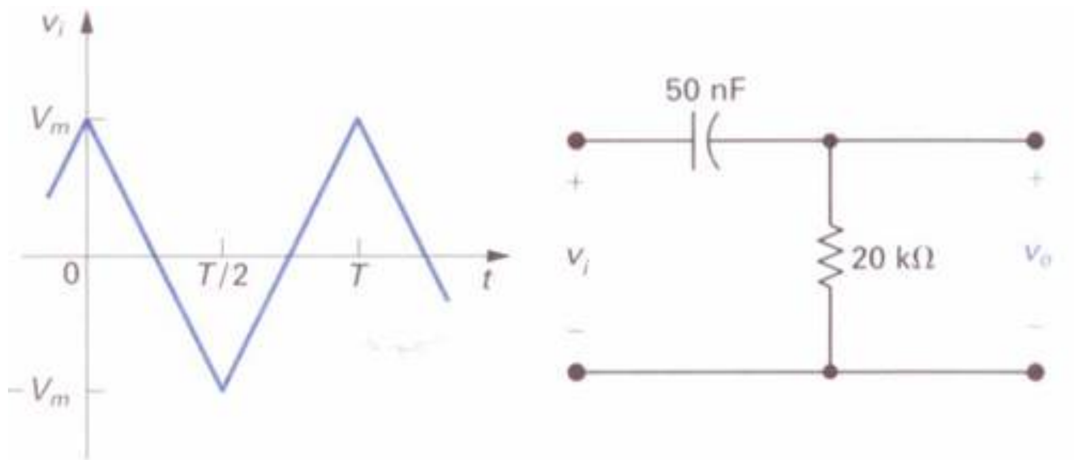
A_5 = -9.0032 Volts and $\theta_5 = 0°$

Partially correct
Marks for this submission: 2.00/11.00. Accounting for previous tries, this gives **11.00/11.00**.

Question **5**

Partially correct

Mark 1.22 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

$v_{0'1}(t) =$ 57.34 ✗ cos(1 ✗ t + 45 ✓ °) Volts

$v_{0'3}(t) =$ 87.339 ✗ cos(1 ✗ t + 64.67 ✗ °) Volts

$v_{0'5}(t) =$ 1 ✗ cos(1 ✗ t + 90 ✗ °) 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

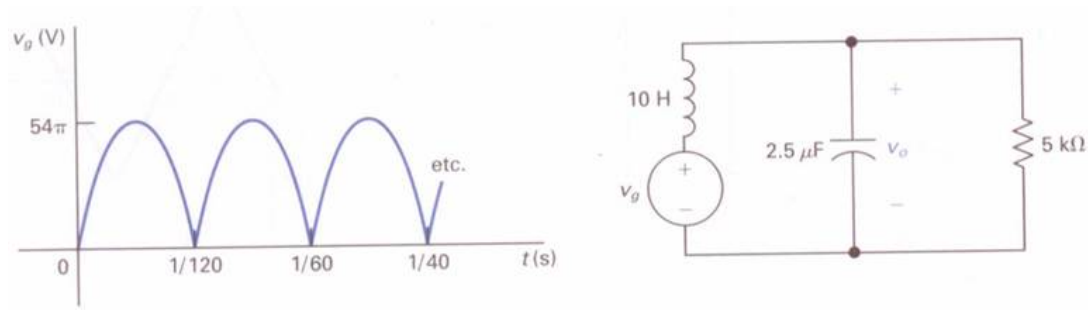
$v(t) = 2.5456\cos(1{,}000t + 45.0°) + 0.3795\cos(3{,}000t + 18.43°) + 0.1412\cos(5{,}000t + 11.31°)$ Volts

Partially correct
Marks for this submission: 1.22/11.00. Accounting for previous tries, this gives **1.22/11.00**.

Question 6

Partially correct

Mark 6.60 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

$v_{0\text{'}1}(t) =$ 0.63 cos(240 π t + 174.33 °) Volts

$v_{0\text{'}2}(t) =$ 0.257 cos(480 π t + 3.09 °) Volts

$v_{0\text{'}3}(t) =$ 6 cos(720 π t + 6.18 °) 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

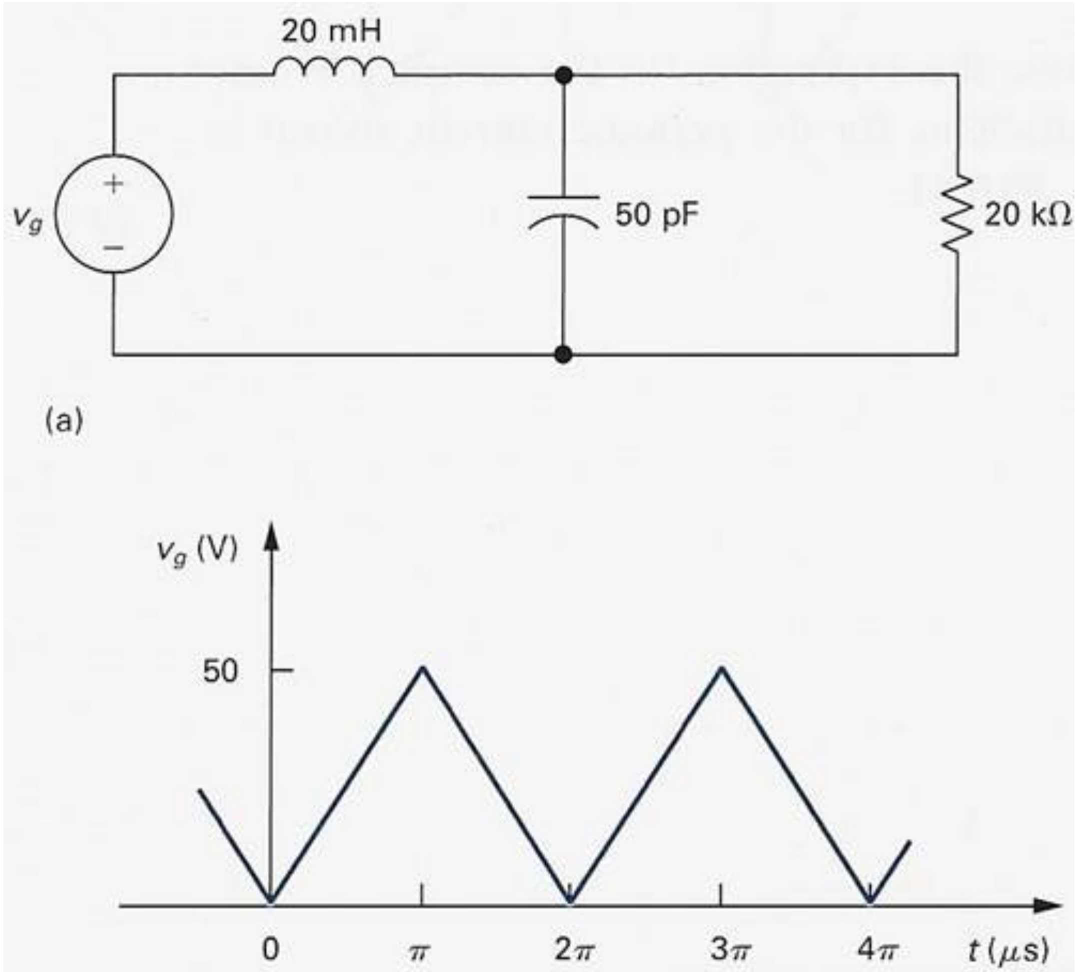
Partially correct

Marks for this submission: 6.60/11.00.

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 $0 \leq t \leq \pi$ µs (micro sec)

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

$P_{20\Omega,\text{steady-state}}$ = 41.52 mW (milli W)

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

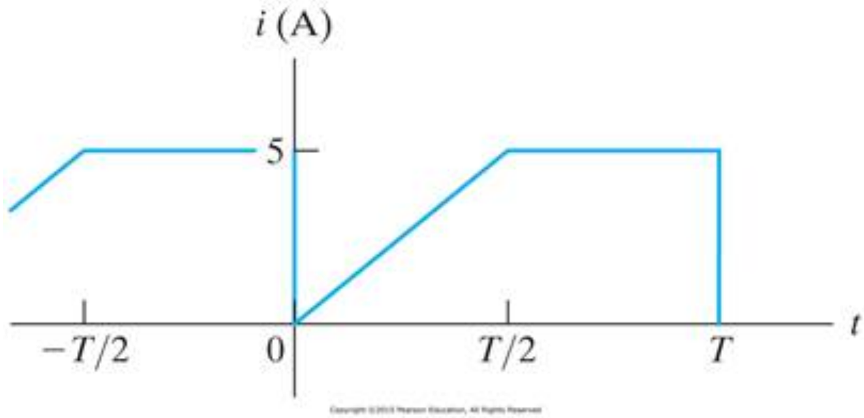
Correct

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%

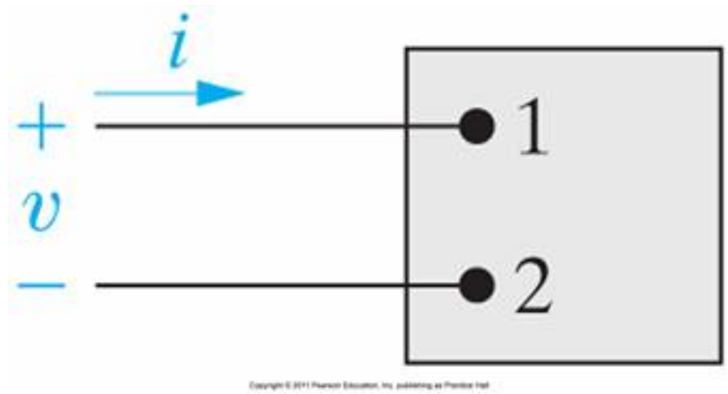
Correct

Marks for this submission: 11.00/11.00.

Question 9

Partially correct

Mark 8.00 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 = 1858.99 ✗ 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} = 11.07 ✓ A_{rms}

a) P = 1,145 W

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

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

Partially correct

Marks for this submission: 8.00/12.00. Accounting for previous tries, this gives **8.00/12.00**.