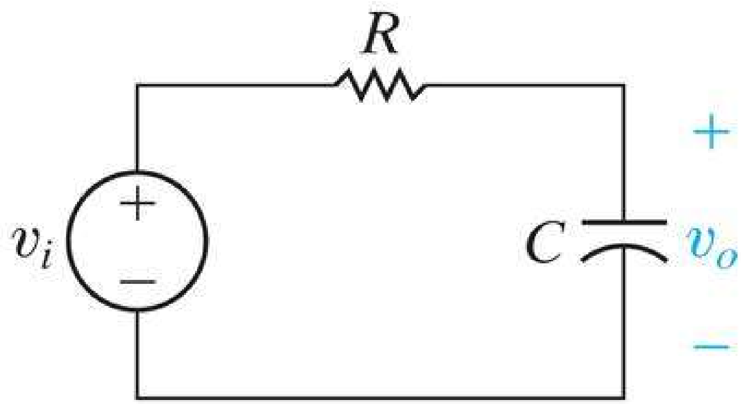
Started on	Monday, 15 May 2017, 10:22 AM
State	Finished
Completed on	Monday, 15 May 2017, 11:18 AM
Time taken	55 mins 35 secs
Grade	**91.50** out of 100.00

Question 1

Correct

Mark 10.00 out of 10.00



Q1c

Given: C = 347 nF (nano F) R = 360 Ω (Ohm)

a) Write the parameters of the transfer function H(s).

$H(s) = V_0 / V_i =$ 8005.5 / (s + 8005.5)

b) Calculate the cutoff frequency ω_c in rad/sec and f_c in Hz.

$\omega_c =$ 8005.5 rad/sec fc = 1274.05 Hz

c) State the phase angle of the output voltage when fully in the passband region where $\omega << \omega_c$.

θ(pass band) = 0 ° (Degrees)

d) State the phase angle of the output voltage at the corner frequency ω_c.

$\theta(\omega_c) =$ -45 ° (Degrees)

e) State the phase angle of the output voltage when fully in the stopband region where $\omega >> \omega_c$.

θ(stop band) = -90 ° (Degrees)

f) Identify the filter type of this circuit.

Filter Type = Low Pass

Numeric Answer

a) H(s) = 8,000.5123 / (s + 8,000.5123)

b) ω_c = 8,000.5123 rad/sec fc = 1,274.0549 Hz

c) θ(pass band) = 0°

d) $\theta(\omega_c)$ = -45°

e) θ(stop band) = -90°

f) Filter Type = Low Pass

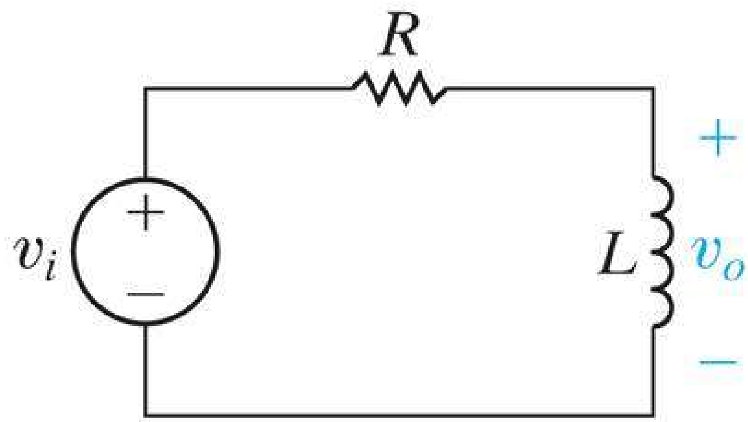
Correct

Marks for this submission: 10.00/10.00.

Question 2

Correct

Mark 10.00 out of 10.00



Q2e

Given: L = 67 mH (milli H)   R = 353 Ω (Ohm)

a) Write the parameters of the transfer function H(s).

$H(s) = V_0 / V_i = s / (s +$ 5268 $)$

b) Calculate the cutoff frequency ω_c in rad/sec and f_c in Hz.

$\omega_c =$ 5266 rad/sec $f_c =$ 838.43 Hz

c) State the phase angle of the output voltage when fully in the passband region where $\omega >> \omega_c$.

θ(pass band) = 0 ° (Degrees)

d) State the phase angle of the output voltage at the corner frequency ωw_c.

$\theta(\omega_c) =$ 45 ° (Degrees)

e) State the phase angle of the output voltage when fully in the stopband region where $\omega << \omega_c$.

θ(stop band) = 90 ° (Degrees)

f) Identify the filter type of this circuit.

Filter Type = High Pass ▾

Numeric Answer

a) H(s) = s / (s + 5,268.6567)

b) ω_c = 5,268.6567 rad/sec f_c = 838.5328 Hz

c) θ(pass band) = 0°

d) $\theta(\omega_c)$ = 45°

e) θ(stop band) = 90°

f) Filter Type = High Pass

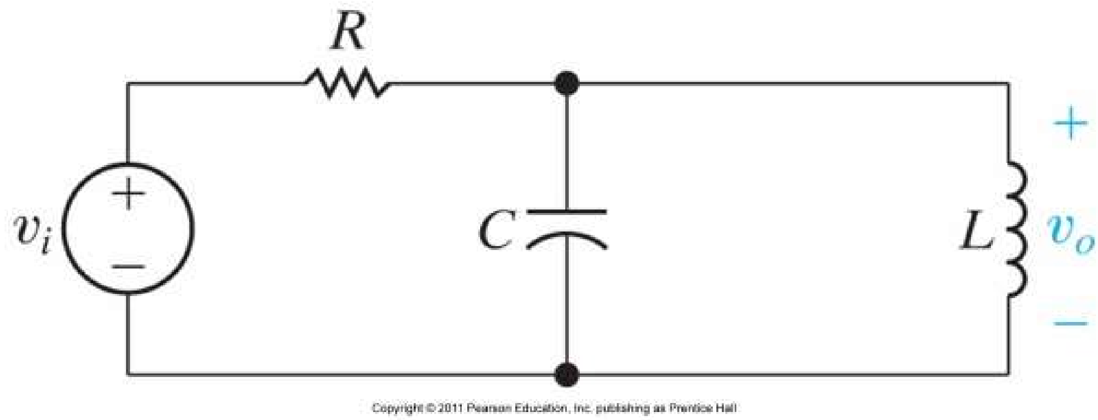
Correct

Marks for this submission: 10.00/10.00.

Question 3

Correct

Mark 10.00 out of 10.00



Q3Pa

Given: R = 160 Ω (Ohm)   C = 5 μF (micro F)   L = 203 μH (micro H)

a) Find the resonant frequency ω_0.

ω_0 = 31388 rad/sec

b) Find the lower half-power frequency w_{c1}.

ω_{c1} = 30763 rad/sec

c) Find the upper half-power frequency w_{c2}.

ω_{c2} = 32013 rad/sec

d) Find the bandwidth β (Beta).

β = 1250 rad/sec

e) Find the quality factor Q.

Q = 25.11

f) Identify the filter type of this circuit.

Filter Type = Band Pass

Numeric Answer

a) ω_0 = 31,388.2410 rad/sec

b) ω_{c1} = 30,769.4629 rad/sec

c) ω_{c2} = 32,019.4629 rad/sec

d) β = 1,250 rad/sec

e) Q = 25.1106

f) Filter Type = Band Pass

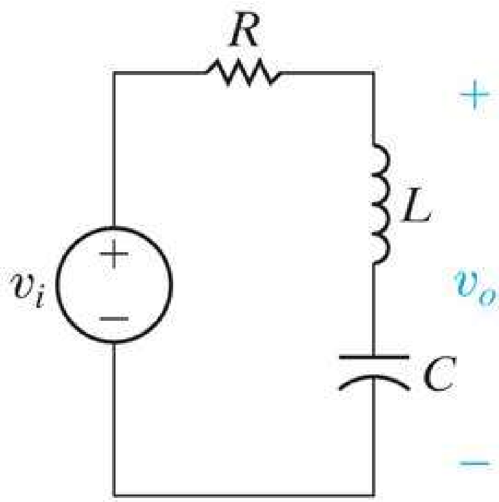
Correct

Marks for this submission: 10.00/10.00.

Question 4

Correct

Mark 10.00 out of 10.00



Q4Sc

Given: R = 1875 Ω (Ohm) C = 20 nF (nano F) L = 200 mH (milli H)

a) Calculate ω_0.

ω_0 = 15811.38 rad/sec

b) Calculate f_0.

f_0 = 2516.46 Hz

c) Find ω_{c1}.

ω_{c1} = 11804 rad/sec

d) Find ω_{c2}.

ω_{c2} = 21180 rad/sec

e) Find β (Beta).

β = 9378 rad/sec

f) Find Q.

Q = 1.68

g) Identify the filter type of this circuit.

Filter Type = Band Reject ▼

Numeric Answer

a) ω_0 = 15,811.3883 rad/sec

b) f_0 = 2,516.4606 Hz

c) ω_{c1} = 11,804.0935 rad/sec

d) ω_{c2} = 21,179.0935 rad/sec

e) β = 9,375 rad/sec

f) Q = 1.6865

g) Filter Type = Band Reject

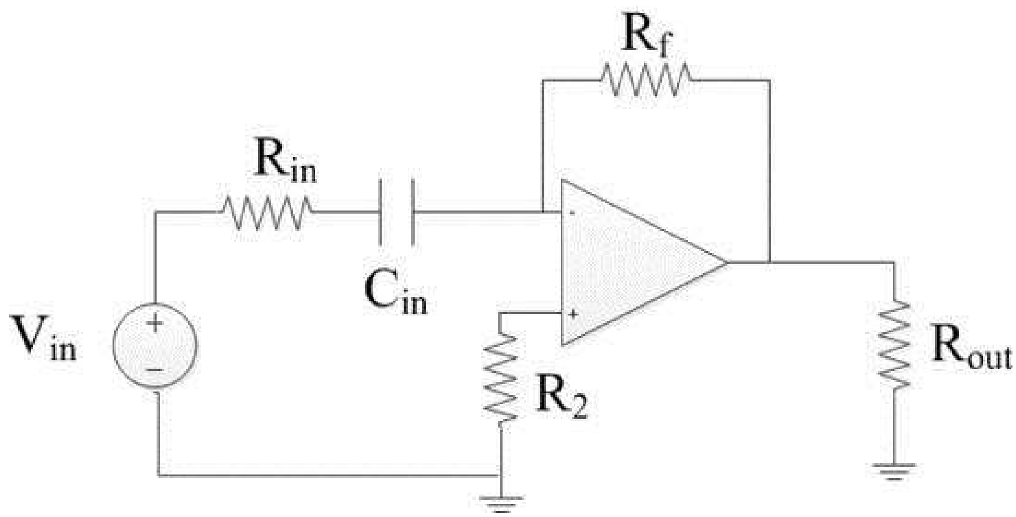
Correct

Marks for this submission: 10.00/10.00.

Question 5

Correct

Mark 10.00 out of 10.00



Q5e

Given: Vin = 25 cos(4,000t) Volts

R_{in} = 40 kΩ (kilo Ohm) C_{in} = 0.1 μF (micro F) Rf = 10 kΩ (kilo Ohm)

R_{out} = 1 kΩ (kilo Ohm) R2 = 10 Ω (Ohm)

The opamp has power input rails at +15V and -15V.

Find the steady-state output voltage V_{out} which is the voltage across the resistor R_{out}.

v_{out} = 6.24 cos (4,000 t + 183.6 ° (Degrees) Volts

State the phase angle as a positive angle in the correct quadrant.

Numeric Answer

v_{out} = 6.2378 cos (4,000 t + 183.5763°) Volts

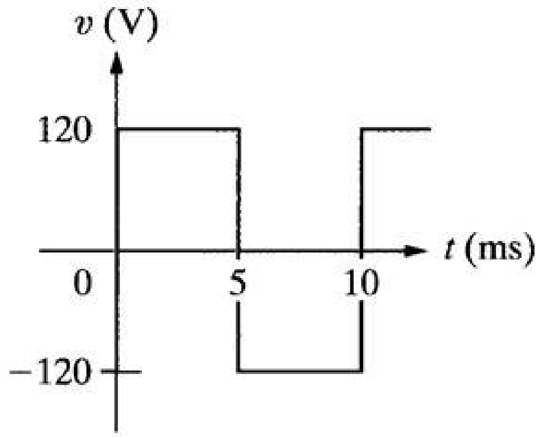
Correct

Marks for this submission: 10.00/10.00.

Question 6

Correct

Mark 10.00 out of 10.00



Q6a

Given: The Fourier coefficients for this waveform are

$a_v = 0$ V $a_n = 0$ V $b_n = 480 / (n\pi)$ for n odd

Write the following terms of this waveform's Fourier series.

a) What is the average value?

Avg = 0 ✓ Volts

Answers for the next two questions are in the order of magnitude, identify cosine or sine and the frequency of the sinusoid in radians/sec.

b) Find the Fourier Series term for n = 1.

$v_1(t) =$ 152.8 ✓ sine ✓ (628.3 ✓ t) Volts

c) Find the Fourier Series term for n = 5.

$v_5(t) =$ 30.6 ✓ sine ✓ (3141.6 ✓ t) Volts

Numeric Answer

a) $a_v = 0$ Volts

b) For n = 1, $v_1(t) =$ 480/p sin (1*200π) = 152.7887 sin(623.3185 t) V

c) For n = 5, $v_5(t) =$ 96/p sin (5*200π) = 30.5577 sin(3,141.5927 t) V

Correct

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Question 7

Correct

Mark 10.00 out of 10.00

Q7a

Given the "normal" trigonometric form of the Fourier series coefficients for a waveform are

a_{avg} = zero $\quad a_n = -10/n^2 \quad b_n = 20/n$

Determine the coefficients for the Alternative trigonometric form of the Fourier series in the polar form

$a_n - jb_n = A_n \measuredangle -\theta_n$ (Magnitude A_n at angle $-\theta_n$)

a) For the first term in the summation where n = 1:

A_1 = 22.38 Volts

$-\theta_1$ (Theta 1) = -116.57 ° (Degrees, angle CW from origin)

b) For the second term in the summation where n = 2:

A_2 = 10.3 Volts

$-\theta_2$ (Theta 2) = -104.04 ° (Degrees, angle CW from origin)

c) For the third term in the summation where n = 3:

A_3 = 6.76 Volts

$-\theta_3$ (Theta 3) = -99.463 ° (Degrees, angle CW from origin)

CW = Clock-wise

Note that the angle also includes the "-" sign as shown in the polar form.

Numeric Answer

a) A_1 = 22.3607 Volts $\quad -\theta_1 = -116.5651°$

b) A_2 = 10.3078 Volts $\quad -\theta_2 = -104.0362°$

c) A_3 = 6.7586 Volts $\quad -\theta_3 = -99.4623°$

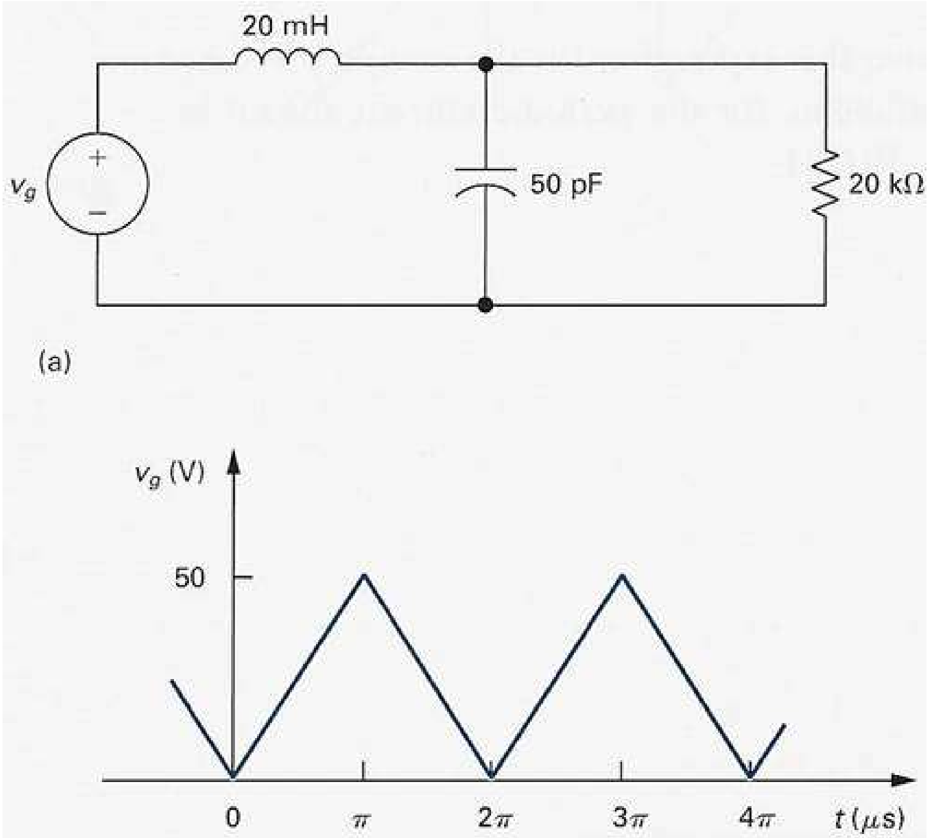
Correct

Marks for this submission: 10.00/10.00.

Question 8

Correct

Mark 10.00 out of 10.00



Q8

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

The Fourier series of this input waveform is

$$v(t) = 25 - \frac{200}{\pi^2} \sum_{n=1,3,5,\ldots}^{\infty} \frac{1}{n} \cos(n\omega_0 t)$$

The s domain transfer function of the circuit is

$$H(s) = \frac{10^{12}}{s^2 + s10^6 + 10^{12}}$$

The desired output is the voltage across the 20 kΩ (kilo Ohm) resistor.

a) Determine the steady-state output voltage for n = 1 written as polar phasor.

$v_{1,20W,steady\text{-}state}(t)$ = Magnitude -20.26 at angle -90 ° (Degrees) Volts (negative magnitude and negative angle)

b) Determine the steady-state output voltage for n = 5 written as polar phasor.

$v_{5,20W,steady\text{-}state}(t)$ = Magnitude -.165 at angle 11.77 ° (Degrees) Volts (negative magnitude and positive angle)

c) Determine an estimate of the time varying power across the 20 kΩ (kilo Ohm) resistor based on the voltage from n = 1 term only.

$P_{20W,steady\text{-}state}$ = 10.26 mW (milli W)

Numeric Answer

a) $v_{1'20W'steady\text{-}state}(t)$ = -20.2642 at angle -90° V

b) $v_{5'20W'steady-state}(t) = -0.1654$ at angle 11.77° V

c) $P_{20W'}$steady-state = 10.266 mW

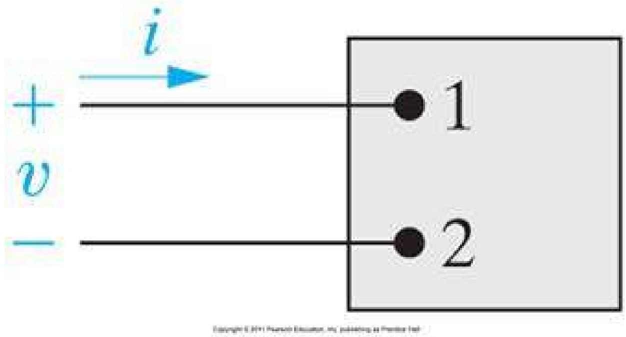
Correct

Marks for this submission: 10.00/10.00.

Question **9**

Correct

Mark 10.00 out of 10.00



Q9d

The voltage and current at terminals of this network are

$v(t) = 150 + 120 \sin(300\,t + 45°) + 40 \cos(900\,t)$ Volts

$i(t) = 45 + 18 \cos(300\,t + 75°) + 8 \sin(900\,t - 15°)$ Amps

a) What is the average power at terminals?

P = 6168.6 W

b) What is the rms value of the voltage of this truncated series?

V_{rms} = 174.64 V_{rms}

c) What is the rms value of the current of this truncated series?

I_{rms} = 47.10 A_{rms}

Numeric Answer

a) P = 6,168.5890 W

b) $V_{rms} = 174.6425\ V_{rms}$

c) $I_{rms} = 47.1063\ I_{rms}$

Correct

Marks for this submission: 10.00/10.00.

Question 10

Complete

Mark 1.50 out of 10.00

You created a Bode Diagram of a given transfer function in-class on May 8th. That in-class work will be manually graded and the score entered here on your final exam.

Comment:
Please review Bode Diagrams. Your in-class work did not show understanding of the Bode concept.