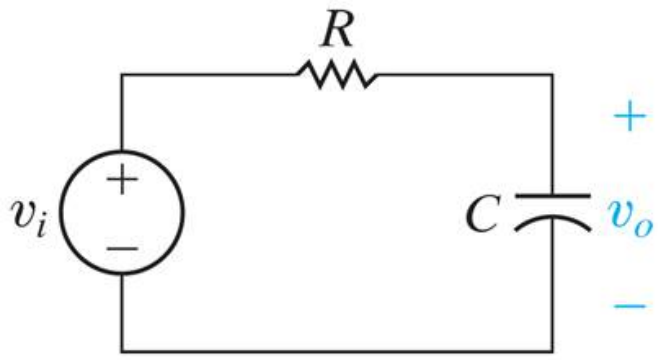
Started on	Monday, 15 May 2017, 10:11 AM
State	Finished
Completed on	Monday, 15 May 2017, 11:18 AM
Time taken	1 hour 6 mins
Grade	**90.00** out of 100.00

Question 1

Correct

Mark 10.00 out of 10.00



Q1b

Given: C = 347 nF (nano F) R = 2.4 kΩ (kilo Ohm)

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

$H(s) = V_0 / V_i =$ 1200.76 ✓ / (s + 1200.76 ✓)

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

$\omega_c =$ 1200.76 ✓ rad/sec $f_c =$ 191.205 ✓ 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~~ ✓

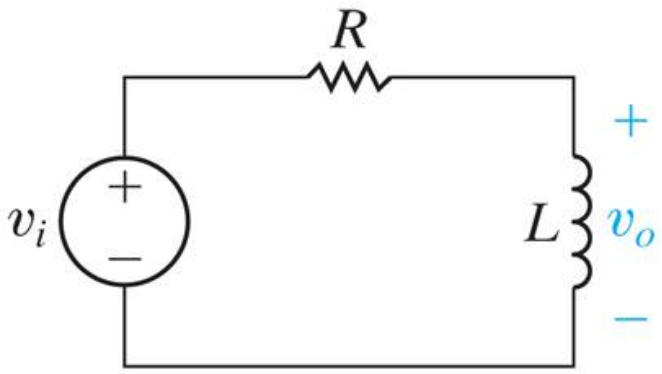
Correct

Marks for this submission: 10.00/10.00.

Question 2

Correct

Mark 10.00 out of 10.00



Q2a

Given: L = 1 mH (milli H) R = 10 Ω (Ohm)

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

$H(s) = V_0 / V_i = s / (s +$ 10000 ✓)

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

$\omega_c =$ 10000 ✓ rad/sec $f_c =$ 1592.35 ✓ 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 ✓

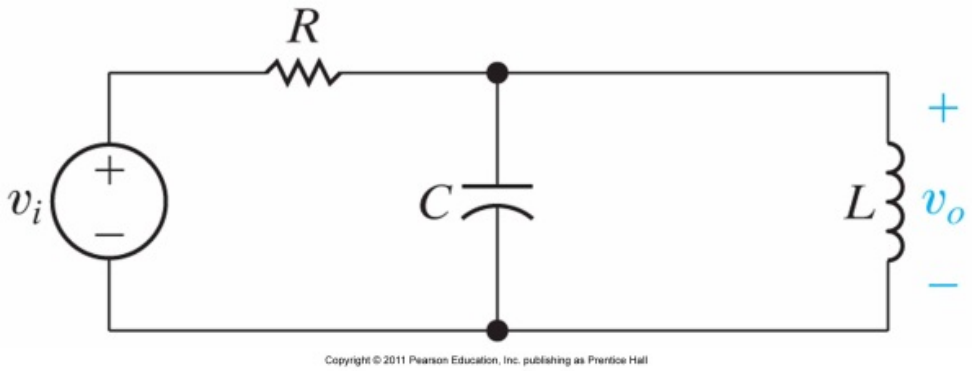
Correct

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 ✓

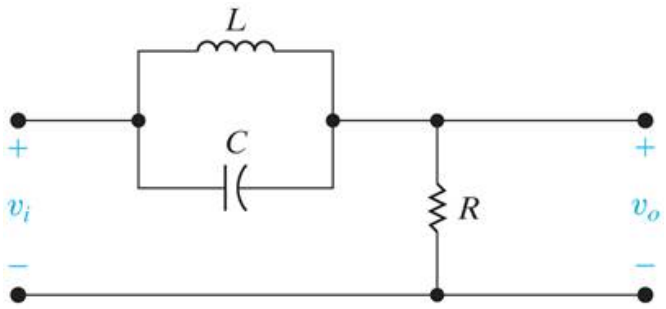
Correct

Marks for this submission: 10.00/10.00.

Question 4

Correct

Mark 10.00 out of 10.00



Q4Pc

Given: R = 750 Ω (Ohm) C = 40 nF (nano F) L = 150 μH (micro H)

a) Calculate ω_0.

ω_0 = 408 ✓ krad/sec (kilo rad/sec)

b) Calculate f_0.

f_0 = 65 ✓ kHz (kilo Hz)

c) Find ω_{c1}.

ω_{c1} = 392 ✓ krad/sec (kilo rad/sec)

d) Find ω_{c2}.

ω_{c2} = 425 ✓ krad/sec (kilo rad/sec)

e) Find β (Beta).

β = 33 ✓ krad/sec (kilo rad/sec)

f) Find Q.

Q = 12.36 ✓

g) Identify the filter type of this circuit.

Filter Type = Band Reject ✓

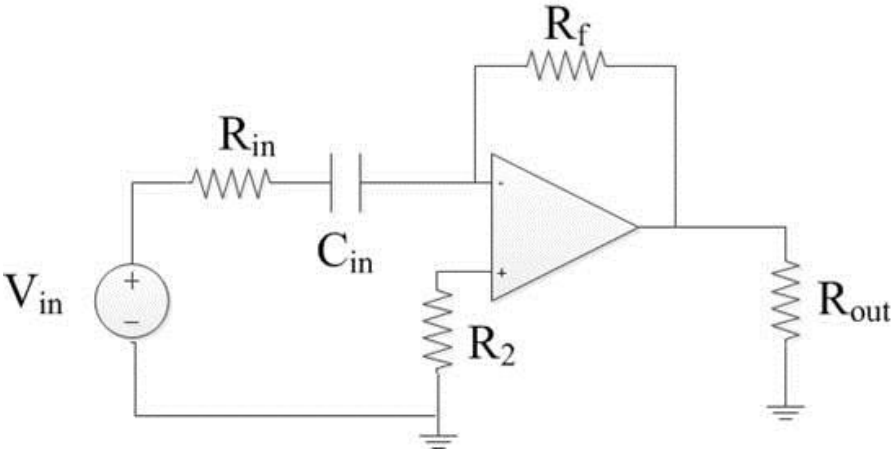
Correct

Marks for this submission: 10.00/10.00.

Question 5

Correct

Mark 10.00 out of 10.00



Q5b

Given: Vin = 20 cos(2,000t) Volts

R_{in} = 20 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} = 9.7 ✓ cos (2,000 t + 194 ✓ ° (Degrees) Volts

State the phase angle as a positive angle (counterclockwise from the origin) in the correct quadrant.

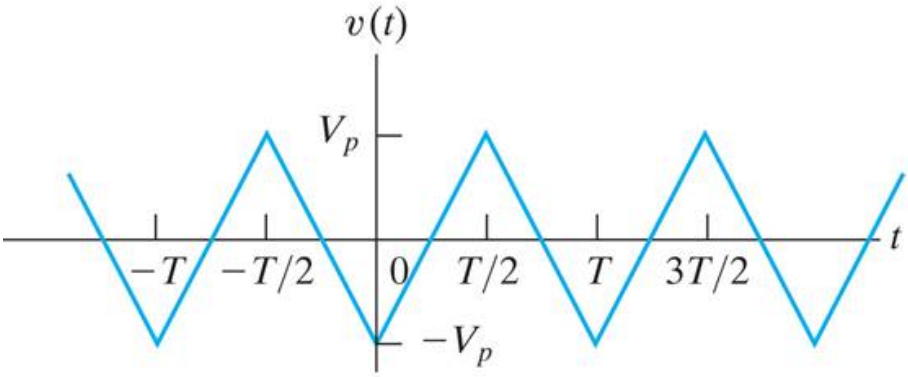
Correct

Marks for this submission: 10.00/10.00.

Question 6

Correct

Mark 10.00 out of 10.00



Q6b

Given: The Fourier coefficients for this waveform are

$a_v = 0$ V $a_n = -8V_p/(n\pi)^2$ Volts for k odd $b_n = 0$ V

$V_p = 50$ V T = 5 ms (milli sec)

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) Write the expression for n = 1.

$v_1(t)$ = 40.53 ✓ cosine ✓ (1256.64 ✓ t) Volts

c) Write the expression for n = 5.

$v_5(t)$ = 1.62 ✓ cosine ✓ (6283.9 ✓ t) Volts

Correct

Marks for this submission: 10.00/10.00.

Question 7

Correct

Mark 10.00 out of 10.00

Q7c

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

a_{avg} = zero $a_n = -20/n^2$ $b_n = 15/n$

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

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

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

A_1 = 25 ✓ Volts

$-\theta_1$ (Theta 1) = -143.13 ✓ ° (Degrees, angle CW from origin)

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

A_2 = 9 ✓ Volts

$-\theta_2$ (Theta 2) = -123.69 ✓ ° (Degrees, angle CW from origin)

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

A_3 = 5.5 ✓ Volts

$-\theta_3$ (Theta 3) = -114 ✓ ° (Degrees, angle CW from origin)

CW = Clock-wise

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

Correct

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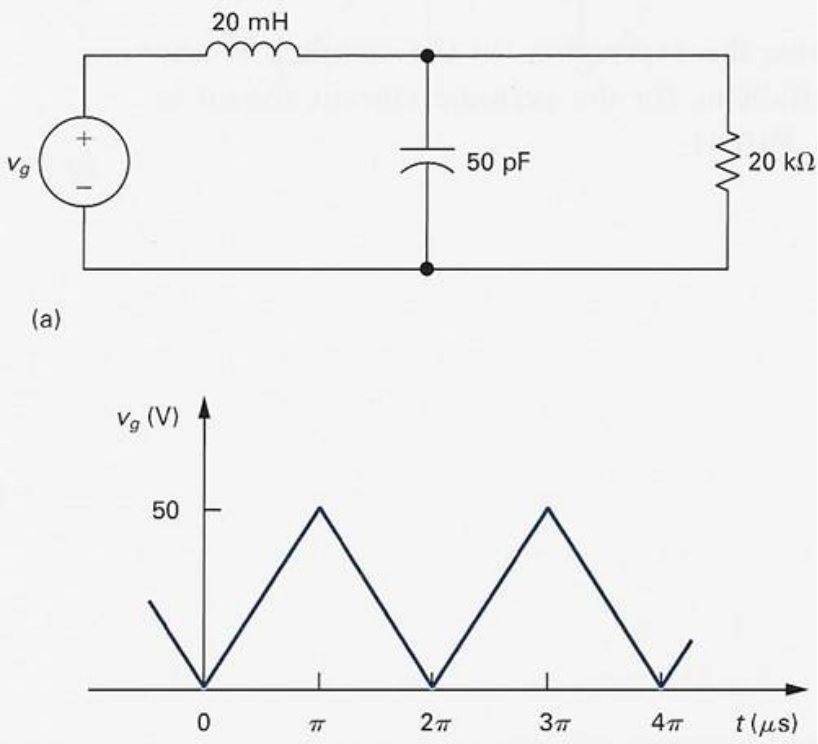
Question 8

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 -0.165 ✓ 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)

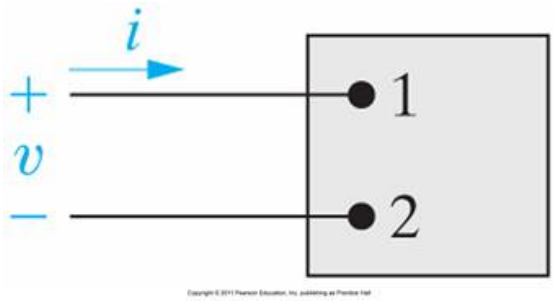
Correct

Marks for this submission: 10.00/10.00.

Question 9

Correct

Mark 10.00 out of 10.00



Q9b

The voltage and current at terminals of this network are

$v(t) = 70 + 200 \sin(500\,t + 45°) + 60 \cos(1{,}500\,t)$ Volts

$i(t) = 8 + 6 \cos(500\,t + 75°) + 3 \sin(1{,}500\,t - 30°)$ Amps

a) What is the average power at terminals?

P = 215 ✓ W

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

V_{rms} = 163.4 ✓ V_{rms}

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

I_{rms} = 9.298 ✓ A_{rms}

Correct

Marks for this submission: 10.00/10.00.

Question 10

Not answered

Marked 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.