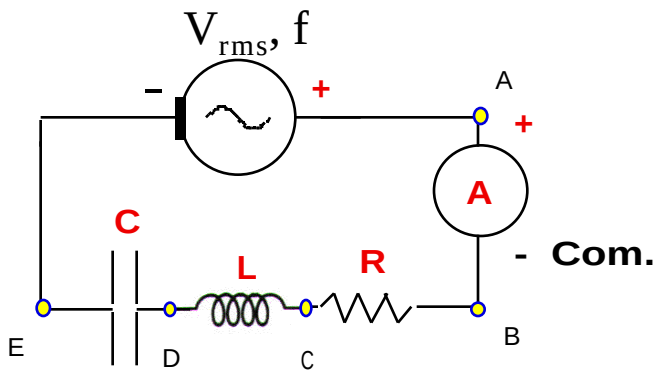
Physics 142 Lecture Quiz9 October 27, 2000

Name Example Solution.v2 (ID# 111-22-3333) Reci. Section 8:30 11:00 12:30

Please do your own work. Open book and notes. Please do not talk to your neighbors.

You may earn up to 19 points -

You have been given a series RLC circuit (as shown) and a 12.0 V (rms) ac potential source which can provide ac at different frequencies. The resistor has a value of 4.00 ohms.
•The size of the inductor in millihenries(1mH = 10^{-3}H) is given by the first three digits of your student ID number.
•The size of the capacitor in microfarads(1μF = 10^{-6} F) is given by the middle two digits of your student ID number.
•The initial frequency setting is given in Hz by the last four digits of your student ID number.



(1 point) My L value = 111 millihenries (1 point) My C value = 22 μF
(1 point) My initial f value = 3333 Hz **Give all answers to three significant figures.**

1. (2 points) What is the inductive reactance for this circuit at the initial frequency?
$X_L = 2\pi fL = 2\pi(3333\ Hz)(111x10^{-3}\ H) = 2320\ ohms$

2. (2 points) What is the capacitive reactance for this circuit at the initial frequency?
$X_C = 1/(2\pi fC) = 1/(2\pi(3333\ Hz)(22x10^{-6}\ F)) = 2.17\ ohms$

3. (2 points) What is the impedance for this circuit at the initial frequency?
$Z = (R^2 + (X_L - X_C)^2)^{1/2} = 2320\ ohms$

4. (2 points) What is current in this circuit at the initial frequency?
$I_{rms} = V_{rms}/Z = 0.00517\ amps$

5. (2 points) What is the average power dissipated in this circuit at the initial frequency?
$P = I_{rms}V_{rms}\cos(phi) = I_{rms}V_{rms}(R/Z) = 1.07*10^{-4}\ watts$

6. (2 points) What is maximum current that can flow in this circuit ?
NOTE: *peak* current at this frequency would be sqrt(2)*I_{rms}, but instead we want to consider the *maximum rms* current for the circuit, AT ANY FREQUENCY. This occurs at the frequency where Z is minimized for the circuit (see questions 3 and 4). Z is minimized when $X_L = X_C$, so $Z_{min} = R$.
$I_{maxrms} = V_{rms}/Z_{min} = V_{rms}/R = 3.00\ amps$

7. (2 points) At what frequency in Hz will the maximum current flow in this circuit ?
$f_0 = 1/(2\pi(LC)^{1/2}) = 102\ Hz$

8. (2 points) What is maximum power dissipated in this circuit?
This occurs when frequency $f = f_0$, which means $Z = Z_{min} = R$, which also means phi = 0.
$P_{max} = V_{rms}I_{maxrms} = 36.0\ watts$

(If you need more space for writing, please use the back of this page)