# Practical Lab 3

Due date: 5 April 2024 | Software Design 1 (SDN150S)

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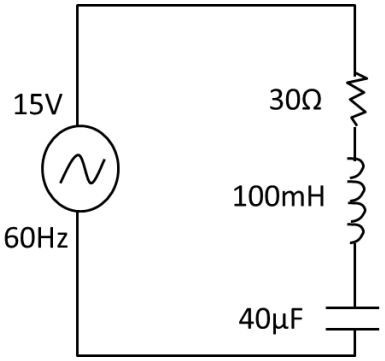
**Question 1: Resolving a Series RLC Circuit**




**Description:** A 40µF capacitor is in series with 100mH inductor, a 30ohm resistor, and a 15V AC signal with a frequency of 60Hz. Write a C program utilizing your knowledge of functions to perform the following operations:

a) Calculate the capacitive reactance and the inductive reactance in the circuit.
b) Determine the impedance.
c) Calculate the rms current in the circuit.
d) Calculate the voltage across the resistor, the inductor, and the capacitor.
e) How much power is consumed in the circuit?
f) What is the resonant frequency of the circuit?

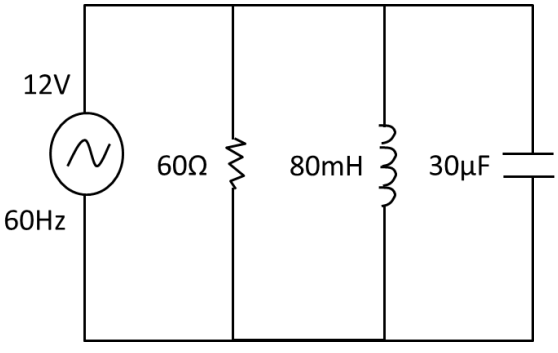
**Programming Steps**:

1. Include the required headers and macro definitions.
2. Declare your function signature/prototype.
3. Initialize and assign the input values from circuit.
4. Write the function call to perform the necessary operations.
5. Print the output to console.
6. Define all function definitions called in the main function (use the formulae sheet below).
7. Run & debug your program for errors.

Remember to check ***manual.cs50.io*** for header files and corresponding standard library functions.

**Question 2: Resolving a Parallel RLC Circuit**

**Description**: Using functions with no return type, calculate the impedance as well as the current flowing in each element in a parallel RLC circuit as shown below.



**Programming Steps**:

1. Include the required headers and macro definitions.
2. Declare your function signature/prototype.
3. Initialize and assign the input values from circuit.
4. Write the function call to perform the necessary operations.
5. Print the output to console.
6. Define all function definitions called in the main function (use the formulae sheet below).
7. Run & debug your program for errors.

**Question 3: Student Test Score Analyzer**

**Description**: Develop a program that receives test scores for 5 students, each having 5 test scores. These scores are to be stored in a two-dimensional array and then analyzed by a function. For analysis, the function is tasked with executing basic statistical operations such as calculating the mean, standard deviation, minimum, and maximum scores, and returning these results to the main function using a pointer.

**Programming Steps**:

1. Prompt the user to enter 5 test scores for each of the 5 students.
2. Store these scores in a 5x5 two-dimensional array.
3. Pass the *array* to a statistical analysis function.
4. Within the function, calculate the Mean, Standard Deviation, Minimum. & Maximum score.
5. Return the results to the main function using a pointer.
6. Display the statistical results to the user.

**Condition:**

- Ensure that the program can pass a 2d-array to the function, perform the calculation, and return an array containing the results back to the main function.
- Provide options for the user to either re-enter the scores for all students or exit the program.

**FORMULAE SHEET**

1. Capacitive Reactance ($X_C$) = $\frac{1}{2\pi fc}$
2. Inductive Reactance ($X_L$) = $2\pi fl$
3. Impedance (Z) = $\sqrt{R^2 + (X_L - X_C)^2}$
4. RMS Current ($I_{rms}$) = $\frac{Volatge\ Source}{Impedance} = \frac{V_s}{Z}$
5. Source Voltage ($V_S$) = $\sqrt{{V_R}^2 + (V_L - V_C)^2}$
6. Voltage across: **Resistor** ($V_R$) = $I_{rms} \times R$ | **Inductor** ($V_L$) = $I_{rms} \times X_L$ | **Capacitor** ($V_C$) = $I_{rms} \times X_C$
7. Source Current ($I_S$) = $\frac{V_S}{Z}$
8. Current across: **Resistor** ($I_R$) = $\frac{V_S}{R}$ | **Inductor** ($I_L$) = $\frac{V_S}{X_L}$ | **Capacitor** ($I_C$) = $\frac{V_S}{X_C}$
9. Power (P) = ${I_{rms}}^2 \times R$
10. Resonant Frequency ($F_R$) = $\frac{1}{2\pi\sqrt{LC}}$