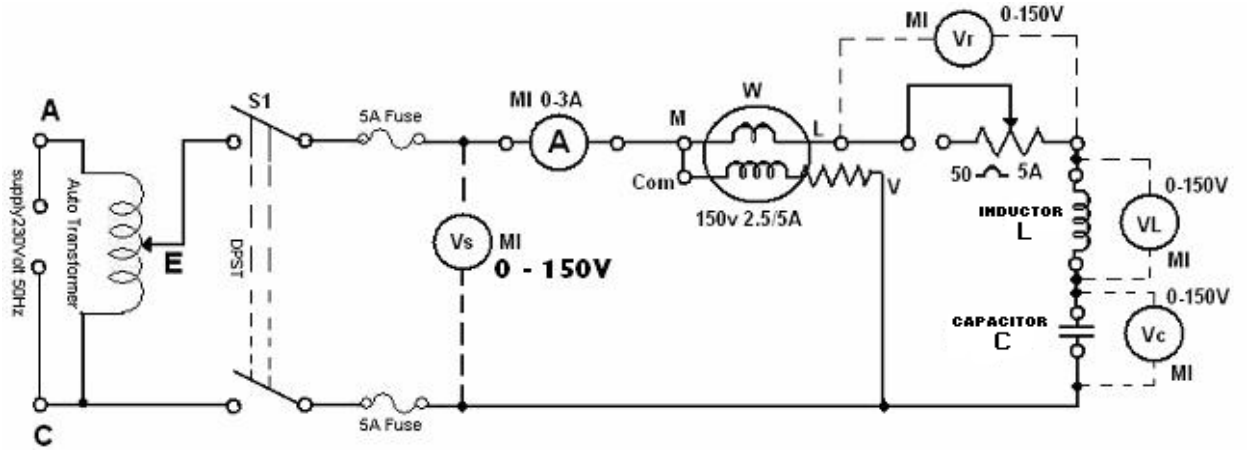
DEPARTMENT OF ELECTRICAL ENGINEERING

FIRST YEAR E.T. LAB EXP. NO. – 3

SERIES RLC Circuit



OBJECTIVE: To study the behavior of a series R-L-C circuit.

PROCEDURE :

1. Connect the circuit as shown in the diagram.
2. Adjust the rheostat for maximum resistance and the auto transformer to the position of zero-output voltage and switch on the supply.
3. Adjust the voltage across the circuit to about 70 V, the resistance to about $\underset{\sim}{}$ 20Ω, and the Cap to 35μF, and the inductor to 35mH and note I, V_S, V_L, V_C, V_R and W.
4. Connect the Cap for 35μF and repeat step 3 for all five inductance values. Keep R at 20W.
5. Connect the Cap for 70μF and then 140 μF and repeat step 3 again for all inductance values with R held constant.
6. Steps 3,4 and 5 *may be repeated* for another value of resistance $\underset{\sim}{}$ 40Ω.
7. Compare the values of phase angle as obtained from the meter readings and from the phasor diagrams. (From the phasor diagrams compute cos θ and θ as given in the last two columns of the table)

OBSERVATION:

TABLE- 1 Study of series R- L-C circuit

Sl No		C	L (appx)	I	VR	Vc	VL	W	Remarks
A	1	35 μF	7 mH						
	2		30 mH						
	3		33 mH						
	4		104 mH						
B	1	70 μF	7 mH						
	2		30 mH						
	3		33 mH						
	4		104 mH						
C	1	140 μF	7 mH						
	2		30 mH						
	3		33 mH						
	4		104 mH						

Draw phasor diagrams showing I, V_S, V_L, V_C, & V_R for:

a. C = 35μF and two inductances in cumulative, series (104 mH);
b. C = 140μF and two inductances in differential, parallel (7.4 mH);

Account for the resistance of the inductor coils also when drawing the phasor diagram

DISCUSSION:

1. Do you expect θ to be a constant? Is it so as per your experiment? Why?

2. Is IV_R equal to W? Compare the difference of wattmeter reading W with IV cos θ for a few readings and give your comments.
3. Discuss the phenomenon of series resonance in an electrical circuit.
4. Is it possible to have a voltage drop across the energy storage element greater than the supply?
5. How will you experimentally identify the different combinations of inductor connections?

Capacitance values available:

a. The two 70μF Caps in series ---- 35 μF
b. One Cap only ---- 70 μF
c. Two Caps in parallel ---- 140 μF

Approximate Inductance values L_{eq} available**:

a. Two inductances in differential, parallel ----- 7.4 mH [$L_{eq} = (L^2 – M^2) / 2(L + M)$]
b. Two inductances in differential, series ------ 30 mH [$L_{eq} = 2(L - M)$]
c. Two inductances in cumulative, parallel ------- 26 mH [$L_{eq} = (L^2 – M^2) / 2(L - M)$]
d. Any one inductance only --------- 33 mH
e. Two inductances in cumulative, series -------104 mH [$L_{eq} = 2(L + M)$]

**[assumed that the two inductances, L, are identical and the coupling factor is 0.57]