American International University-Bangladesh (AIUB)
Engineering Faculty
EEE 2101: Electrical Circuits-2 (AC)

Assignment: Marks Distribution System

	With in December 16, 2016	**With in December 24, 2016**	**With in December 27, 2016**	**After December 27, 2016**
Parallel Resonance Circuit	4	3	2	0
Network Theorem	4	3	2	0
Polyphase Balance and Unbalanced System and Power Measurement	8	6	4	0
Couple Circuit	4	3	2	0
Total Marks	**20**	**15**		**0**

Parallel Resonance Circuit

[**Q1**] For a practical parallel resonance circuit write the express of followings: (**i**) Condition for parallel resonance in terms of susceptance, (**ii**) Condition for parallel resonance in terms of reactance, (**iii**) Resonance frequency, (**iv**) Quality factor, and (**v**) Bandwidth

[**Q2**] For a wave-trap circuit write the express of followings: (**i**) Condition for parallel resonance in terms of susceptance, (**ii**) Condition for parallel resonance in terms of reactance, (**iii**) Resonance frequency, (**iv**) Quality factor, and (**v**) Bandwidth

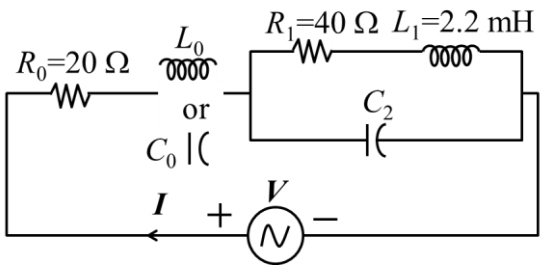
[**P1**] Two impedances $\boldsymbol{Z}_L=R_L+j14$ ohm and $\boldsymbol{Z}_C=8.54-j6.83$ ohm are connected in parallel. Calculate the value of R_L to make this circuit is resonance.

[**P2**] Two impedances $\boldsymbol{Z}_L=4+j14$ ohm and $\boldsymbol{Z}_C= -jX_C$ ohm are connected in parallel. Calculate the value of C to make this circuit is resonance at 1 kHz.

[**P3**] Two impedances $\boldsymbol{Z}_L=4+jX_L$ ohm and $\boldsymbol{Z}_C=8.54-j6.83$ ohm are connected in parallel. Calculate the value of L to make this circuit is resonance at 1 kHz.

[**P4**] A RL series branch having $R_L= 7$ ohm and $L =2.23$ mH are connected with a RC series branch having $R_C= 8.54$ ohm and $C =23.3$ μF. Calculate (**i**) the resonance frequency, (**ii**) the quality factor, and (**iii**) the bandwidth.

[**P5**] Design a resonance circuit as shown in the following figure to pass any wave of 15 kHz and block 45 kHz wave. (**i**) Find the value of C_2. (**ii**) What type of reactance (inductive or capacitive) must be placed in series with the source? (**iii**) Calculate the value of L_0 or C_0 which is required to put. (**iv**) Calculate the impedance and current if the circuit is impressed by 200 V.

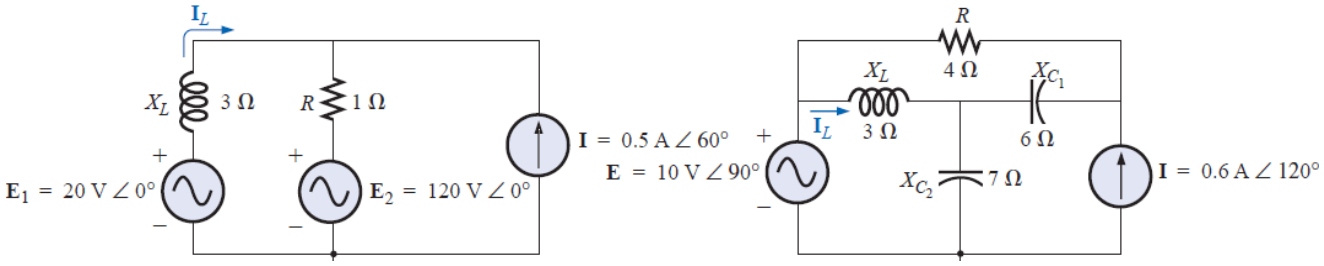


Network Theorem

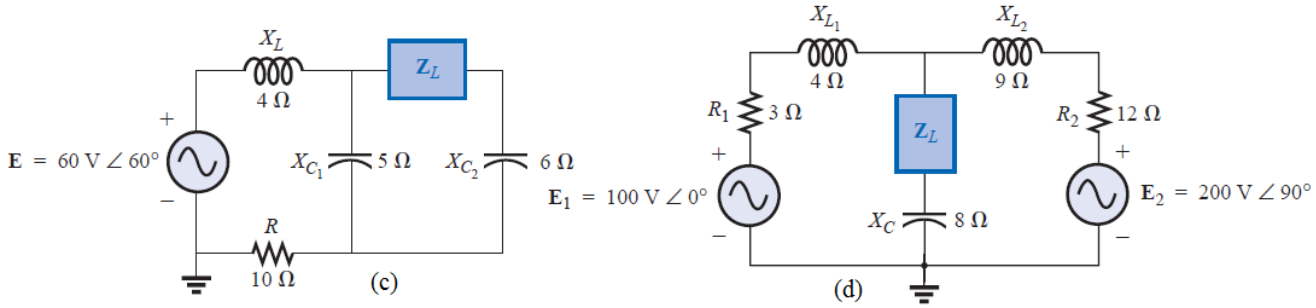
[**Q1**] State the Maximum Power Transfer Theorem. Write the expression of load impedance in terms of Thevenin's impedance to receive the maximum power by load impedance.

[**Q2**] State the Super Position Theorem.

[**P1**] Using superposition, determine the current $\boldsymbol{I}_L$ for each network as shown in the following figure.



[**P2**] Find the load impedance $\boldsymbol{Z}_L$ for the networks of following figures for maximum power to the load, and find the maximum power to the load.



Polyphase Balanced System

[**P1**] If the line current is 120 A and line voltage is 440 V for a balanced five-phase system, find the magnitude of the phase voltage and the phase current for (**i**) the star-connection, and (**ii**) the mesh-connection.

[**P2**] A three-phase Y-connected balanced source with *abc* sequence is connected with a Y-connected balanced load having the per phase impedance 10+*j*20 Ω. The neutrals of both source and load are connected. The phase voltage of source is given by $\boldsymbol{E}_{an}$=250∠0° V. Calculate (**i**) the phase voltages ($\boldsymbol{V}_{an}$, $\boldsymbol{V}_{bn}$, $\boldsymbol{V}_{cn}$), (**ii**) the line voltages ($\boldsymbol{E}_{AB}$, $\boldsymbol{E}_{BC}$, $\boldsymbol{E}_{CA}$), (**iii**) the phase currents ($\boldsymbol{I}_{an}$, $\boldsymbol{I}_{bn}$, $\boldsymbol{I}_{cn}$), (**iv**) the line currents ($\boldsymbol{I}_{Aa}$, $\boldsymbol{I}_{Bb}$, $\boldsymbol{I}_{Cc}$), (**v**) the power factor and reactive factor, and (**vi**) the power, reactive power and apparent power.

[**P3**] A three-phase Δ-connected balanced source with *abc* sequence is connected with a Δ-connected balanced load. In each phase, a 20 ohm resistance is connected in parallel with a capacitor having 15 ohm reactance. The phase voltage of source is given by $\boldsymbol{E}_{AB}$=220∠0° V. Calculate (**i**) the phase voltage, (**ii**) the line voltage, (**iii**) the phase current, (**iv**) the line current, (**v**) the power factor and reactive factor, and (**vi**) the power, reactive power and apparent power.

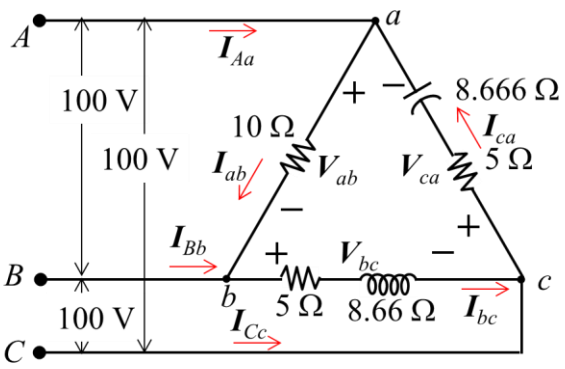
[**P4**] A three-phase Y-connected balanced source with *abc* sequence is connected with a Δ-connected balanced load having the per phase impedance 12-*j*9 Ω. The phase voltage of source is given by $\boldsymbol{E}_{an}$=200∠0° V. Calculate (**i**) the phase voltage, (**ii**) the line voltage, (**iii**) the phase current, (**iv**) the line current, (**v**) the power factor and reactive factor, and (**vi**) the power, reactive power and apparent power.

[**P5**] A three-phase Δ-connected balanced source with *abc* sequence is connected with a Y-connected balanced load having the per-phase impedance 3+*j*4 ohm. The phase voltage of source is given by $\boldsymbol{E}_{AB}$=110∠0° V. Calculate (**i**) the phase voltage, (**ii**) the line voltage, (**iii**) the phase current, (**iv**) the line current, (**v**) the power factor and reactive factor, and (**vi**) the power, reactive power and apparent power.

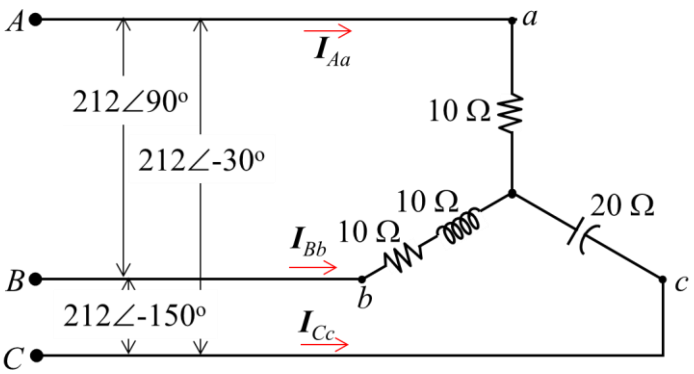
[**P6**] A three-phase motor takes 10 kW to 0.7 power factor lagging from a source of 440 volts. It is in parallel with a balanced delta load having 18 ohms resistance and 24 ohms inductive reactance in series in each phase. Find the total volt-amperes, power, line current and power factor of the combination.

Polyphase Unbalanced System

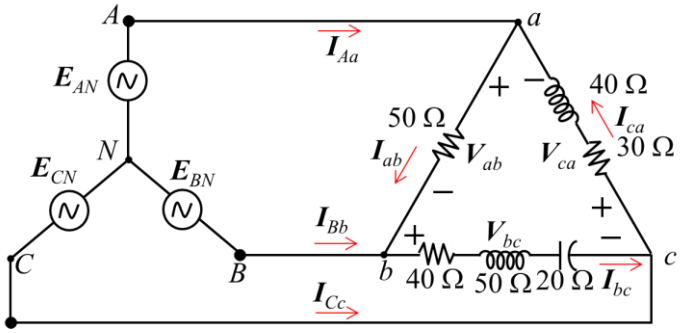
[**P1**] A balanced three-phase source of 100 V is connected with an unbalanced Δ–connected load as shown in the following figure. Calculate (**i**) the phase currents (***I***$_{ab}$, ***I***$_{bc}$, ***I***$_{ca}$), (**ii**) the line currents (***I***$_{Aa}$, ***I***$_{Bb}$, ***I***$_{Cc}$), (**iii**) the overall power, reactive power, apparent power.



[**P2**] A balanced three-phase source of 212 V is connected with an unbalanced Y–connected load as shown in the following figure. Calculate (**i**) the line currents (***I***$_{Aa}$, ***I***$_{Bb}$, ***I***$_{Cc}$), and (**ii**) the overall power, reactive power, apparent power.



[**P3**] Refer to the following figure, ***E***$_{AN}$, ***E***$_{BN}$, and ***E***$_{CN}$ are balanced three-phase voltages with magnitude of 115.4 volts and a phase sequence the sequence of *ABC*. Calculate (**i**) the phase voltages of load (***V***$_{ab}$, ***V***$_{bc}$, ***V***$_{ca}$), (**ii**) the phase currents of load (***I***$_{ab}$, ***I***$_{bc}$, ***I***$_{ca}$), (**iii**) the line currents (***I***$_{Aa}$, ***I***$_{Bb}$, ***I***$_{Cc}$). (**iv**) the total power, reactive power, and apparent power.



Power Measurement of Polyphase System

[**Q1**] With vector diagram by using the two wattmeter method the measured power is given by: $(\sqrt{3})V_L I_L \cos\theta$.

[**Q2**] Draw the power factor vs watt-ratio curve.

[**P1**] The two wattmeter method produces wattmeter readings are 1560 W and 2100 W when connected to balanced delta-connected load. If the line voltage is 220 V, calculate (**i**) the per-phase power, (**ii**) the per-phase reactive power, (**iii**) the power factor, and (**iv**) the phase impedance.

[**P2**] Let the line voltage 208 V and the wattmeter readings of the balanced system are -560 W and 800 W. Determine (**i**) the total power, (**ii**) the total reactive power, (**iii**) the power factor, (**iv**) the phase impedance, and (**v**) Is the impedance inductive or capacitive.

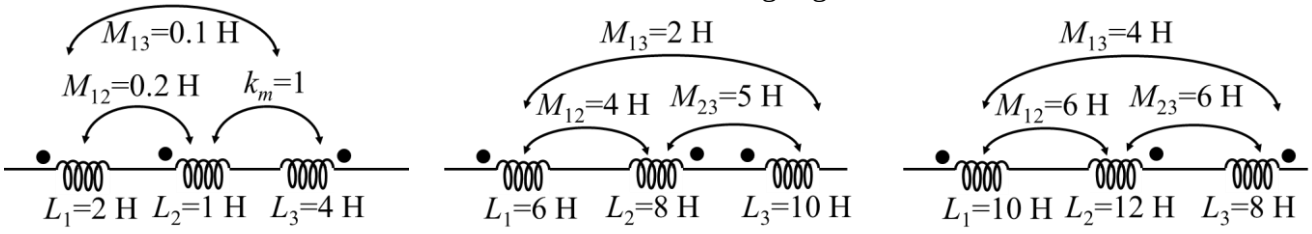
[**P2**] For the unbalanced delta-connected load of following figures with two properly connected wattmeters: (**i**) Determine the magnitude and angle of the phase currents. (**ii**) Calculate the magnitude and angle of the line currents. (**iii**) Determine the power reading of each wattmeter. (**iv**) Calculate the total power absorbed by the load. (**v**) Compare the result of part (iv) with the total power calculated using the phase currents and the resistive elements.

Coupling Circuit

[P1] Two similar coils have a coupling coefficient of 0.25. When they are connected cumulatively in series, the total inductance is 80 mH. Calculate the self-inductance inductance of each coil. Also, calculate the total inductance when the coils are differentially connected in series.

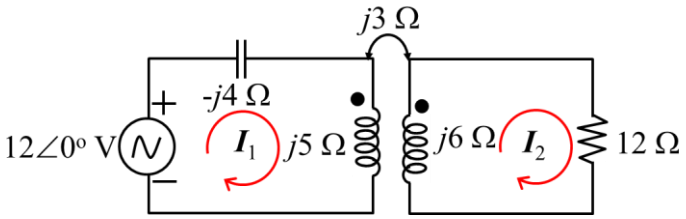
[P2] Two inductively coupled coils have self-inductances 7.5 H and 25 H. If the coupling coefficient is 0.8 (i) find the value of mutual inductance between the coils, and (ii) what is the maximum possible mutual inductance?

[P3] Find the total inductance of the series coils of following Figures.

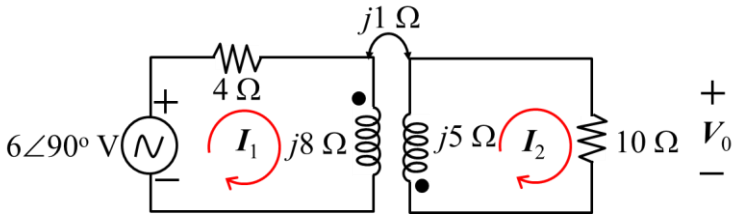


(a) (b) (c)

[P4] For the following circuits write the loop equations and calculate (i) the currents, $\boldsymbol{I}_1$, and $\boldsymbol{I}_2$, and (ii) the equivalent impedance. and (iii) the consumed power.



[P5] For the following circuits write the loop equations and calculate (i) the currents, $\boldsymbol{I}_1$, $\boldsymbol{I}_2$, and $\boldsymbol{V}_0$, and (ii) the equivalent impedance. and (iii) the consumed power.



[P6] For the following circuits write the loop equations and calculate (i) the currents, $\boldsymbol{I}_1$, and $\boldsymbol{I}_2$, and (ii) the equivalent impedance. and (iii) the consumed power.