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

Final Term Assignment 01 (Resonance Circuit) [Total 10 Marks]

Submission Date	Marks	Tick on following
With in April 26, 2017 [Exam day 5]	10	
April, 26, 2017 to May 2, 2017	5	
After May 2, 2017	0	

Polyphase Balanced System

[**Q1**] How many ways the poly-phase system can be connected?

[**Q2**] Show the star connection and mesh connection for a five phase source system.

[**Q3**] With proper circuit diagram and vector diagram show the line voltage for a Y-connected *abc* sequence source is leads the phase voltage by 30^o.

[**Q4**] With proper circuit diagram and vector diagram show the line current for a Δ-connected *abc* sequence source is lags the phase current by 30^o.

[**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 *ab*c sequence is connected with a Y-connected balanced load having the per phase impedance $10+j20\ \Omega$. The neutrals of both source and load are connected. The phase voltage of source is given by $\boldsymbol{E}_{an}=250\angle 0^o$ 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, (**vi**) the power, reactive power and apparent power, and (**vii**) Draw the vector diagram by showing all phase and line voltages and phase current and line currents.

[**P3**] A three-phase Δ-connected balanced source with *ab*c 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 $\boldsymbol{E}_{AB}=220\angle 0^o$ 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, (**vi**) the power, reactive power and apparent power, and (**vii**) Draw the vector diagram by showing all phase and line voltages and phase current and line currents.

[**P4**] A three-phase Y-connected balanced source with *ab*c sequence is connected with a Δ-connected balanced load having the per phase impedance $12-j9\ \Omega$. The phase voltage of source is given by $\boldsymbol{E}_{an}=200\angle 0^o$ 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 *ab*c 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 $\boldsymbol{E}_{AB}=110\angle 0^{o}$ 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.

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**] Write the mathematical expression of (i) real power, (ii) reactive power, (iii) power factor angle, and (iv) power factor in terms of the two watt meters reading of W_a and W_b.

[**Q4**] Draw the power factor vs watt-ratio curve.

[**Q5**] Explain the significance of (i) equal wattmeter readings, (ii) a zero reading on one wattmeter, (iii) reading of W_a is greater than the reading of W_b, and (iv) reading of W_b is greater than the reading of W_a.

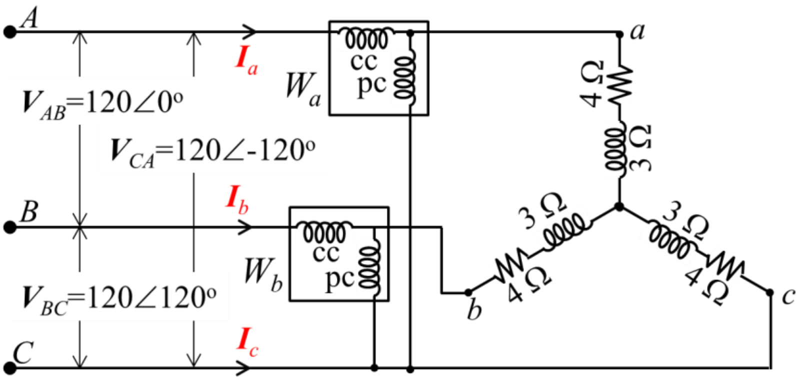
[**P1**] The two wattmeter method produces wattmeter readings are 1560 W and 2100 W when connected to balanced delta-connected load. If the line voltage is 220 V, calculate (**i**) the per-phase power, (**ii**) the per-phase reactive power, (**iii**) the power factor, and (**iv**) the phase impedance.

[**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.

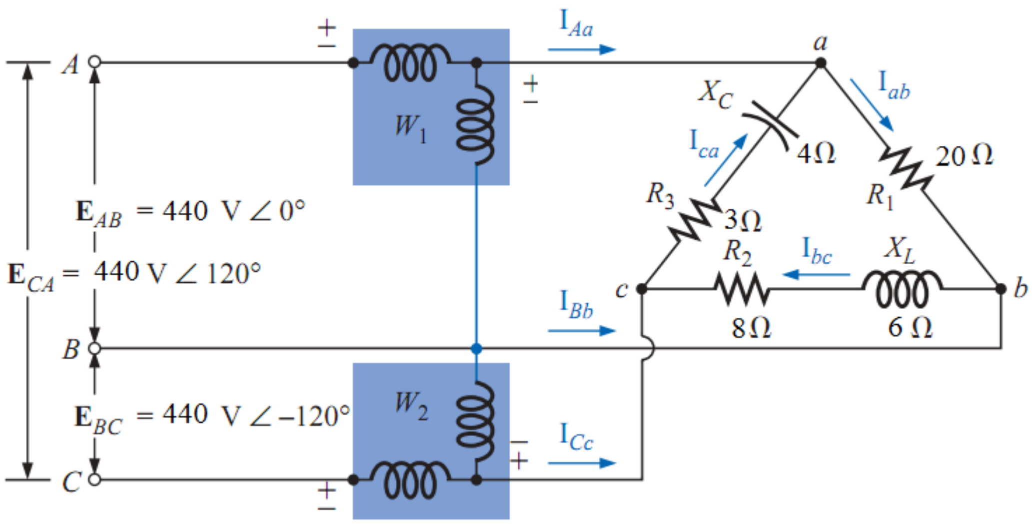
[**P3**] In a three phase circuit, the wattmeter W_a reads 300 watts and W_b reads 500 watts. When the potential coil of W_c is disconnected at *c* and connected at *b*, the needle goes against the down-scale stop. Calculate the total power, watt ratio, reactive power, apparent power and power factor.

[**P4**] A three-phase, 250 V motor load has a power factor of 0.8. Two wattmeters connected to measure the power show the input to be 40 kW. Find the reading on each instrument.

[**P5**] For the balanced Y-connected load of following figures with two properly connected wattmeters: (**i**) 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.

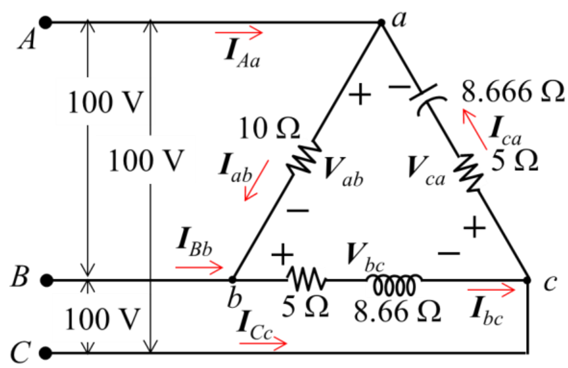


[**P6**] For the unbalanced delta-connected load of following figures with two properly connected wattmeters: (**i**) Determine the magnitude and angle of the phase currents. (**ii**) Calculate the magnitude and angle of the line currents. (**iii**) Determine the power reading of each wattmeter. (**iv**) 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.

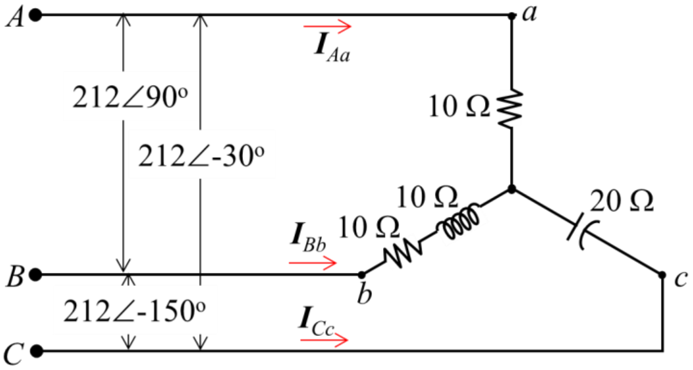


Polyphase Unbalanced System

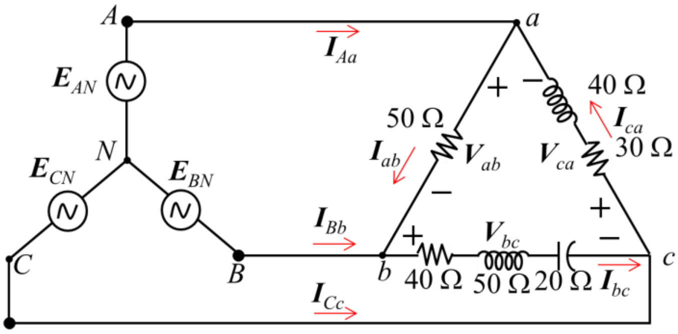
[**P1**] A balanced three-phase source of 100 V is connected with an unbalanced Δ–connected load as shown in the following figure. Calculate (**i**) the phase currents (I_{ab}, I_{bc}, I_{ca}), (**ii**) the line currents (I_{Aa}, I_{Bb}, I_{Cc}), (**iii**) the overall power, reactive power, apparent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



Coupling Circuit

[**Q1**] Define coupling circuit. Classify the coupling circuit.

[**Q2**] Define magnetic coupling circuit, self-flux, leakage flux and mutual flux.

[**Q3**] Explain briefly explain how to identify the sign of mutual inductance.

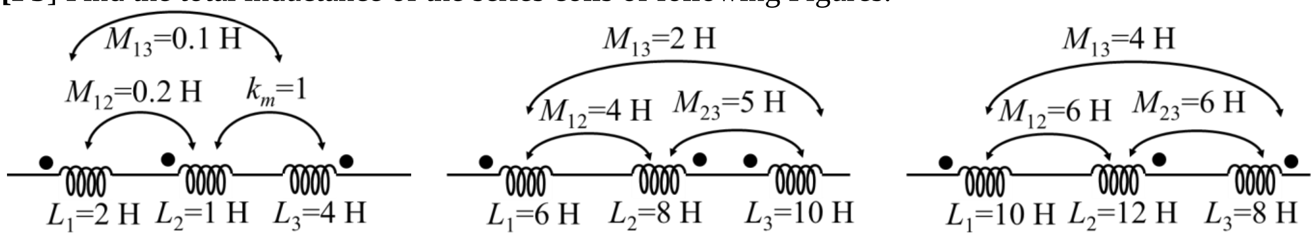
[**Q4**] Define coupling co-efficient. Based on the range of coupling coefficient of a magnetic circuit define the perfectly coupling, tightly coupling and loosely coupling circuits.

[**Q5**] Define transformer, primary side and secondary side.

[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.

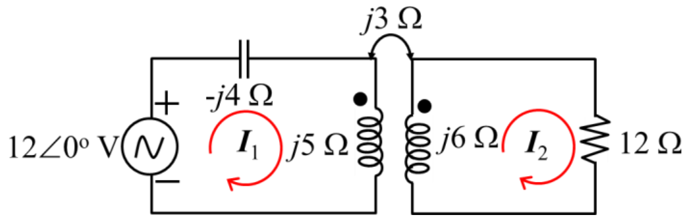
[P2] Two inductively coupled coils have self-inductances 7.5 H and 25 H. If the coupling coefficient is 0.8 (i) find the value of mutual inductance between the coils, and (ii) what is the maximum possible mutual inductance?

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

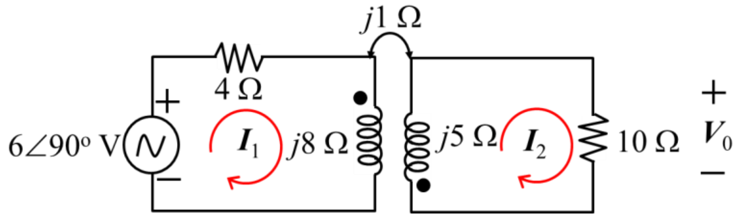


(a) (b) (c)

[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.