INC 122 Electric Circuits Analysis II

Semester: 2/2022
Schedule: Tue 16.30–18.20 (A, B) **Classroom:** CB 40610(1)
Exams: Waiting for an announcement
Instructors:

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Required pre-requisites:
INC 121 Electric Circuits Analysis I

Course Description:
Capacitor and inductor, basic RL and RC circuits, basic RLC circuits, natural response of RL, RC, and RLC circuits, phasor analysis, AC circuit power analysis, Frequency response.

Course Objectives

- To teach students basic mathematical and computational tools for RC, RL, RLC circuits
- To train students to identify, model analyze, design, and simulate RC, RL, RLC circuits
- To teach students using a software package to analyze the mathematic circuit.

Course Learning Outcomes (CLOs):

- Able to explain and analyze electric circuits in the time-domain using transient response analysis method.
- Able to analyze AC using phasor technique.
- Able to calculate the power of the AC networks.

Learning Activities: The courses activities include lectures, computer laboratory modelling tutorials, presentations, group discussions, assignments, and reports on case studies.

Learning Resources: Website https://inc.kmutt.ac.th/~sudchai.boo/Teaching/inc122/inc122.html, LEB2 and Facebook group. They can include lecture material, supplementary course notes, problem sheets and solutions, and useful references.

The criterion using in class are:
Level 5: Excellent $(80-100\%)$, Level 4: Good $(70-79\%)$, Level 3: Expected $(60-69\%)$, Level 2: Fair $(50-59\%)$, Level 1: Poor/Minimal Pass $40-49\%$

CLOs	Performance Indicator (PI)	Level
CL01: Be able to explain and analyze electric circuits in the time domain using the transient response analysis method.	PI1: Construct Differential Equations of the RL, RC, and RLC circuit	5: Be able to construct any RL, RC, and RLC circuits in terms of the differential equation without any mistakes.
		4: Be able to construct any RL, RC, and RLC circuits in terms of the differential equation with one or two mistakes.
		3: Be able to construct any RL, RC, and RLC circuits in terms of the differential equation. Show the confusion about the difference between a differential equation and an integrodifferential equation.
		2: Be able to construct any RL, and RC, circuits in terms of the differential equation without any mistakes. But have problems with RLC circuits.
		1: Be able to construct any RL, RC, and RLC circuits in terms of the differential equation containing more than two mistakes. However, the configuration of the differential equation is still correct.
	PI2: Explain and analyze the transient response of the RC and RL circuit.	5: Be able to explain and analyze the transient response of the RC and RL circuit in terms of the first-order system. Students can calculate the time constant and the setting time of the circuit without any mistakes.
		4: Be able to explain and analyze the transient response of the RC and RL circuit in terms of the first-order system. Students can calculate the time constant and the setting time of the circuit with some minor mistakes.
		3: Be able to explain and analyze the transient response of the RC and RL circuit in terms of the first-order system. Students can calculate the time constant and the setting time of the circuit with some minor mistakes.
		2: Be able to explain and analyze the transient response of the RC and RL circuit in terms of the first-order system. Students can calculate the time constant with some minor mistakes.
		1: Be able to explain and analyze the transient response of the RC and RL circuit in terms of the first-order system. Students can calculate the time constant with some mistakes.
	PI3: Explain and analyze the transient response of the RLC circuit.	5: Be able to explain and analyze the transient response of the RLC circuit. Be able to identify all categories of the transient response in terms of the second-order system without any mistakes.
		4: Be able to explain and analyze the transient response of the RLC circuit. Be able to identify all categories of the transient response in terms of the second-order system with some minor mistakes.
		3: Be able to explain and analyze the transient response of the RLC circuit. Be able to identify all categories of the transient response in terms of the second-order system with some mistakes.
		2:Be able to explain and analyze the transient response of the RLC circuit. Be able to identify at least one category of the transient response in terms of the second-order system without any mistakes.
		1: Be able to explain and analyze the transient response of the RLC circuit. Be able to identify at least one category of the transient response in terms of the second-order system with some mistakes.
	PI4: Using MATLAB and SimScape to analyze the transient response of the RC, RL, and RLC circuits.	5: Be able to use MATLAB and SimScape to plot and measure all characteristics of the transient response.
		4: Be able to use MATLAB and SimScape to plot and measure all characteristics of the transient response with some minor mistakes.

CLOs	Performance Indicator (PI)	Level
		3: Be able to use MATLAB and SimScape to plot and measure all characteristics of the transient response. However, the students need some hints from the lecture or TA.
		2: Be able to use MATLAB and SimScape to plot and measure all characteristics of the transient response. However, the students need help from the lecture or TA.
		1: Be able to use MATLAB and SimScape to plot and measure all characteristics of the transient response by changing the parameters of the example.
CLO2: Be able to analyze AC using the phasor technique.	PI1: Explain and analyze steady-state AC circuits in terms of phasor form.	5: Be able to use the phasor concept to explain and analyze the steady-steady circuits using all analysis techniques such as Nodal and mesh analysis.
		4: Be able to use the phasor concept to explain and analyze the steady-steady circuits using all analysis techniques, such as Nodal and mesh analysis, with some minor mistakes.
		3: Be able to use the phasor concept to explain and analyze the steady-steady circuits using all analysis techniques, such as Nodal and mesh analysis, with some mistakes.
		2: Be able to construct the problem correctly. There are some significant mistakes in the calculation process.
		1: Be able to construct the problem with some minor mistakes.
	PI2: Explain and analyze steady-state AC circuits in terms of phasor form by using MATLAB	5: Be able to use MATLAB to construct and solve the problem correctly.
		4: Be able to use MATLAB to construct and solve the problem with some minor mistakes.
		3: Be able to use MATLAB to construct and solve the problem with some hints.
		2: Use MATLAB to construct and solve the problem correctly with some help from the lecture and TA.
		1: Use MATLAB to construct and solve the problem by changing some parameters from the examples.
	PI3: Calculate the maximum power transfer for the AC circuit.	5: Be able to use Nodal and Mesh analysis as well as the Thevenin equivalent circuit to calculate the maximum power transfer without any mistakes.
		4: Be able to use Nodal and Mesh analysis as well as the Thevenin equivalent circuit to calculate the maximum power transfer with some minor mistakes.
		3: Be able to use Nodal and Mesh analysis as well as the Thevenin equivalent circuit to calculate the maximum power transfer with some mistakes. However, the students can correct them with some suggestions.
		2: Be able to use Nodal and Mesh analysis as well as the Thevenin equivalent circuit to calculate the maximum power transfer with some significant mistakes. However, the students can correct the errors after some helps.
		1: Be able to construct the problem correctly and can show how to solve it. However, the students cannot calculate the solution numerically.
	PI4: Explain and analyze the power of the AC circuit.	5: Be able to calculate and explain all topics of AC power: Apparent power, real power, reactive power, complex power, and power factor.
		4: Be able to calculate and explain most topics of AC power: Apparent power, real power, reactive power, complex power, and power factor.
		3: Be able to calculate and explain some topics of AC power: Apparent power, real power, reactive power, complex power, and power factor.
		2: Know how to calculate apparent power, real power, and reactive power.
		1: At least you know what real power is.
	PI5: Explain and analyze the Three-phase circuit	5: Be able to calculate and explain all topics of the three-phase circuit.

CLOs	Performance Indicator (PI)	Level
		4: Be able to calculate and explain all topics of the three-phase circuit with some minor mistakes.
		3: Be able to calculate and explain all topics of the three-phase circuit with some mistakes but correct them after some hints.
		2: Be able to calculate and explain all topics of the three-phase circuit by adapting the example.
		1: Be able to explain some topics related to the three-phase circuits.

Course text:

- William H. Hayt, Jr., Jack E. Kemmerly, and Steven M. Durbin "Engineering Circuit Analysis", 8th Edition McGraw-Hill, 2012.
- J. David Irwin, and R. Mark Nelms "Basic Engineering Circuit Analysis", 11th, Wiley, 2015

Grading scheme:
In class activities: 15% Midterm (or Quizzes) Exam: 35% Final (or Quizzes) Exam: 35% term assignment: 15%

Course Schedule (Tentative)

Week	Topic	Date	Lecturer
1	Introduction	17 Jan 23	Sudchai
2	Capacitors	24 Jan 23	Sudchai
3	Inductors	31 Jan 23	Sudchai
4	RC and RL Circuits I	7 Feb 23	Sudchai
5	RC and RL Circuits II	10 Feb 23	Sudchai
6	RLC Circuit I	17 Feb 23	Sudchai
7	Midterm Exam	28 Feb 23	Sudchai

Week	Topic	Date	Lecturer
8	RLC Circuit II	7 Mar 23	Sudchai
9	AC Steady-State Circuit	14 Mar 23	Sudchai
10	Phasor Concept	21 Mar 23	Sudchai
11	Phasor Diagram	28 Mar 23	Sudchai
12	Exam Break	3-7 Apr 23	Sudchai
13	Special Vacations	10-14 Apr 23	Sudchai
14	Power Analysis I	18 Apr 23	Sudchai
15	Power Analysis II	25 Apr 23	Sudchai
16	Three-Phase Circuit I	2 May 23	Sudchai
17	Three-Phase Circuit II	9 May 23	Sudchai
19	Final Exam	16 May 23	Sudchai

Note: All topics and timetable may be changed!