Lahore University of Management Sciences

EE240 - Circuits-I

Fall 2024

Instructors	Dr. Zubair Khalid
Room No.	9-251 (Zubair)
Office Hours	TBA
Email	Zubair.khalid@lums.edu.pk
Telephone	042 3560 8477
Secretary/TA	
TA Office Hours	
Course URL (if any)	https://www.zubairkhalid.org/ee240_2022.html

Course Teaching Methodology (Please mention following details in plain text)
• Teaching Methodology: In-Person • Attendance is mandatory. Students not frequently attending the lecture will find difficult to cope with the course. We may take pop-up quizzes to gauge active participation in the class.

Course Basics				
Credit Hours	3			
Lecture(s)	Nbr of Lec(s) Per Week	2	Duration	1 hour and 15 minutes
Recitation/Lab (per week)	Nbr of Lec(s) Per Week		Duration	
Tutorial (per week)	Nbr of Lec(s) Per Week	1	Duration	1 hour (need based)

Course Distribution	
Core	Core Course for Electrical Engineering
Elective	
Open for Student Category	BS students
Close for Student Category	

COURSE DESCRIPTION
The course provides an introduction to circuit analysis. Topics covered include introduction to passive components (R, L, C), independent and controlled energy sources, lumped parameter models, conventions for describing networks, analysis and solution of first order and second order circuits, determination of initial conditions in these circuits and their transient and steady state responses.

COURSE PREREQUISITE(S)	
•	Pre-requisites: MATH-101 Calculus-1
•	Co-requisites: None

COURSE OBJECTIVES	
•	Equip the students with the fundamental knowledge of electric quantities (charge, current, voltage), basic passive components R, L,C and their interactions
•	Enable the students to understand and use network conventions and network topology, formulate network equations using Krichhoff's voltage and current laws
•	Enable the students to analyse first and second order switched circuits for their initial and final condition, transient response etc.

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Course Learning Outcomes	
EE240-	The students should be able to:
CLO1:	Derive and apply working principle of passive components R, L,C and independent and controlled energy sources for device and circuit modeling and analysis
CLO2:	Demonstrate the understanding and use of component and network conventions and network topology
CLO3:	Formulate network equations based on the understanding of Krichhoff's voltage and current laws
CLO4:	Analyze first and second order switched circuits for their initial and final condition, transient response etc.
CLO5:	Solve switched linear networks up to second order using initial conditions

Relation to EE Program Outcomes

EE-240 CLOs	Related PLOs	Levels of Learning	Teaching Methods	CLO Attainment checked in
CLO1	PLO1	Cog-3	Instruction, Tutorial, Assignments	Midterm, Final
CLO2	PLO1	Cog-3	Instruction, Tutorial, Assignments	Midterm, Final
CLO3	PLO1	Cog-3	Instruction, Tutorial, Assignments	Midterm, Final
CLO4	PLO2	Cog-4	Instruction, Tutorial, Assignments	Final
CLO5	PLO2	Cog-4	Instruction, Tutorial, Assignments	Final

Grading break up: Component Details and weightages

Assignment(s)/Homework(s): 20%
Quiz(s): 20%
Mid-term Examination: 25%
Final Examination: 35%

Online Assessment Details:
In case oral viva is conducted online; students are advised to prepare themselves for online assessment (oral viva exam). It is expected that you have a reasonably stable internet connection and you have pre-prepared and familiarized yourself with the indicated online modalities (like Zoom).

Plagiarism policy details:
Usual LUMS plagiarism policy will apply; Following the honor code is expected from students while being assessed in online mode. They are expected to work on their own without consultation from their fellow students for any assessment component except where group work is explicitly indicated; The discussion partners, website, and other sources used in assignments that have contributed to the solution must be acknowledged. Instructions regarding close book task have to be strictly observed; You are advised to work regularly and target consistency in performance. Any abnormal inconsistency in performance in an individual assessment task with the ongoing general performance can be further scrutinized for plagiarism.

Disciplinary Action policy:
Clear cases of noncompliance with regard to violation of honor code, above instructions and plagiarism may also be sent for disciplinary actions. Similarly any other non-serious behavior disrupting the smooth execution of online course may also be referred to DC.

Examination Detail	
Midterm Exam	Yes/No: Yes Combine Separate: Combined Duration: 120 minutes Preferred Date: TBA Exam Specifications: TBA

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Final Exam	Yes/No: Yes Combine Separate: Combined Duration: 180 minutes Exam Specifications: TBA

Course Overview				
Week No.	Book Chapter	Topic	Book sections	Related CLOs & Additional Remarks
1	1 Development of the circuit concept	Course introduction Charge and Energy Relationship of field and circuit concepts	1-1 1-2 1-3	CLO1 3 lectures
		The Capacitance parameter	1-4	
		The Inductance parameter	1-5	
		The Resistance parameter	1-6	
2		Units, scaling, and circuit interpretation of physical systems	1-7 1-8	
3	2 Conventions for describing networks	Reference directions for current and voltage, Active element conventions, The dot convention for coupled circuits	2-1 2-2 2-3	CLO1, CLO2 3 lectures
		Topological description of networks	2-4	
4,5,6	3 Network equations	Kirchhoff's laws, The number of network equations	3-1 3-2	CLO3 7 lectures
		Source transformations, Examples of formulation of network equations	3-3 3-4	
		Examples of formulation of network equations…cont., Loop variable analysis	3-4 3-5	
		Node variable analysis, Determinants: Minors and the Gauss elimination method	3-6 3-7	
		Additional examples of: Solving networks with active dependent sources Solving networks with super nodes Loop analysis with current loops	additional readings	
7		Duality, State variable analysis	3-8 3-9	
8,9	4 First-order differential equations	General and particular solutions, Time constants	4-1 4-2	CLO4, CLO5 6 lectures & Midterm
		The integrating factor	4-3	
		Midterm exam (in class)	All covered	

10		More complicated networks; Thevenin and Norton equivalent of resistive networks	4-4 and additional material	
11	5 Initial conditions in networks	Why study initial conditions, Initial conditions in elements	5-1 5-2	CLO4 4 lectures + Review of midterm exam in tutorial
		Geometrical interpretation of derivatives, Procedure for evaluating initial conditions	5-3 5-4	
12		Initial state of a network	5-5 and additional material	
13,14	6 Differential equations, continued	Second order equation: Internal Excitation	6-1	CLO5 5 lectures
		Networks excited by external energy sources	6-3	
		Response as related to the s-plane location of roots	6-4	
		General solution	6-5	

Textbook(s)/Supplementary Readings

Textbook:

- Network Analysis, 3rd edition, by M. E. Van Valkenburg, Pearson Education or PHI

Additional/Supplementary Reading:

- **Recommended for practice: Basic Engineering Circuit Analysis by J D Irwin and R M Nelms, Wiley, 9th Edition, 2008**
- The Analysis and Design of Linear Circuits by R E Thomas, A J Rosa and G J Toussaint, John Wiley, 6th Edition, 2000
- Electric Circuits Fundamentals by S Franco, Oxford University Press, 2002