FUTURE UNIVERSITY IN EGYPT جامعة المستقبل

Faculty of Engineering & Technology

Analog Integrated Circuits Design

Information :

Course Code :	ELE 526	**Level :**	Undergraduate	**Course Hours :**	3.00- Hours

Department : Specialization of Electronics & Communication

Instructor Information :

Title	Name	Office hours
Associate Professor	Mohamed Hassan Mohamed Elmahlawy	9
Teaching Assistant	Hamdy Sherif Hamdy Amin Elshehaby	

Area Of Study :

Prepare students about the principles of analog circuits and apply the techniques for the design of analog integrated circuits.
Develop the studentsôknowledge about analysis, design, and applications of analog circuits using integrated circuit technologies.
Develop studentsôskills to simulate the basic analog circuits.

Description :

Introduction to analog VLSI, Device modelling, Basic analog building blocks (current mirrors, common source, common drain, common gate, cascode), Noise, Voltage and current references differential pair, Frequency response, Stability and frequency compensation, Operational amplifiers (basic, two-stage, Miller, symmetrical, telescopic, folded, cascode), Noise, Voltage and current references.

Course outcomes :

a.Knowledge and Understanding: :	
1 -	Define the suitable device model for applications of analog integrated circuits.
2 -	Explain the fundamentals of the single-stage amplifiers; common source, common drain, common gate, cascode, and folded cascode.
3 -	Define the principles of the voltage and current references differential pair.
4 -	Explain the principles of the frequency response of amplifier circuits and their effects on the amplitude response and the phase response.
5 -	Explain the design of the operational amplifier circuits and their problems and applications.
6 -	Illustrate the principles of stability and frequency compensation in the design of operational amplifiers, and the noise in analog circuits.
b.Intellectual Skills: :	
1 -	Solve problems related to single-stage amplifiers with their different types of load.
2 -	Solve problems related to differential amplifiers with their different types of load.
3 -	Design problems related to operational amplifier circuits with their different types.

4 -	Evaluate the characteristics and performance of analog circuits.
c.Professional and Practical Skills: :	
1 -	Clarify theories and techniques of mathematics to solve analog circuit problems in the transistor level.
2 -	Build the components and requirements for designing a complete analog circuit
3 -	Develop the design of analog circuits using the Electronic Design Automation (EDA).
4 -	Read thoroughly datasheets and identify appropriate specifications of the operational amplifier.
d.General and Transferable Skills: :	
1 -	Collaborate effectively within multidisciplinary team
2 -	Communicate effectively.
3 -	Effectively manage tasks, time, and resources.
4 -	Search for information and engage in life-long self-learning discipline.

Course Topic And Contents :

Topic	No. of hours	Lecture	Tutorial / Practical
Basic concepts of the MOSFETs in analog integrated circuits	5	3	2
Device modelling and parameters	7	3	4
Single-stage amplifiers: Common-source amplifiers (resistive load, diode-connected load, current source load, source degeneration). Common-drain (source-follower) amplifiers (resistive load, current source load). Common-gate amplifiers. Cascode amplifiers. Folded cascade amplifiers.	15	9	6
Differential Amplifiers (resistive load, diodeconnected load, current source load).	6	4	2
Voltage and current references differential pair and current mirrors (Cascode current mirror, Common-mode rejection ratio).	7	5	2
Frequency response of amplifiers: Device Capacitances. Bode plot. Pole determination in common-source, common-drain, common-gate, and cascode amplifiers. Pole determination in the differential pair.	10	6	4
Design of operational amplifiers in the integrated circuit level (two-stage, telescopic cascode, folded cascode)	15	9	6
Stability and frequency compensation of operational amplifiers.	5	3	2
Noise in analog circuits.	5	3	2

Teaching And Learning Methodologies :

Interactive Lecture

Problem-based Learning
Discussion
Assignments

Course Assessment :

Methods of assessment	Relative weight %	Week No	Assess What
Assignments	10.00		
Final exam	40.00		
Lab Experiments	5.00		
Mid- Exam I	15.00		
Mid- Exam II	15.00		
Oral Exam	5.00		
Quizzes	10.00		

Course Notes :

- Taken by the student inside classroom

Recommended books :

Recommended book (text books): B. Razavi, Design of Analog CMOS Integrated Circuits, McGraw-Hill, 2016.
2. Essential book: Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, and Orbert G. Meyer, Analysis and Design of Analog Integrated Circuits, Fifth Edition, John Wiley, 2009