

Course Title	Analog and Digital Electronic Circuits
Course Code	EE3408
No. of Credit Hrs (Lecture + Tutorial + Lab)	4 (3+0+1)
No. of Contact Hrs (Lecture + Tutorial + Lab)	5 (3+0+2)
Level-Year	6-3
Prerequisite (if any)	EE3404

1) Course Objectives:

The objective of this course is to provide students with a strong foundation and understanding of the concepts and principles of analog and digital electronic circuits and apply these principles practically to solve engineering problems required for initial design activities. The analog electronics element will focus on basic knowledge of semiconductor devices, their application, the operational amplifier (op-amp) and the common op-amp circuit configurations. The digital electronics element will focus on a wide range of CMOS circuits and logic families. The laboratory experiments provide hands-on experience to practically verify the theoretical concepts studied during this course.

2) Expected Learning Outcomes:

After completing this course, the students should be able to:

1. Identify the fundamental building blocks of analog and digital circuits used in electronic systems. KLO1 [1]
2. Develop and apply circuit models for elementary components such as resistors, sources, inductors, capacitors, operational amplifiers, and digital ICs. KLO1 [1]
3. Analyze and design basic analog and digital circuits, including operational amplifier applications and TTL/CMOS logic circuits. KLO2 [2]
4. Investigate and differentiate the design, analysis, and functional behavior of analog and digital circuits through experiments. KLO3 [6]
5. Compare theoretical predictions with practical results to evaluate the performance of analog and digital circuits. KLO3 [6]
6. Communicate experimental observations and design results effectively through structured reports. KLO8 [3]

3) Course Contents:

1. Introduction to Analog and Digital Circuits.
2. Operational Amplifiers: Non-Inverting Amplifier, Inverting Amplifier, Integrator and Differentiator, Voltage Adder.
3. Frequency Response: Relationship Between Transfer Function and Frequency Response, Bode's Rules, Miller's Theorem, Frequency Response of Common-Emitter (CE).
4. Feedback: Loop Gain, Properties of Negative Feedback, Feedback Topologies, Stability in Feedback.
5. Oscillators: Ring Oscillator, LC Oscillator, Phase Shift Oscillator, Crystal Oscillator.
6. Power Amplifiers: Emitter Follower as Power Amplifier, Push-Pull Stage, Short Circuit Protection, Heat Dissipation and Efficiency.
7. Digital CMOS Circuits: General Consideration, CMOS Inverter, CMOS NAND and NOR Gates.

8. Digital logic families: RTL, DTL, TTL, ECL, MOS, and CMOS logic families and their comparison.
9. Fundamentals of Analog and Digital ICs.

4) Electronic Circuits Lab Contents:

1. Orientation.
2. Op-amp characteristics
3. Amplifying circuits using op-amp
4. Computing circuits using op-amp
5. Active Filter circuits using op-amp
6. Comparators, Schmitt trigger and unstable multi-vibrators using op-amp
7. Oscillators circuits using op-amp
8. CMOS inverter characteristics
9. TTL inverter characteristics
10. ECL characteristics

5) Teaching Methods:

- Lectures and Discussion
- Videos
- Self-learning
- Laboratory demonstrations

6) Mode of Evaluation: Course Assessment Methods

- Quizzes and assignment
- Major Exams
- Final Exam
- Lab Work

Evaluation

• **Semester Work**

Major Exams	30%
Quizzes	5%
Assignments	5%
Lab/Tutorial	20%

• **Final**

Paper work	40%
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7) Textbook(s):

- Behzad Razavi, "Microelectronics", Second Edition, Wiley Publication.

8) References:

- Sedra and Smith, "Microelectronic Circuits", 9th Ed., Oxford University Press Pub.
- Laboratory experiment manual

