SEMESTER S6

ANALOG IC DESIGN LAB

Course Code	PCEVL607	CIE Marks	50
Teaching Hours/Week (L: T:P: R)	0:0:3:0	ESE Marks	50
Credits	2	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	PCECL303-Analog Circuits PCEVT601 - Analog CMOS Design	Course Type	PCL

Course Objectives:

1. Acquire skills in analog circuit design and analysis.
2. To familiarize students with EDA tools for simulation of analog integrated circuits.

Expt. No.	Experiments
1	Study the transfer characteristics of a MOSFET (n-MOS and p-MOS) and determine the threshold voltage.
2	Study the output characteristics of a MOSFET (n-MOS, p-MOS).
3	Study the effect of substrate potential on the threshold voltage and I-V characteristics of a MOSFET.
4	Design a CS amplifier with resistive load and triode load. Perform Transient, DC, and AC analyses, plot the frequency response, and obtain the bandwidth.
5	Design a CS amplifier with diode-connected load and constant current source load. Perform Transient, DC, and AC analysis, plot the frequency response, and obtain the bandwidth.
6	Design a Common Drain amplifier and perform AC analysis.
7	Design a Common Gate amplifier for a specified current gain and perform AC analysis.
8	Design a RC coupled amplifier using MOSFET and perform AC analysis.

9	Design a current mirror with passive and active loads.
10	Design a cascode current mirror with active and passive loads.
11	Design a differential amplifier for a specified gain and perform transient analysis.
12	Perform the layout design of a Common Source amplifier and check DRC and LVS.
13	A/D Converters - 3-bit Flash ADC
14	D/A converter - 3-bit Ladder type
15	Study of PLL: free running frequency lock range capture range

Course Assessment Method
(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Internal Examination	Total
5	**25**	**20**	**50**

End Semester Examination Marks (ESE):

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	**15**	**10**	**10**	**5**	**50**

- ***Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified record.***
- ***Endorsement by External Examiner:*** *The external examiner shall endorse the record*

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Analyse single stage amplifiers and evaluate its characteristics.	**K4**
CO2	Design various circuits such as current mirrors, differential amplifiers.	**K5**
CO3	Outline various architectures of Data converters.	**K2**
CO4	Understand the concepts of layout generation of analog circuits.	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO- PO Mapping (Mapping of Course Outcomes with Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		3		1				2		1	
CO2	3		3	3	2				2		1	
CO3	3				2				2		1	
CO4	3				3				2		1	

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Design of Analog CMOS Integrated Circuits	Behzad Razavi	McGraw-Hill Education	2nd Edition 2015
2	CMOS Analog Circuit Design	Philip E. Allen and Douglas R. Holberg	Oxford University Press	2nd Edition 2010
3	Analysis and Design of Analog Integrated Circuits	Hurst, S. Lewis and R. G. Meyer, WilePaul R. Gray, Paul Jy	Wiley	5th Edition 2010

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Analog Integrated Circuit Design	David A. Johns, Ken Martin	Wiley	2nd Edition 2013
2	CMOS: Circuit Design, Layout and Simulation	Baker, Li, and Boyce	Wiley	1st Edition 2009
3	Introduction to PSpice Using Orcad for Circuits and Electronics	M. H. Rashid	Pearson	3rd Edition 2003
4	Linear Integrated Circuits	D. Roy Choudhary, Shail B Jain	New Age International Books	3rd Edition 2021

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/117/106/117106030/
2	https://onlinecourses.nptel.ac.in/noc22_ee37/preview
3	https://www.youtube.com/@InderjitSingh87

Continuous Assessment (25 Marks)

1. Preparation and Pre-Lab Work (7 Marks)

- Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. Conduct of Experiments (7 Marks)

- Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.

- Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

3. **Lab Reports and Record Keeping (6 Marks)**

    - Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
    - Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

4. **Viva Voce (5 Marks)**

    - Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.

Evaluation Pattern for End Semester Examination (50 Marks)

1. **Procedure/Preliminary Work/Design/Algorithm (10 Marks)**

    - Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
    - Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
    - Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
    - Creativity and logic in algorithm or experimental design.

2. **Conduct of Experiment/Execution of Work/Programming (15 Marks)**

    - Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

3. **Result with Valid Inference/Quality of Output (10 Marks)**

    - Accuracy of Results: Precision and correctness of the obtained results.

- Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

4. **Viva Voce (10 Marks)**

    - Ability to explain the experiment, procedure results and answer related questions
    - Proficiency in answering questions related to theoretical and practical aspects of the subject.

5. **Record (5 Marks)**

    - Completeness, clarity, and accuracy of the lab record submitted

SEMESTER 7

ELECTRONICS ENGINEERING

(VLSI DESIGN AND TECHNOLOGY)