



SECOND SEMESTER 2020-21
COURSE HANDOUT

Date: 16.08.2021

In addition to part I (General Handout for all courses appended to the Time table) this portion gives further specific details regarding the course.

Course No : **EEE/INSTR F244**
Course Title : **Microelectronic Circuits**
Instructor-in-Charge : **ANU GUPTA**
Instructor(s) : **Samtha Benedict**
Tutorial/Practical Instructors: **Nitin Chaturvedi, Pankaj Arora, Sharda Tripathi, K .Babu Ravi Teja, Samtha Benedict**

1. Course Description: Basic microelectronic circuit analysis and design, biasing in discrete and integrated circuit amplifiers, an overview of modeling of microelectronic devices single and two transistor amplifier configurations with passive and active loads; current mirrors & current sources; single-ended and differential linear amplifiers , differential and multistage amplifiers; 2 stage CMOS OPAMP, frequency response of amplifiers; negative feedback in amplifiers, R-C frequency compensation.

2. Scope and Objective of the Course:

The objective of this course is to develop an ability to analyze and design integrated electronic circuits. The course aims at thorough understanding of electronic circuits & building blocks necessary for effective realizations of integrated circuits. The course also includes the usage of SPICE as a circuit design aid.

Objectives of the Course:

- Understand device modelling, two port network models, amplifier characterization parameters
- Understand the necessity of and techniques to set DC bias, Quiescent point location for different types of amplifiers.
- Understand analysis and synthesis of different single/ multi stage amplifiers and their characterization.
- Practice EDA tools in design of amplifiers.

3. Text Book: Adel. S. Sedra, Kenneth C Smith, “Microelectronic Circuits”, Oxford University Press, Seventh Edition.

4. Reference Books:

Prime Reference Book/s: Behzad Razavi, “Design of Analog CMOS Integrated Circuits”, TATA McGRAW Hill, 2001.

Other reference books :

- a. Richard. C. Jaeger, “Microelectronic Circuit Design”, Tata McGraw-Hill Companies Inc., International Edition.
- b. R.Jacob.Baker, Harry.W.Li, David.Boyce, “CMOS circuit Design Layout and simulation.”IEEE Press series on Microelectronic Systems, PHI.



5. Course Plan:

<i>Approx. No. of Lectures</i>	<i>Module</i>	<i>Lecture Session</i>	<i>Reference From the Text Book (Article)</i>	<i>Learning Outcomes Student will be able to --</i>
1	Introduction Review of circuit analysis techniques: Superposition, Thevenin and Norton Theorems.	Review of circuit analysis techniques	Revision from previous courses	Strengthening of concepts of previous courses
3	Two Port Networks: Z,Y,H,G,ABCD, Cascaded networks.	Theory of two port network models	Reference Book (c)	Understanding/ configuration of two port network models of any circuit.
4	Introduction to Amplifiers	Basic performance measures of Amplifiers,) Amplifiers: Terminology, Topologies, concept of stability and negative feedback (qualitative treatment only)	Text chapter-1 1.4, 1.5, 1.6 Text Ch 6	Characterize an Amplifier performance
3	Basic building blocks: BJT , MOSFET , operation region and small signal models. Revision of MOSFET/ BJT devices operation	Models of MOSFET, Overview-physics of MOSFET, BJT	Text Ch- 4, 5 Prime Ref -chapter 2	Understand MOS/ BJT device characteristics, models
10	DC Biasing and Bias point stability: Biasing using resistors, current mirrors (basic, cascode, low voltage cascode) Single stage amplifier design Frequency response of amplifiers	Voltage biasing and current biasing--Passive and active current mirrors.	Prime Ref —ch. 3, 5 ch. 7, Text Ch. 6 Ch 7— 7.1 – 7.3,	Design basic IC MOSFET Amplifier
		Integrated circuit BJT Amplifiers, frequency response and BJT models	Text Ch 6 Ch. 6	Differentiate between Discrete and IC BJT Amplifier Design
		Integrated circuit MOSFET Amplifier circuits, and Frequency response	Prime Ref Ch. 3, 6 Text Ch. 6, 7, 9	Designing of DC bias circuits



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9	Differential Amplifier	Differential amplifiers	Prime Ref -Ch. 4 Text --Ch.7	Designing differential amplifiers
	Multistage high gain Operational Amplifiers	Operational Amplifiers design	Prime Ref ch-9 Text Ch.9	Design and characterization of an integrated OP-AMP
10	Feedback Amplifiers	Impact of negative feedback on performance of amplifiers	Prime Ref ch-8 Text Ch. 10	Apply Concept of feedback in feedback amplifier-design, analysis
	Stability	Stability & frequency compensation in OP AMP, Noise (only qualitative)	Prime Ref ch.-10, 7 Text Ch-10	Apply Techniques for stability of opamp in feedback mode.
	Feedback topologies	Configuration of Feedback amplifiers	Text Ch-12	
2	Opamp applications	Example/s of integrated electronic systems— An overview	Filter, oscillator, signal generator, wave shaping circuits, tuned amplifiers	Building of electronic systems
42 total				

6. Evaluation Scheme:

Component	Duration	Marks/ Weightage (%)	Date & Time	Nature of component (Close Book/ Open Book)
Mid-Semester Test	90 Min.	90 (30%)	<TEST_1>	OB
Regular Quiz (Weekly Tutorial hour)	Regular	50 (16.6%)	Spread throughout the semester	OB
SPICE Assignments and/ or quiz,	Spread throughout the semester	55 (18.3%)	To be announced and conducted/ evaluated during the semester	OB
Comprehensive Examination	2 Hr.	105 (35%)	<TEST_C>	OB/CB



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7. Chamber Consultation Hour: To be announced in the class. May Contact IC to fix a time.

Email--anug@pilani.bits-pilani.ac.in

8. Notices: All notices related to the course will be put on the **EEE** Notice board/ NALANDA (online portal).

9. Make-up Policy: Makeup will be given only on genuine basis. Prior permission from instructor is necessary

10. Note (if any):

Instructor-in-charge
Course No. EEE/INSTR F244