ANALOG CIRCUITS AND SYSTEMS

1.1 Course Number: ECE232

1.2 Contact Hours: 3-1-0 Credits: 11

1.3 Semester-offered: 2nd Year-Even

1.4 Syllabus Committee Member: Dr. Umakant Dhar Dwivedi, Dr. Abhishek Kumar Singh, Dr. Sajal Agarwal, Dr. Vijay Kumar Singh, Dr. Ankur Pandey.

1.5 PREREQUISITE: - Solid State Electronic Devices; Network Analysis & Synthesis

2. OBJECTIVE: This course is an introduction to amplifiers using transistors. Students will be introduced to MOS transistors, their characteristics, techniques for biasing them, and amplifiers using them. The basic transistor amplifier stages are seen as realizations of different controlled sources using negative feedback. Small- and large-signal characteristics of each amplifier will be discussed. At the end of this course, students should be able to recognize and analyze the basic amplifiers and biasing arrangements using MOS or bipolar transistors.

3. COURSE CONTENT:

Unit	Topics	Lectures
1. Nonlinear-circuit analysis & Diode Model	Nonlinear-circuit analysis using incremental networks, Large-Signal and Small-Signal Operation, Wave shaping circuits, Zener Diode characteristics and Operation, Voltage regulator circuits.	06
2. Transistor Amplifiers	Introduction of MOSFET, Characteristics Biasing & Transconductance Large Signal and Small Signal Operation Common Source Topology, Common Source Topology with variants, Common Source with Degeneration Biasing Techniques and Introduction of Common Gate Amplifier MOS Amplifier Topology: Common Gate Amplifier Topologies: Common−Base Stage Amplifier Topologies: Source Follower	10
3. Multistage Amplifiers	Cascode Stages: Bipolar and MOS Cascode as Amplifier: Bipolar and MOS Current Mirrors: Bipolar and MOS Bipolar and MOS differential pairs. Small-Signal Analysis Cascode Differentials amplifier	06
4. Frequency Response & Feedback of Amplifiers	Bode's Rules, Association of Poles with nodes, Miller's Theorem High−Frequency Models of Transistors Frequency Response of Circuits Elements of Feedback, Properties of Negative Feedback Loop Gain Systems Amplifiers and Sense/Return Methods	06

	Four Types of Feedback Loop Instability, Phase Margin, Frequency Compensation	
5. Operational Amplifier	Single Stage Op-Amp, Op-Amp Properties, VCVS using Op-Amp, CCVS using an Op-Amp, Virtual Short Concept in Op-Amp, and various Op-Amp Nonidealities. Two stage- Op-Amp: small signal gain and feedback analysis, Offsets, swing limits and how to eliminate Systematic offset.	06
6. Oscillator Multivibrators, Timing Circuit ADCs/DACs & PLL	Oscillator Circuits, Bistable & Monostable Multivibrators, 555Timers IC, ADC/DAC, PLL Circuits and operation,	06

4 READINGS

4.1 TEXTBOOK

1. Linear Integrated Circuits, D Roy Choudhury and S Jain, New Age International (P) Limited Publishers

2. Electronic Devices and Circuits, J Millman, C C Halkias and S Jit, Tata Mc Graw Hill

3. Design of Analog CMOS Integrated Circuits (Behzad Razavi), McGraw-Hill, 2001

4.2 REFERENCE BOOKS

1. Electronic Devices and Circuit Theory, Robert L Boylested and L Nashelsky, Prentice Hall of India

2. Design with operational amplifiers and analog integrated circuit, Sergio Franco, Tata Mc Graw Hill

3. Fundamentals of microelectronics. B Razavi. John Wiley & Sons, 2021

5. OUTCOME OF THE COURSE:

After successful completion of the course, students will be able to analyze dc circuits and relate ac models of electronics devices. Design and analyze electronic circuits. Evaluate frequency response to understand behavior of Electronics circuits.