NIRMA UNIVERSITY

Institute:	**Institute of Technology**
Name of Programme:	**B. Tech. in Electrical Engineering**
Semester:	**III**
Course Code:	**2EE301**
Course Title:	**Analog Electronics**
Course Type:	**Core**
Year of Introduction:	**2023 – 24**

L	T	Practical component				C
		LPW	PW	W	S	
2	0	2	-	-	-	3

Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. Illustrate transistor modes and its operation **(BL2)**
2. Contrast conventional and differential amplifier **(BL3)**
3. Apply knowledge of operational amplifier in various applications **(BL4)**
4. Appraise various specialized IC applications **(BL4)**
5. Design various electronic circuits using concepts of analog electronics **(BL5)**

Syllabus: **Teaching Hours: 30**

Unit-1 Transistors and Biasing Circuits **05**

Introduction to semiconductor materials, types of transistors (BJT and FET), transistor construction, different operating modes of transistor, concept of amplification, operation of transistor as an amplifier, operation of transistor as a switch, input-output characteristics and transfer character of transistors, concept of biasing, voltage biasing using single and dual supply, current biasing techniques, dc signal and ac signal operation of transistor, examples based on above topics

Unit-2 Conventional and Differential Amplifier **05**

Different types of amplifiers, performance analysis of different conventional amplifiers, design of common emitter amplifier using single and dual supply, drawbacks of conventional amplifiers, evolution of differential amplifier, transfer characteristic of differential amplifier, operating modes of differential amplifiers, comparison between conventional and differential amplifiers, cascading, examples based on above topics

Unit-3 Operational Amplifier Circuits **05**

Idea of operational amplifier, types of operational amplifiers, characteristics of operational amplifier, Equivalent circuit of operational amplifier, introduction to general purpose operational amplifier IC 741, pin diagram, parameters and datasheet study of IC 741, open loop and closed loop operation of IC 741, analysis of voltage shunt and voltage series feedback of IC 741, single supply and dual supply operation of op-amp, errors / limitations of practical OpAmp e.g. PSSR, Gain, Slew rate etc.

Unit-4 Operational Amplifier Applications **05**

Various applications like unity gain follower, summing, scaling, averaging, V to I and I to V converter with grounded and floating loads, integrator, differentiator, logarithmic operations, subtractor, differential amplifier, basic comparator, zero crossing detector, Schmitt trigger, clipper, clampers, ac and dc low voltage voltmeter using op-amp, instrumentation amplifier

Unit-5 Specialized IC Applications **05**

Concept of multivibrator circuit, Pin diagram of IC 555, different operating modes of IC 555 and its applications, voltage controlled oscillator using IC 566, concept and operational importance of phase locked loop (PLL), voltage to frequency (V to f) and frequency to voltage (f to V) conversion using IC 9400

Unit-6 Design of Linear Power Supply **05**

Linear voltage regulator, linear power supply using fixed and adjustable voltage regulators, line regulation, load regulation, protection technique

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

This shall consist of at least 10 practical / simulations based on the above syllabus.

Suggested Reading:

1. R. Boylestad and L. Nashelsky, Textbook of Electronics Devices & Circuit Theory, PHI Publication.
2. R. Gayakwad, Textbook of Operational Amplifiers and Linear Integrated Circuits, PHI Publication.
3. Albert Malvino, David J. Bates and Patrick E. Hoppe, Electronic Principles, Mcgraw Hill Publications.
4. Donald A. Neamen, Electronic Circuits, Mcgraw Hill Publications.
5. A. Mottershed, Textbook of Electronics Devices and Circuits An Introduction, PHI Publication.
6. Millman and Halkias, Textbook of Integrated Electronics, Mc Graw Hill.
7. Sergio Franko, Textbook of Designing with Operational Amplifiers and Analog Integrated Circuits, Mc Graw Hill.
8. R. Coughlin and Driscoll, Textbook of OpAmp & Linear Integrated Circuits, PHI Publications.
9. David A. Bell, Electronic Devices and Circuits, Oxford Publications.
10. David A. Bell, Operational Amplifiers and Linear ICs, Oxford Publications
11. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits, Oxford Publications.

Suggested List of Experiments (not restricted to the following): (Only for Information)

	Title of Experiment	Hrs.
1.	To plot input-output and transfer characteristics of transistor.	2
2.	To design conventional common emitter amplifier.	2
3.	To analyze various modes of operation for differential amplifier.	2
4.	To analyze inverting and non inverting mode of operation of op-amp.	2
5.	To demonstrate mathematical operations like adder, subtractor using op-amp	2
6.	To demonstrate mathematical operations like log, antilog using op-amp	2
7.	To design integrator using op-amp	2
8.	To design differentiator using op-amp	2
9.	To demonstrate various current biasing techniques	2
10.	To implement zero crossing detector, comparator and Schmitt trigger using op-amp.	2
11.	To implement monostable, astable multivibrators and VCO using IC 555.	2
12.	To perform phase locked loop using IC 565.	2
13.	To perform V to f and f to V conversion using IC 9400.	2
14.	To design linear power supply using regulator.	2
		2

L = Lecture, T = Tutorial, P = Practical, C = Credit