Course Name : Electronics Engineering Group

Course Code : ET/EN/EX/EJ/IE/IS/IC/DE/EV/MU/IU/ED/EI

Semester : Fourth

Subject Title : Linear Integrated Circuits

Subject Code : 174

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	02	03	100	50#	--	25@	175

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

Modern age technology has developed on high density and high speed electronics circuits. Integrated circuits are basis of these high density circuits enabled to reduce size, weight and cost of equipments. They have intrinsic features such as low power consumption, low noise and ease of design.

Today the growth of any industry depends upon electronics to great extent. Contents of this subject are the basic building blocks of different analog circuits.

Basic operating and designing principle of such a large collection of circuits establishes a foundation for understanding new development in the electronics field, instrumentation and power control. This subject acquaints student with general analog principles and design methodologies using integrated circuit for system design.

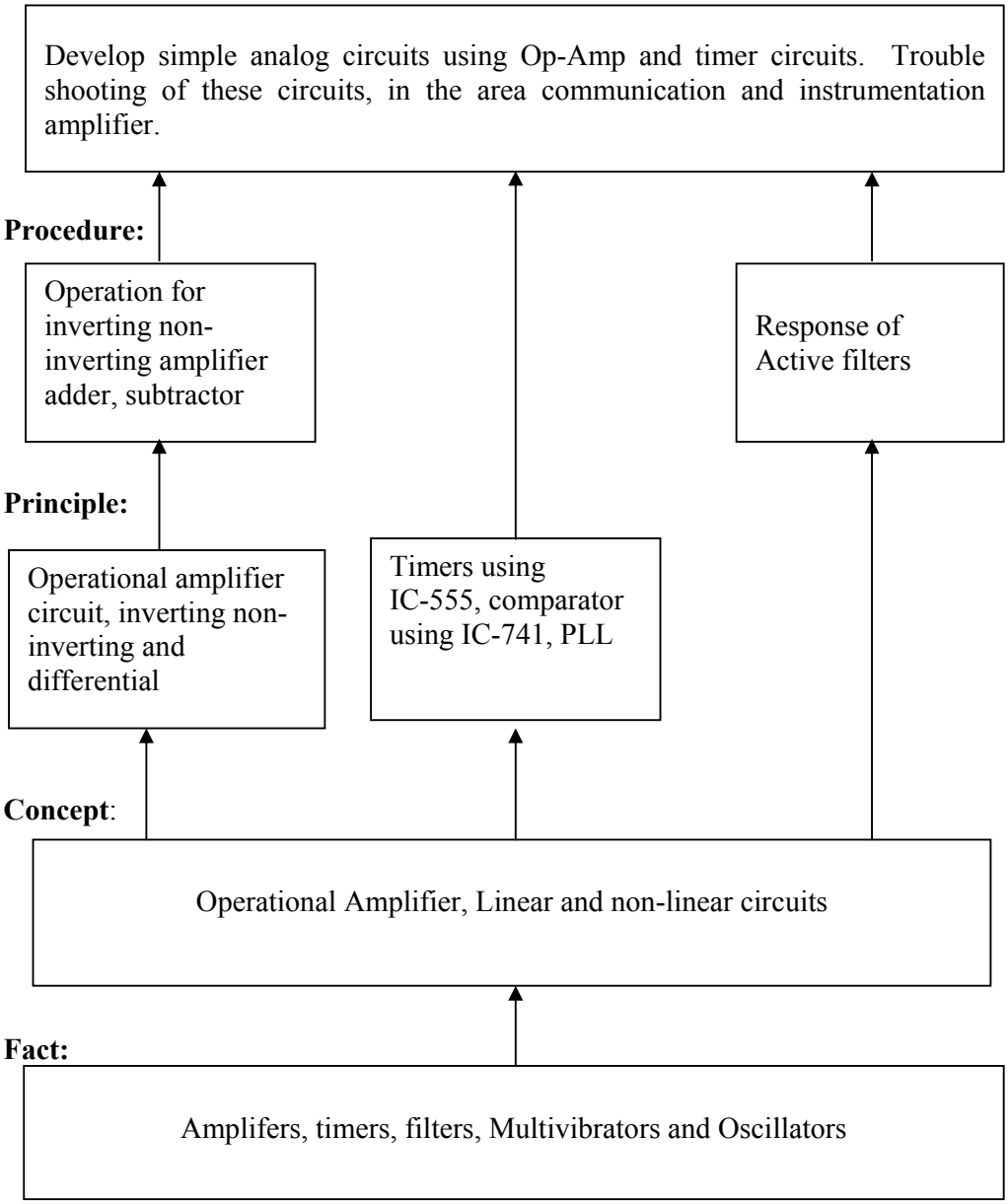
Prerequisites various devices and circuits studied in elements of electronics and electronic devices and circuits. Prospects- LSI, MSI, VLSI.

General Objectives:

Students will be able to:

- Understand working principle of Op-Amp and IC555
- Develop electronics circuits using timer IC555 and Op-Amp
- Analyze the response of frequency selective circuits such as PLL with respect to the incoming signal.

Learning Structure:



Contents: Theory

Topic	Content	Hours	Marks
1	**Operational Amplifier (Op-Amp):** Specific Objectives : ➢ Draw labeled block diagram of Op-Amp ➢ Specify and define Different parameters of Op-Amp ➢ Interpret ideal transfer characteristics of Op-Amp Contents: • Importance of Op-Amp: Block diagram of Op-Amp and function of each block with the circuit such as balanced, Unbalanced, differential amplifiers with simple current source, level shifter and complementary push-pull amplifier. Equivalent Circuit, Circuit Symbols And Terminals. Op-Amp IC-741 pin diagram and function. • Parameters of Op-Amp: Input offset voltage, Input offset current, Input bias current, differential input resistance, Input capacitance, Input voltage range, offset voltage adjustment range, Common Mode Rejection Ratio (CMRR), Supply Voltage Rejection Ratio (SVRR), large signal voltage gain and transfer characteristics, supply voltages, supply current, output voltage swing, output resistance, slew rate, gain bandwidth product, output short circuit current.	12	10
2	**Op-Amp Configuration:** Specific Objectives: Students will be able to ➢ Differentiate open and close loop configuration. ➢ Identify inverting and non-inverting configuration. ➢ Construct integrator and differentiator. **2.1** Open loop and closed loop configuration of Op-Amp, its comparison. Virtual ground, virtual short concept. [08] Open loop configuration – Inverting , Non-inverting Close loop configuration – Inverting, non- inverting, differential amplifier, unity gain amplifier (voltage follower), inverter(sign changer) **2.2** Inverting and non-inverting configuration of Adders (summing amplifier, scaling Amplifier, averaging amplifier) Subtractor. [10] Basic Integrator Basic Differentiator Basic concept of frequency compensation of Op-Amp and Offset nulling. Numerical based on designing of above circuit.	12	18
3	**Applications of Op-Amp:** Specific Objectives: ➢ Compute component values for instrumentation amplifier. ➢ Explain IC LM-324 ➢ Explain different applications of Op-Amp. **3.1** Need for signal conditioning and signal processing. [08]	12	22

	Circuit diagram, operation, derivation of output voltage Equation. advantages and applications of Instrumentation amplifier. Pin diagram pin functions and specifications of IC LM 324 Voltage to current converter (with floating load, with grounded load) Current to voltage converter. **3.2** Sample and hold circuit. [16] Logarithmic and antilogarithmic amplifiers (using Diodes) Analog divider and analog multiplier Comparator: Circuit diagrams and operation of • Zero crossing detector, • Schmitt trigger, • Window detector, • Phase detector, • Active peak detector, • Peak to peak detector		
4	**Filters:** Specific Objectives: ➢ Distinguish the types of filter ➢ Explain active and passive filter ➢ Explain different parameters of filter. Contents: • Introduction to filters ,Classification of filters, • Concept of passive and active filters • Merits and demerits of active filters over passive filters • Ideal and actual characteristics, terms: - cut off frequency, Pass band, Stop band, center frequency, roll off rate, BW, Q-factor, first order and second order Butterworth filters, order of filter, Low pass filter, high pass filter, band pass filter (wide band pass , narrow band pass filter) Band reject filter(wide band reject, narrow band reject filter), all pass filter. Numerical based on design of different filters.	10	16
5	**Timers** Specific Objectives: ➢ Draw block diagram of IC 555 ➢ Understand industrial applications of IC 555 ,565 5.1 Introduction to timer IC 555 [10] • Block diagram of IC 555 and its pin diagram and function of each pin. • Concepts of different timer circuits used in industries: water level controller, Touch plate switch, frequency divider. • Numericals based on timers. 5.2 Phase Lock Loop • Principle of operation, block diagram of PLL. [08] • Applications of PLL as multiplier, FM demodulator. • Pin diagram and pin functions of IC 565(PLL)	10	18

6	**Oscillators:** Specific Objectives: ➢ Explain concept of oscillators ➢ Explain different types of oscillators ➢ Develop multivibrators and oscillators for given values. Contents: • Concept of oscillators, • Types of oscillators: Phase shift oscillators, Wien bridge oscillators using IC-741 • Types of Multivibrators: Monostable, Astable, Bistable using IC-555 and IC-741. Schmitt trigger, voltage controlled oscillator (VCO) using IC-555.	08	16
	Total	**64**	**100**

Practical:

Intellectual Skills:

1. Interpret the waveforms.
2. Find faults in circuits.

Motor Skill:

1. Testing and Measurement.

List of Practicals:

1. Determine various parameters of OP-AMP.
2. Inverting and non-inverting amplifier.
3. Adder and subtractor circuits using Op-Amp.
4. Observe output of active differentiator and integrator using OP-AMP.
5. V to I converter and I to V converter.
6. Draw the characteristics of OP-AMP comparator and its interpretation
7. Zero crossing detector and active peak detector.
8. Astable multivibrator using IC 741.
9. Bistable multivibrator using IC 555.
10. Schmitt trigger using IC 555.
11. Monostable multivibrator using IC 555.
12. Frequency multiplier using IC565.

Learning Resources:

Books:

Sr. No.	Author	Title	Publisher
01	K.R. Botkar	Integrated Circuit	Khanna
02	Ramakant Gayakwad	Op-Amps and Linear Integrated Circuit	PHI
03	Serigo Franco	Design with Operational Amplifier and Analog Integrated Circuit	Tata-McGraw Hill
04	Willam D. Stanley	Operation Amplifier with Linear Integrated Circuit	Person