

Devi Ahilya University, Indore, India Institute of Engineering & Technology				II Year B.E. (Electronics and Instrumentation Engg.)			
Subject Code & Name	Instructions Hours per Week			Credits			
	L	T	P	L	T	P	Total
<b>4EIRC3</b> <b>LINEAR DEVICES</b> <b>AND APPLICATIONS</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>5</b>
<b>Duration of Theory</b> <b>Paper: 3 Hours</b>							

### Learning Objectives:

- Provide student the knowledge of different operations performed using Linear Devices
- Develop skills to design the circuit using OP-Amp.
- Develop skills to analyse Op-Amp circuit.
- Develop ability to implement circuit with Linear device IC's

### Prerequisites:

Knowledge of Feedback concept

## COURSE OF CONTENTS

### UNIT I : FUNDAMENTALS OF OPERATIONAL AMPLIFIERS (OP-AMP)

Operational Amplifier, Equivalent Circuit, Circuit symbols and Terminals, Op-Amp IC 741 pin diagram and pin function, Op-Amp parameters 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), Slew Rate, Large Signal Voltage Gain, Supply voltage, Supply Current, Output voltage Swing, Gain Bandwidth Product, Output Short Circuit Current, Transfer Characteristic- Ideal and Practical Voltage Transfer Curve, Op-Amp Configuration: Open Loop and Closed loop, Virtual Ground Concept, Features, pin diagram and pin function of dual Op Amp IC 747

### UNIT II : GENERAL APPLICATIONS OF OP-AMP

Closed Loop configuration, modes of operations: Inverting and Non- Inverting modes, Differential amplifier, Unity Gain Amplifier (voltage follower), Arithmetic operations: Addition, multiplication, Scaling, Averaging, Subtraction, Integrator, Differentiator etc, Concept of frequency compensation of Op-Amp and offset nulling.

### UNIT III : LINEAR APPLICATIONS OF OP-AMP

Op-Amp as an Instrumentation amplifier: Working, Derivation of output voltage, IC LM 324-Pin Configuration, specification and application, Voltage to Current converter with Floating and Grounded load, Current to Voltage converter, Sample and Hold Circuit, Logarithmic and

Antilogarithmic amplifier using diodes, Analog Divider and analog multiplier, Comparators: IC LM710 Zero Crossing Detector, Schmitt Trigger, Window Detector, Phase Detector Active Peak Detector Peak to Peak Detector

#### **UNIT IV : APPLICATIONS OF OP-AMP**

Filter and its classification, Merits and demerits of active filters over passive filters, Filter characteristic terms: order of filter, cut off frequency. Pass band. Stop band, Centre frequency, Q factor, Filter types and its Frequency Response: Low pass (First Order and second order). High Pass (First Order and second order). Band pass (Wide and Narrow), Band Reject (Wide and Narrow), All Pass Filter; Oscillator types using IC 741: Phase shift oscillator, Wein Bridge oscillator, Colpitts oscillator, Hartley oscillator.

#### **UNIT V : IC 555 AND APPLICATIONS**

IC 555: Block Diagram of Timer, Pin diagram and functions, Astable, Monostable, Bistable multivibrator, Schmitt trigger and Voltage Control Oscillator, Phase Lock Loop (PLL): Block diagram and its operation, lock range and capture range, Applications of PLL: PLL as Multiplier, FM Demodulator, IC 565: Pin diagram and function

#### **Learning Outcomes:**

Upon completing the course, students will be able to:

- Understand controlled gain using feedback.
- Implement circuit for arithmetic operations.
- Implement circuit with optimized hardware.
- Design and Analyse any Op-Amp circuit
- Design circuit to generate clock and pulses of desired frequency using IC555.

#### **BOOKS RECOMMENDED:**

- [1] Millman & Halkias - Integrated Electronics, Tata McGraw Hill.
- [2] Franco-Design with Operational Amplifiers & Analog Integrated Circuits, TMH
- [3] Schilling & Belove-Electronic Circuit, Discrete & Integrated, TMH
- [4] Gayakwad R.A- Op-Amps and Linear IC's, Pearson .
- [5] Coughlin and Driscoll – Operational Amplifier and Linear Integrated Circuits – Pearson Education Asia.

#### **LIST OF PRACTICALS:**

- 1) To design of inverting & non-inverting amplifier with desired gain.
- 2) To analyze the voltage transfer characteristics of op-amp.
- 3) To design inverting/ Non-inverting adder & subtractor configuration of op-amp.
- 4) To study the differentiator configuration of op-amp.
- 5) To study the integrator configuration of op-amp.
- 6) To design low pass & high pass filter with desired gain and cut-off frequency.
- 7) To design band pass & band reject filter.
- 8) To implement comparator operation for desired application.
- 9) To use IC 555 for desired application.