

16EC301 LINEAR IC's AND APPLICATIONS

Hours Per Week :

L	T	P	C
3	-	2	4



Course Description and Objectives:

This course introduces theoretical aspects and circuits of Operational-Amplifier (Op-Amp), timers, PLLs, Voltage Regulators and OTAs, which are essential building blocks of linear integrated circuits. The objective of the course is to introduce the various linear and non-linear applications of Op-Amp and others.

Course Outcomes:

Upon successful completion of this course, students should be able to:

- CO1: Understand the characteristics and specifications of operational amplifiers.
- CO2: Analyze operational amplifiers based circuits used for various applications.
- CO3: Design various types of filters and regulators using operational amplifiers.
- CO4: Understand and analyze the operation and applications of timer, phase locked loop and voltage controlled oscillators.
- CO5: Understand data converters and OTA.
- CO6: Design and verify some common electronic circuits using linear ICs.

SKILLS:

- ✓ *Analyze and design Waveform Generators / Oscillators.*
- ✓ *Design Multivibrators for a given application.*
- ✓ *Develop Voltage Regulators for a given specification.*
- ✓ *Design Modulators like PWM, PPM, FSK.*
- ✓ *Implement Data converters.*
- ✓ *Design Frequency Synthesizers.*

ACTIVITIES:

- *Design inverting amplifier and voltage follower used in Buffers.*
- *Design Integrator, used in ADC's and Wave form generators.*
- *Develop RC phase shift oscillator using Op-Amp.*
- *Design Active Low pass Filters, used in Radio Transmitters.*
- *Implement Monostable Multivibrator.*

UNIT - 1**L-9**

FUNDAMENTALS OF LINEAR ICs: Differential DC amplifier, Common mode analysis, Differential mode analysis, CMRR, Constant current source in place of R_E , Design of a differential DC amplifier using bipolar transistors, 741 operational amplifier, Ideal and practical characteristics, Inverting and non-inverting configurations, Summing amplifier, Difference amplifier.

UNIT - 2**L-9**

APPLICATIONS OF OPERATIONAL AMPLIFIERS: Op-Amp as - Instrumentation amplifier, Integrator and lossy integrator, Differentiator and practical differentiator, Logarithmic amplifier, Astable-multivibrator, Monostable multivibrator, Comparators and schmitt trigger, RC phase shift and wien bridge oscillators.

UNIT - 3**L-9**

ACTIVE FILTERS AND REGULATORS: Application of Op-Amp as active filter, Butterworth first and second order filters, Low pass, High pass, Band pass and band reject filters, Design of practical filters, 3-terminal regulators, LM723 regulator.

UNIT - 4**L-9**

TIMER AND PLL: Functional diagram of 555 timer, Timer as astable and monostable multivibrators, Timer as FSK generator, Voltage controlled oscillator (VCO), Phase lock loop (PLL), Capture range, Lock range, PLL 565 and applications.

UNIT - 5**L-9**

DATA CONVERTER AND OPERATIONAL TRANS-CONDUCTANCE AMPLIFIER(OTA): Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R ladder DAC, Parallel comparator ADC, Successive approximation ADC and dual slope ADC, Characteristics of A/D and D/A converters. Basic configuration of an OTA, OTA applications.

LABORATORY EXPERIMENTS**LIST OF EXPERIMENTS**

Total hours-30

1. Op-Amp as non Inverting amplifier (LM 741).
2. Op-Amp as adder and subtractor (LM 741).
3. Op-Amp as Differentiator (LM 741).
4. Function Generator using 741 Op-Amp.
5. Active Filters –HPF (first order).
6. IC 555 Timer as Astable Multivibrator.
7. IC 741 Op-Amp as D/A Converter.
8. Regulator experiments need to be add(78XX /79XX series).
9. PLL Experiments (565 series).
10. VCO experiments (566 series).

TEXT BOOKS:

1. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", 4th edition, PHI, 2009.
2. G.B.Clayton, "Operational Amplifiers", 5th edition, Butterworth, 1971.

REFERENCE BOOKS:

1. Tahira Parveen, "Operational Transconductance Amplifier and Analog Integrated Circuits", I K International Publishing House Pvt.Ltd, 2010.
2. D. Roy Choudhury, "Linear Integrated Circuits", 4th edition, New Age International (p) Ltd, 2014.
3. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 3rd edition, McGraw Hill, 1988.
4. Millman, "Micro Electronics", 4th edition, McGraw Hill, 2009.