

<b>Semester</b>	<b>IV</b>	<b>Course Title</b>	<b>Linear Integrated Circuits</b>	<b>Course Code</b>	<b>18 EC 46</b>
<b>Teaching Period</b>	<b>50 Hours</b>	<b>L – T – P – TL*</b>	<b>3 – 1 – 0 – 4</b>	<b>Credits</b>	<b>4</b>
<b>CIE*</b>	<b>40 Marks</b>	<b>SEE*</b>	<b>60 Marks</b>	<b>Total</b>	<b>100 Marks</b>
<b>CREDITS – 04</b>					
<b>Course objectives:</b> This course will enable students to: <ul style="list-style-type: none"> <li>Define and describe various parameters of Op-Amp, its characteristics and specifications.</li> <li>Discuss the effects of Input and Output voltage ranges upon Op-Amp circuits. Sketch and Analyze Op-Amp circuits to determine Input Impedances, output Impedances and other performance parameters.</li> <li>Sketch and Explain typical Frequency Response graphs for each of the Filter circuits showing Butterworth and Chebyshev responses where ever appropriate.</li> <li>Describe and Sketch the various switching circuits of Op-Amps and analyze its operations.</li> <li>Differentiate between various types of DACs and ADCs and evaluate the performance of each with neat circuit diagrams and assuming suitable inputs.</li> </ul>					
<b>Module – 1</b>					
<b>Operational Amplifier Fundamentals:</b> Basic Op-amp circuit, Op-Amp parameters – Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations. <b>OP-Amps as DC Amplifiers</b> – Biasing OP-amps, Direct coupled voltage followers, Non-inverting amplifiers, inverting amplifiers, Summing amplifiers, and Difference amplifiers. Interpretation of OP-amp LM741 & TL081 datasheet. <b>(Text1)</b> <span style="float: right;"><b>L1, L2,L3</b></span>					
<b>Module – 2</b>					
<b>Op-Amps as AC Amplifiers:</b> Capacitor coupled voltage follower, High input impedance–Capacitor coupled voltage follower, Capacitor coupled non inverting amplifiers, High input impedance – Capacitor coupled Non inverting amplifiers, Capacitor coupled inverting amplifiers, setting the upper cut-off frequency, Capacitor coupled difference amplifier. <b>OP-Amp Applications:</b> Voltage sources, current sources and current sinks, current amplifiers, instrumentation amplifier, precision rectifiers. <b>(Text1)</b> <span style="float: right;"><b>L1, L2,L3</b></span>					
<b>Module – 3</b>					
<b>More Applications :</b> Limiting circuits, Clamping circuits, Peak detectors, Sample and hold circuits, V to I and I to V converters, Differentiating Circuit, Integrator Circuit, Phase shift oscillator, Wien bridge oscillator, Crossing detectors, inverting Schmitt trigger. <b>(Text 1)</b> Log and antilog amplifiers, Multiplier and divider. <b>(Text2)</b> <span style="float: right;"><b>L1, L2,L3</b></span>					
<b>Module – 4</b>					
<b>Active Filters:</b> First order and second order active Low-pass and high pass filters, Bandpass Filter, Bandstop Filter. <b>(Text 1)</b> Voltage Regulators: Introduction, Series Op-amp regulator, IC voltage regulators. 723 general purpose regulators. <b>(Text 2)</b> <span style="float: right;"><b>L1, L2,L3</b></span>					
<b>Module – 5</b>					

Phase locked loop: Basic Principles, Phase detector/comparator, VCO. DAC and ADC convertor: DAC using R-2R, ADC using Successive approximation. Other IC Application: 555 timer, Basic timer circuit, 555 timer used as astable and Monostable multivibrator. (Text 2) **L1, L2,L3**

**Course Outcomes: After studying this course, students will be able to:**

- Explain op-amp circuits and parameters including CMRR, PSRR, Input, Output impedance and slew rate
- Discuss the linear and nonlinear applications of an op amp.
- Test circuits of an op amp based voltage /current sources and sinks, current, instrumentation and precision amplifiers.
- Analyse and design amplifiers active filters and waveform generators using an op amp.
- Analyse and design of circuits using special IC chips.

**Text Books:**

- **David A. Bell**, 2nd edition, PHI/Pearson, 2004. ISBN 978-81-203-2359-9.
- **D. Roy Choudhury and Shail B. Jain**, 4th edition, Reprint 2006, New Age International ISBN 978-81-224-3098-1.

**Reference Books:**

- **Ramakant A Gayakwad**, —Op-Amps and Linear Integrated Circuits||, Pearson, 4th Ed, 2015. ISBN 81-7808-501-1.
- **B Somanathan Nair**, —Linear Integrated Circuits: Analysis, Design & Applications,|| Wiley India, 1st Edition, 2015.
- **James Cox**, —Linear Electronics Circuits and Devices||, Cengage Learning, Indian Edition, 2008, ISBN-13: 978-07-668-3018-7.
- Data Sheet: <http://www.ti.com/lit/ds/symlink/tl081.pdf>.