Program : **Diploma in Electronics/ Electronics and Communication Engineering/ Biomedical Engineering**	
Course Code : **4047**	Course Title: **Linear Integrated Circuits Lab**
Semester : **4**	Credits: **1.5**
Course Category: **Program Core**	
Periods per week: **3 (L:0, T:0, P:3)**	Periods per semester: **45**

Course Objectives:

- To equip students to acquire skills in designing and testing various practical circuits using analog integrated circuits like LM741, NE555.
- To give an outline on fixed and variable voltage regulators and digital to analog converter.

Course Prerequisites:

Topic	Course code	Course name	Semester
Working of diodes , transistors, amplifiers, multivibrators and oscillators		Electronic Circuits Lab	3
Characteristics and working of Operational amplifiers		Linear Integrated Circuits	4

Course Outcomes:

On completion of the course, the student will be able to:

COn	Description	Duration (Hours)	Cognitive Level
CO1	Design and develop various amplifier circuits using operational amplifier	9	Applying
CO2	Design and develop various comparators, wave shaping circuits and waveform generators using operational amplifier 741	15	Applying
CO3	Develop multivibrator circuits using 555 timer IC	6	Applying
CO4	Demonstrate fixed and variable power supplies and converters	9	Understanding
	Lab Exam	6	

CO-PO Mapping:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3						
CO2	3	3	3				
CO3	3						
CO4	2						

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

Course Outline:

Module Outcomes	Description	Duration (Hours)	Cognitive Level
CO1	**Design and develop various amplifier circuits using operational amplifier**		
M1.01	Setup a Voltage follower circuit using Op-Amp 741 1. Plot the I/O waveforms 2. Measure the gain 3. Find out the phase difference between input and output	1	Applying
M1.02	Design and setup an Inverting Amplifier circuit using Op-Amp 741 1. Plot the I/O waveforms 2. Measure the gain 3. Find out the phase difference between input and output	1	Applying
M1.03	Design and setup a Non-Inverting Amplifier circuit using Op-Amp 741 1. Plot the I/O waveforms 2. Measure the gain 3. Find out the phase difference between input and output	1	Applying
M1.04	Construct a Summing amplifier circuits using Op-Amp 741 and verify the output	3	Applying
M1.05	Construct Difference amplifier circuits using Op-Amp 741 and verify the output	3	Applying
CO2	**Design and develop various comparators, waveshaping circuits and waveform generators using operational amplifier 741**		
M2.01	Setup a Zero crossing detector circuit using Op-Amp 741 and plot the I/O waveforms	1	Applying
M2.02	Design a Schmitt trigger circuits using Op-Amp 741 1. Plot the I/O waveforms 2. Measure the LTP and UTP of the Schmitt trigger	2	Applying

M2.03	Design a Differentiator circuit using Op-Amp 741 and plot the pulse and frequency response	1	Applying
M2.04	Design an Integrator circuit using Op-Amp 741 and plot the pulse and frequency response.	1	Applying
M2.05	Design a triangular wave generator using Op-amp 741 and measure its frequency of operation	1	Applying
M2.06	Design a monostable multivibrator using Op-amp 741 1. Plot the waveforms 2. Measure the time delay	3	Applying
M2.07	Design a symmetrical astable multivibrator using Op-Amp 741 1. Plot the waveforms 2. Find out the frequency of oscillation	1.5	Applying
M2.08	Design an asymmetrical astable multivibrator using Op-Amp 741 1. plot the waveforms 2. Find out the frequency of oscillation	1.5	Applying
M2.09	Design a RC phase shift oscillator using Op-Amp 741 1. Plot the output waveform 2. Measure the frequency of oscillation	1.5	Applying
M2.10	Design a Wien bridge oscillator using Op-Amp 741 1. Plot the output waveform 2. Measure the frequency of oscillation	1.5	Applying
	Lab Exam– I	3	
CO 3 :Implement multivibrator circuits using 555 timer IC			
M3.01	Design a symmetrical astable multivibrator using IC 555 1. Plot the output waveform 2. Measure the frequency and duty cycle of oscillation	1.5	Applying
M3.02	Design an asymmetrical astable multivibrator using IC 555 1. Plot the output waveform 2. Measure the frequency and duty cycle of oscillation	1.5	Applying
M3.03	Design a monostable multivibrator using 555 IC 1. Plot the output waveform 2. Measure the time delay	3	Applying

CO4	Demonstrate fixed and variable power supplies and converters		
M4.01	Setup a +5V, 1A power supply using IC 7805	3	Understanding
M4.02	Setup a low voltage power supply using LM 723	3	Understanding
M4.03	Construct a 4-bit R-2R ladder DAC and obtain the output voltage level for all input combinations	3	Understanding
	Lab Exam – II	3	

Text / Reference:

T/R	Book Title/Author
T1	Roy D. C. and S. B. Jain, **Linear Integrated Circuits**, New Age International, 3/e, 2010
T2	Sergio Franco, **Design with operational amplifiers and analog integrated circuits**, 3rd Edition, Tata McGraw-Hill, 2008
R1	Gayakwad R. A., **Op-Amps and Linear Integrated Circuits**, Prentice Hall, 4/e, 2010
R2	Botkar K. R., **Integrated Circuits**, 10/e, Khanna Publishers, 2010
R3	SalivahananS. ,V. S. K. Bhaaskaran, **Linear Integrated Circuits**, Tata McGraw Hill, 2008
R4	David A. Bell, **Operational Amplifiers & Linear ICs**, Oxford University Press, 2nd edition,2010

Online Resources:

Sl.No	Website Link
1	http://vlab.amrita.edu/?sub=3&brch=225
2	http://he-coep.vlabs.ac.in/List%20of%20experiments.html?domain=ElectronicsandCommunications
3	https://www2.mvcc.edu/users/faculty/jfiore/et262.html
4	https://freevideolectures.com/course/2915/linear-integrated-circuits

Student Activity

Suggested Open-ended Experiments:

Students can do open ended experiments as a group of 3-5. There is no duplication in experiments in between groups. This is mainly for the purpose of continuous internal evaluation and a score of 15 marks. Students should prepare a separate report on open ended experiment of their choice.

Example :

1. Lamp Flasher circuit(lamp dimmer circuit – where the lamp is turned ON/OFF at set frequency or time intervals) using NE 555.
2. 10 minute timer circuit using 555
3. Temperature control DC fan using 741.
4. Stereo balance indicator using 741.

Sample Questions to Test Outcomes

1. Given IC 555 construct a waveshaping circuit to generate a pulse of duration T=1 ms.
2. Given IC 741, generate a square wave with duty cycle 75% which oscillates at a frequency of 1kHz.