



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Power Electronics

Course / Subject Code: DI03024061

Course / Subject Name: Linear Electronic Circuits

W. E. F. Academic Year:	2024-25
Semester:	3 rd
Category of the Course:	PCC

Prerequisite:	Fundamental knowledge of Transistors
Rationale:	Linear electronic circuits that containing Operational amplifier is one of the most common electronic parts in sensor and signal conditioning equipment. To maintain signal conditioning circuits, it is essential to test the performance of operational amplifiers. Hence, this course deals with all those aspects of operational amplifiers with positive and negative feedback for various configurations. Therefore, undertaking this course will help to maintain the linear electronics circuits comprising of the operational amplifiers used in various applications.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Explain IC technology and basic terminology of Operational Amplifier.	R, U, A
02	Test Op-Amp in Closed loop Configuration.	R, U, A
03	Use Op-Amp for various Linear applications.	R, U, A
04	Use Op-Amp for various Non-Linear applications.	R, U, A
05	Use Op-Amp for Waveform generation and Audio applications.	R, U, A

*Revised Bloom's Taxonomy (RBT)

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR		C	Theory		Tutorial / Practical	
			ESE (E)		PA (M)	PA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Power Electronics

Course / Subject Code: DI03024061

Course / Subject Name: Linear Electronic Circuits

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction to Operational Amplifiers IC: Classification of IC (based on type, Temperature, Type of user, No of integrated components), IC packages, pin identification Operational Amplifier: definition, block diagram, Pin Outs (TO-5, 8-DIP,14-DIP), Circuit symbol, Parameters (Input offset voltage and current, Input bias current, Input capacitance, Input voltage range, Common mode rejection ratio, Output voltage swing, output resistance, Power consumption, slew rate, Thermal Drift, Power Supply rejection ratio, Noise), Characteristics of Ideal Op-Amp Vs Practical Values for IC 741.	09	20
2.	Op-Amp with Negative Feedback Open loop Op-Amp Configurations: Non-Inverting, Inverting and Differential. Closed loop Op-Amp Configurations: Inverting, Non-Inverting, Differential Amplifier (1 Op-Amp, 2 Op-Amp). Voltage follower, Buffer.	09	20
3.	Linear Applications of Op-Amp Summing Amplifier configurations: Inverting, Non-Inverting, Differential. Integrator, Differentiator: Ideal Active Integrator, Practical Integrator, Summing Integrator, Ideal Active Differentiator, Practical Differentiator, Voltage to Current Converter: Grounded Load, Inverting Amplifier. Current to Voltage converter Instrumentation Amplifier: Requirements, Three Op-Amp Amplifier, Using Transducer Bridge, Using Programmable Gain	13	30
4.	Non-Linear Applications of Op-Amp Input Offset Voltage Compensation: Inverting, Non-Inverting, Differential Configuration Circuits. Input Bias Current Compensation. Comparator: Ideal (Inverting, Non-Inverting), Practical circuit, Limitations, Comparator Applications: Zero Crossing Detector, Schmitt Trigger (Inverting, Non-Inverting)	07	15



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Power Electronics

Course / Subject Code: DI03024061

Course / Subject Name: Linear Electronic Circuits

5.	Special Applications of Op-Amp AC/DC amplifier circuit waveform analysis with single supply. Audio Amplifier: Audio Power Amplifier and Siren/Alarm (using LM 380) Three terminal adjustable Regulator LM317: Various regulators comparison, connection diagram, output voltage equation, Functional diagram, Limitations	07	15
Total		45	100 %

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	60	0	0	0

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Op-Amps and Linear Integrated Circuits	Gayakwad R. A.	PHI Learning, New Delhi (2009), 4th edition or latest
2	Electronic devices and circuits	Gupta J. B.	S. K. Kataria & Sons (2012), 3rd edition or latest
3	Op-Amps and Linear Integrated Circuits	Dr. Sharma Sanjay	S. K. Kataria & Sons (2017), 4th edition or latest
4	Linear Integrated Circuits and Applications	Bakshi U. A., Godse A. P.	Technical Publications (2007), 1st edition or latest

(b) Open-source software and website:

1. http://www.electronics-tutorials.ws/opamp/opamp_1.html
2. <http://educyclopedia.karadimov.info/electronics/electronicaopening.htm>
3. <http://www.electronics-tutorials.ws/>
4. http://www.analog.com/library/analogDialogue/archives/39-05/op_amp_applications_handbook.html
5. <http://www.indiabix.com/electronics/questions-and-answers/>



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Power Electronics

Course / Subject Code: DI03024061

Course / Subject Name: Linear Electronic Circuits

6. <http://holbert.faculty.asu.edu/ece201/opamp.html>
7. SEQUEL

Suggested Course Practical List:

S. No.	Practical Outcomes (PrOs)
1	Study various IC types and Packages.
2	Interpret the parameters of given Op-Amplifier using Data Sheet.
3	Test the performance of open loop inverting amplifier.
4	Test the performance of open loop non-inverting amplifier.
5	Test the performance of open loop differential amplifier.
6	Test the performance of closed loop inverting amplifier.
7	Test the performance of closed loop non-inverting amplifier.
8	Test the performance of differential amplifier using one op-amp.
9	Test the performance of differential amplifier using two op-amp.
10	Test the performance of AC amplifier using single supply.
11	Test the performance of Summing amplifier using inverting and non-inverting configuration.
12	Test the performance of Averaging amplifier using inverting and non-inverting configuration.
13	Test the performance of Subtractor using inverting, non-inverting and differential configuration of Op-amp.
14	Test the performance of voltage to current converter.
15	Test the performance of Practical Integrator circuit.
16	Test the performance of Practical differentiator circuit.
17	Check the performance of zero crossing detector.
18	Determine the frequency of Schmitt trigger circuit.
19	Test the performance of AC/DC Amplifiers with single supply.
20	Test the performance of adjustable voltage power supply using LM317.
21	Test the performance of adjustable voltage power supply using LM317.

List of Laboratory/Learning Resources Required:

S. No.	Equipment Name with Broad Specifications
1.	Digital Multimeter.
2.	Operational Amplifier Trainer.
3.	Power Supply.
4.	Variable voltage power supply trainer using LM317.
5.	DSO.



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Power Electronics

Course / Subject Code: DI03024061

Course / Subject Name: Linear Electronic Circuits

Suggested Project List:

1. Make universal test board for op-amp to verify different applications using op-amp and discrete components.
2. Demonstrate use of Op-Amp Instrumentation Amplifier in Interfacing of various sensors and transducers for display purpose.

Suggested Activities for Students:

1. Compare and analyze any two Op-Amp Datasheets.
2. Observe the output parameter as well waveform using simulation and compare it with practical results.
3. Prepare Hazard Analysis report for various materials used in ICs.
4. Use Op-Amp for Sensor signal conditioning and amplification circuit.

* * * * *