Name of Institute: Indus Institute of Technology and Engineering
Name of Faculty: Dr Minesh P Thaker

Course code: EC 0401
Course name: Linear Integrated Circuits
Pre-requisites: Basic Electronics
Credit points: 4
Offered Semester: IV the

Course Coordinator (weeks 01 – 16)
Full Name: Dr Minesh P Thaker
Department with sitting location:EC LAB 6
Telephone: 3201
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Consultation times:

Students will be contacted throughout the Session via **Google Classroom** with important information relating to this Course.

Course Objectives

By participating in and understanding all facets of this Course a student will:

1) **Study** the basic principles, configurations and practical limitations of op-amp.
2) **Analyse** , **design**, **construct** and **create** various linear and non-linear applications of op-amp
3) **Analyze** and **design** op-amp oscillators, single chip oscillators and frequency generators
4) **Analyze**, **design** and **explain** the characteristics and applications of active filters, including the switched capacitor filter
5) **Understand** ,**design construct** and **create** the most commonly used Power supplies(78xx,79xx,LM723 etc.) and Timer ICs(555)

Course Outcomes (CO)

CO1	To **explain** the op-amp's basic construction, characteristics, parameter limitations, various configurations and countless applications of op-amp.
CO2	To **compare** and **select** the various operational amplifier ICs using performance parameter given in the data sheets
CO3	To **analyze** basic op-amp circuits, particularly various linear and non-linear circuits, active filters, signal generators, and data converters
CO4	To **design** basic op-amp circuits, particularly various linear and non-linear circuits, active filters, signal generators, and data converters

CO5	To **apply** the concepts of op-amps and become proficient with computer skills (eg., Multisim) for the analysis and design of circuits
CO6	To **create** the analog circuit system for domestic applications

Course Outline

(Key in topics to be dealt)

UNIT I		
Chapter	**Titles**	**Hrs**
Chapter 1	Circuit Symbol, and terminals, basic Operational amplifier circuit, voltage follower Circuit, non inverting and inverting amplifier	3
Chapter 2	Operational Amplifier Parameter and Performances, Ideal and Practical Operational Amplifier, Input Output and Supply voltages, offset voltages and currents, Input and Output Impedances, Slew rate and frequency limitations	4
Chapter 3	Summing Amplifier, Difference Amplifier, Instrumentation Amplifier	5
UNIT II		
Chapter 7	Current to Voltage Converter, Basic Log and basic Anti Log Amplifier	6
Chapter 8	Voltage Level Detector, Schmitt Trigger Circuits, Comparator, Differentiator, Integrator.	5
UNIT III		
Chapter 9	Precision Half wave and Full wave Rectifier circuits	5
Chapter 10	Tri-angular Wave Generator, 555 Timer, Mono-stable A-stable Multi-vibrator Design and Analysis	6
UNIT IV		
Chapter 12	Active Filter Design calculations for First order and Second order low pass filters	5
Chapter 13	Fixed and Adjustable voltage regulators	3
Chapter 15	Analog to digital conversion basics and Digital to analog Convertion,	3

Method of delivery

(Face to face lectures, self study material, Active Learning Techniques)

Face to Face lectures via power point presentations and chalk-Blackboard

Study time

(How many hours per week including class attendance)

3 hours Theory

2 Hours Lab

CO-PO Mapping (PO: Program Outcomes)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO 1	3	3	3	3	3	-	2	1	1-	1	1	1
CO 2	3	2	3	1	3	-	-	-	-	-	-	-
CO 3	3	2	2	2	3	-	-	-	-	-	-	-
CO 4	3	2	1	-	-	-	-	-	-	-	-	1
CO 5	3	2	3	1	3	-	3	3	-	-	-	1
CO 6	3	3	1	1	3	-	3	3	-	-	-	1

Blooms Taxonomyand Knowledge retention(For reference)

(Blooms taxonomy has been given for reference)

Figure 1: Blooms Taxonomy

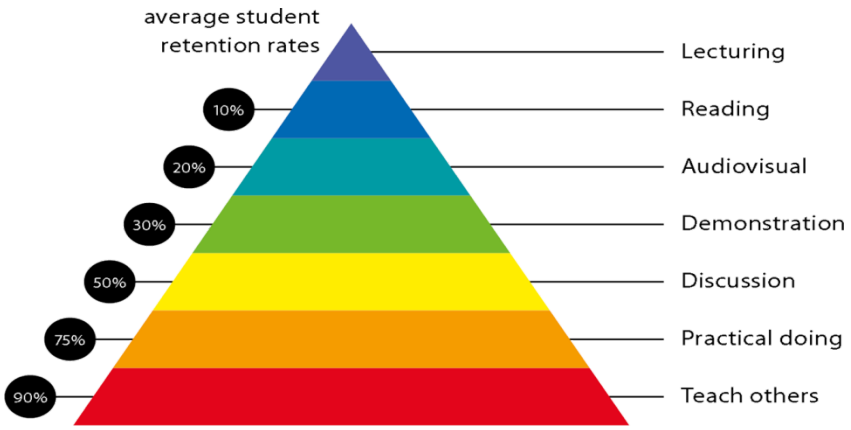

Figure 2: Knowledge retention

Graduate Qualities and Capabilities covered

(Qualities graduates harness crediting this Course)

General Graduate Qualities	Specific Department of EC_Graduate Capabilities
Informed Have a sound knowledge of an area of study or profession and understand its current issues, locally and internationally. Know how to apply this knowledge. Understand how an area of study has developed and how it relates to other areas.	**1 Professional knowledge, grounding & awareness**
Independent learners Engage with new ideas and ways of thinking and critically analyze issues. Seek to extend knowledge through ongoing research, enquiry and reflection. Find and evaluate information, using a variety of sources and technologies. Acknowledge the work and ideas of others.	**2 Information literacy, gathering & processing**
Problem solvers Take on challenges and opportunities. Apply creative, logical and critical thinking skills to respond effectively. Make and implement decisions. Be flexible, thorough, innovative and aim for high standards.	**4 Problem solving skills**
Effective communicators	**5 Written communication**
	6 Oral communication

Articulate ideas and convey them effectively using a range of media. Work collaboratively and engage with people in different settings. Recognize how culture can shape communication. **Responsible** Understand how decisions can affect others and make ethically informed choices. Appreciate and respect diversity. Act with integrity as part of local, national, global and professional communities.	**7 Teamwork** **10 Sustainability, societal & environmental impact**

Practical work:

(Mention what practical work this Course involves)

Lecture/tutorial times

(Give lecture times in the format below)

Example:

A

The University norms states that it is the responsibility of students to attend all lectures, tutorials, seminars and practical work as stipulated in the Course outline. Minimum attendance requirement as per university norms is compulsory for being eligible for mid and end semester examinations.

Details of referencing system to be used in written work

Text books

T1	**Text Book** David A Bell, "Operational Amplifier and Linear IC's", Third Edition, Oxford University Press, ISBN 13: 9780195696134
R1	**Reference Books** Ramakant Gayakwad "Op-amps and Linear Integrated Circuits", 4/e, PHI publication, ISBN 13: 9788120320581
R2	Sergio Franco "Design with Operational Amplifiers and Analog Integrated Circuits", Tata Mcgraw-hill 2009 Edition, ISBN 13: 9780070217997

R3	D. Roy Choudhury and Shail B. Jain, “Linear Integrated Circuits”, 3/e New Age International Publishers, ISBN 13: 9788122430981

Additional Materials

All material will be found on Google class room of this subject.

ASSESSMENT GUIDELINES

Your final course mark will be calculated from the following:
For Theory:

Assignments	20 % of 60 marks(week3,6,9,13)	Derivations , Numericals (Design & Analysis) and explanation (Diagram Operation)
Quiz	15 % of 60 (week 5)	MCQ
Attendance	15 % of 60 (week 9)	minimum 80
Mid semester (closed book)	50 % of 60 (due in week 10)	All the above
Final exam (closed book)	100% of 40 marks	All the Above

For Practical

Performance on Practical work	20% of 60 Marks	Assessment is based practical performance. Regularities ,accuracy and speed are the major parameters to be observed. Minimum 10 experiment is to be performed with the approval of faculty for appearing at practical exam.
Mini Project(Minor 1& Minor 2)	60 % of 60 Marks (7.5 Marks each for Design, Simulation, Breadboard implementation and GPB.)	Student has to gone through four stages. Design, Simulation, testing Using Bread Board and final on General Purpose board.

Attendance	20% of 60 marks	100 % attendance in Practicals
Final exam (Practical Exam)	100 % of 40 Marks	Final exam consists of two. One is Viva Voce of 30% and 30 % of Practical performance at the time of exam.

SUPPLEMENTARY ASSESSMENT

Students who receive an overall mark less than 40% in mid semester or end semester will be considered for supplementary assessment in the respective components (i.e mid semester or end semester) of semester concerned. Students must make themselves available during the supplementary examination period to take up the respective components (mid semester or end semester) and need to obtain the required minimum 40% marks to clear the concerned components.

Practical Work Report/Laboratory Report:

A report on the practical work is due the subsequent week after completion of the class by each group.

Late Work

Late assignments will not be accepted without supporting documentation. Late submission of the reports will result in a deduction of 2% of the maximum mark per calendar day

Format

All assignments must be presented in a neat, legible format with all information sources correctly referenced. **Assignment material handed in throughout the session that is not neat and legible will not be marked and will be returned to the student.**

Retention of Written Work

Written assessment work will be retained by the Course coordinator/lecturer for two weeks after marking to be collected by the students.

University and Faculty Policies

Students should make themselves aware of the University and/or Faculty Policies regarding plagiarism, special consideration, supplementary examinations and other educational issues and student matters.

Plagiarism - Plagiarism is not acceptable and may result in the imposition of severe penalties. Plagiarism is the use of another person's work, or idea, as if it is his or her own

- if you have any doubts at all on what constitutes plagiarism, please consult your Course coordinator or lecturer. Plagiarism will be penalized severely.

Do not copy the work of other students.
Do not share your work with other students (except where required for a group activity or assessment)

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Course schedule(subject to change)

(Mention quiz, assignment submission, breaksetcas well in the table under the Teaching Learning Activity Column)

Week #	Topic & contents	CO Addressed	Teaching Learning Activity (TLA)
Weeks 1	Unit 1 mentioned in the syllabus	1 2	
Weeks 2	Unit 1 mentioned in the syllabus	1 2	Assignment 1
Week 3	Unit 1 mentioned in the syllabus	*1 2 3*	
Week 4	Unit 2 mentioned in the syllabus	2 3	Assignment 1 submission and assignment 2 given, Test
Week 5	Unit 2 mentioned in the syllabus	2 3 4	
Week 6	Unit 2 mentioned in the syllabus	*2 3 4*	*Assignment 3 given and Assignment 2 submission*
Week 7	Unit 3 mentioned in the syllabus	3 4	Quiz
Week 8	Unit 3 mentioned in the syllabus	3 4 5	Assignment 4 given and Assignment 3 submission
Week 9	Unit 3 mentioned in the syllabus	*3 4 5*	*Oral Test*
Week 10	Unit 4 mentioned in the syllabus	3 4 5	Assignment 4 submission
Week 11	Unit 4 mentioned in the syllabus	3 4 5	Query and problem solving
Week 12	Unit 4 mentioned in the syllabus	3 4 5	Final Assessment declaration.

Prgram Map for Engineering
(Electronics and Communication)