NATIONAL INSTITUTE OF TECHNOLOGY TIRUCHIRAPPALLI

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE OUTLINE TEMPLATE

Course Title	Linear Integrated Circuits		
Course Code	EEPC17	No. of Credits	3
Department	Electrical and Electronics Engineering	Faculty	Mr. Karthik Thirumala
Pre-requisite Course	CIRCUIT THEORY		
Course Coordinator			
E-mail	thirumala@nitt.edu	Telephone No.	+91 9848 626 021
Course Type	Program Core (PC)		

COURSE OVERVIEW

This course introduces and presents properties and analysis of integrate circuits, operational amplifiers, Analog Electronics and Voltage Regulators. It also explains the basic parameters need to be looked in for proper selection of an op-amp and IC for various industrial and control applications.

COURSE OBJECTIVES

This course provides a basic understanding of linear integrated circuits, active filters and their classification. Provides in-depth instructions on the characteristics and applications of operational amplifiers, timers and voltage regulators.

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)

	On completion of the course the students will be able to	
	1. Describe the various ideal and practical characteristics of an op-amp.	PO_1, PO_2, PO_3, PO_8 – PO_{13}
	2. Develop simple op-amp based circuits.	
	3. Implement various analog signal processing circuits.	PO_1, PO_2, PO_3, PO_8 – PO_{13}
	4. Analyze and design various types of ADCs and DACs.	PO_1, PO_2, PO_3, PO_8 – PO_{13}
	5. Analyze and construct various application circuits using 555 timers.	PO_1, PO_2, PO_3, PO_8 – PO_{13}
		PO_1, PO_2, PO_3, PO_8 – PO_{13}

COURSE TEACHING AND LEARNING ACTIVITIES

S. No.	Week	Topic	Mode of Delivery
1.	III week of July (10th – 12th) 1 hr	Introduction to Linear Integrated Circuits	Lecture *(Introduction)*
2.	III week of July (10th – 12th) 1 hr	Introduction to op-amps and its block diagram representation, symbol and analysis	Presentation
3.	III week of July (10th – 12th) 1 hr	Equivalent circuit and characteristics of Ideal Op-amp	Presentation
4.	IV week of July (17th – 19th) 2 hrs	Equivalent circuit and characteristics of Practical Op-amp. Parameters of op-amp	Lecture *Chalk and board*
5.	IV week of July (17th – 19th) 1 hr	Open loop Configurations	Lecture *Chalk and board*
6.	V week of July (24th – 26th) 1 hr	Frequency response of an op-amp	Lecture *Chalk and board*
7.	V week of July (24th – 26th) 2 hrs	Problems	Tutorial
8.	V week of July (24th – 26th) 1 hr	Closed loop frequency response and circuit stability	Lecture *Chalk and board*
9.	I week of August (1st – 2nd) 1 hr	Problems on frequency response and stability	Tutorial

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9.	I week of August (1st – 2nd) 1 hr	Problems on frequency response and stability	**Tutorial**
10.	II week of August (7st – 9th) 1 hr	Introduction to DC and AC Amplifiers with Single phase supply	**Lecture** *Chalk and board*
11.	II week of August (7st – 9th) 1 hr	Summing and scaling amplifier Averaging amplifier and voltage follower	**Lecture** *Chalk and board*
12.	II week of August (7st – 9th) 1 hr	Problems on summing, differential amplifiers	**Tutorial**
13.	III week of August (14th) 1 hr	Differentiator and Integrator	**Lecture** *Chalk and board*
14.	III week of August (16th) 1 hr	Positive and negative Clampers and Clippers	**Lecture** *Chalk and board*
15.	IV week of August (21st – 23rd) 2 hrs	Low-pass, high-pass and bandpass and band rejection Active Filters	**Lecture** *Chalk and board*
16.	IV week of August (21st – 23rd) 1 hr	Problems on filter design	**Tutorial**
17.	V week of August (28th – 30th) 1 hr	Types of Oscillators and their principles	**Lecture** *Chalk and board*
18.	V week of August (28th – 30th) 2 hrs	Sine, Square, triangular wave Oscillators	**Lecture** *Chalk and board*
19.	II week of September (4th – 6th) 1 hr	Saw tooth wave generator	**Lecture** *Chalk and board*
20.	II week of September (4th – 6th) 1 hr	Problems and discussion	**Tutorial**
21.	II week of September (4th – 6th) 1 hr	Comparators and Schmitt trigger	**Lecture** *Chalk and board*
22.	III week of September (11th – 13th) 1 hr	Window detector and peak detector	**Lecture** *Chalk and board*
23.	III week of September (11th – 13th) 1 hr	Problems and discussion	**Tutorial**
24.	III week of September (11th – 13th) 1 hr	Introduction to A/D converter	**Lecture** *Chalk and board*

25.	IV week of September (18th – 20th) 2 hrs	Digital - to - Analog converters, sample and hold circuit	**Lecture** *Chalk and board*
26.	IV week of September (18th – 20th) 1 hr	Voltage controlled Oscillator	**Lecture** *Chalk and board*
27.	V week of September (25th – 27th) 1 hr	Introduction to Phase locked loop, their principles	**Lecture** *Chalk and board*
28.	V week of September (25th – 27th) 1 hr		**Lecture** *Chalk and board*
29.	V week of September (25th – 27th) 1 hr	Applications of the PLL	**Lecture** *Chalk and board*
30.	I week of October (2nd – 4th) 1 hr	Problems and Discussion	**Tutorial**
31.	I week of October (2nd – 4th) 1 hr	Introduction to Multisim and Pspice Circuit simulations Assignment	**Presentation**
32.	II week of October (9th – 11th) 1 hr	The 555 Timer – monostable operation	**Lecture** *Chalk and board*
33.	II week of October (9th – 11th) 2 hrs	Astable mode of operation of 555 Timer	**Lecture** *Chalk and board*
34.	III week of October (16th – 17th) 1 hrs	Voltage Regulators –Fixed, adjustable and switching	**Lecture** *Chalk and board*
35.	III week of October (16th – 17th) 1 hr	Problems and Discussion	**Tutorial**
36.	IV Week of October (23rd – 25th) 2 hrs	Assignment	**Flipped class**
37.	IV Week of October (23rd – 25th) 1 hr		**Flipped class**
38.	III week of November (13th – 15th) 3 hrs	Endsem	**End Semester Examination (Descriptive)**

COURSE ASSESSMENT METHODS

S. No.	Mode of Assessment	Week/Date	Duration	% Weightage
1.	Internal Exams	III week of August ($14^{th} - 16^{th}$)	1 hr	20%
		IV week of September ($18^{th} - 20^{th}$)	1 hr	20% Total = 40%
2.	Assignement	IV week of October ($23^{rd} - 25^{th}$)		10%
3.	End Semester Exam	III week of November ($13^{th} - 15^{th}$)	3 hrs	50%

ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc

1. R. A. Gayakwad, "Op-amp & Linear Integrated Circuits" Prentice Hall of India, New Delhi, 4th Edition, 2009.
2. Roy Choudhury and Shail Jain, "Linear Integrated Circuits", 4th Edition, New Age International Publishers, 2010.
3. Sergio France, "Design with Operational Amplifiers and Analog Integrated Circuits", Tata McGraw Hill, 3rd Edition, 2002.
4. Sedra Smith, "Microelectronic Circuits", Oxford University Press, 6th Edition, 2009.

COURSE EXIT SURVEY

1. Students' feedback through class committee meetings
2. Feedback questionnaire from students – twice during the semester
3. Feedback from students on Course Outcomes at the end of the semester
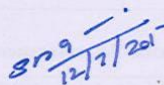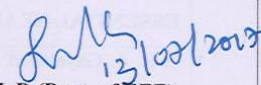
COURSE POLICY

1. All the students are expected to attend all the contact hours.

2. Students should maintain 75% attendance for the physical contact hours to attend the Endsem written examination.

3. No retest will be conducted for those students who are being physically absent for any of the evaluation / assessment methods. Anyhow flexibility is given to the students to fix the date for each mode of evaluation convenient to all the students. In case of medical emergency, the student may appear retest of internals on submission of appropriate documents as proof. The assignment is for 10% weightage and would be framed according to the time frame available.

4. The minimum marks for passing this course and grading pattern will adhere to the regulations of the institute.

5. In case of any student found guilty indulging in any mal practice, he/she will be awarded no marks in that particular assessment. If found using mobile phones or any other gadgets for any mal-practice during the final written examination, the answer sheet of the student will not be evaluated and will be awarded ZERO marks in the final written examination.

ADDITIONAL COURSE INFORMATION

1. The Course Coordinator is available for consultation during the time intimated to the students then and there.
2. All correspondence will be sent to the webmail id of the students alone if required.
3. The students will be communicated through the email id: thirumala@nitt.edu for any academic related issues (including sharing of study materials) with respect to this course.

FOR SENATE'S CONSIDERATION

11/7/2017	*12/7/2017*	*12/07/2017*
[Mr. Karthik Thirumala, TF/EEE] **Course Faculty**	**[Dr. Sishaj P Simon]** **CC-Chairperson**	**HoD (Dept. of EEE)**