ECE2015	INTEGRATED CIRCUITS	L	T	P	J	C
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Prerequisite	BIT1013- Semiconductor Devices and Circuits	**Syllabus version**				
		1.1				

Course Objectives:

1. Describe the linear and non-linear applications of op-amps
2. Discuss filters, ADC and DAC
3. Introduce the concepts of voltage regulator
4. Compare the concepts of waveform generation and introduce some special function ICs

Expected Course Outcome:

The student will be able to

1. Design linear and nonlinear applications of op – amps
2. Choose appropriate A/D and D/A converters for signal processing applications.
3. Generate waveforms using op – amp circuits
4. Gain knowledge about PLL
5. Design oscillators and filters using functional ICs
6. Analyze special function ICs
7. Develop skills to develop simple filter circuits and various amplifiers
8. Identify the method to apply various signal conditioning circuits

Student Learning Outcomes (SLO):	**1,2,5**

Module:1	**Basic Op-amp circuits**	**5 hours**

Op-Amp Fundamentals -Practical Limitations of op-amp circuits-Frequency compensation and stability Gain bandwidth product- Voltage Follower - Design of Instrumentation amplifier- VCVS, CCVS and VCCS- Voltage to Current converter –Computer Aided Analysis of Circuits using Pspice, dual opamp TL082 as a general purpose JFET input opamp.

Module:2	**Active Filters**	**4 hours**

Introduction to filtering - frequency response-characteristics and terminology-active versus passive filters-low pass filter-first order low pass active filter- second order active filter model-second order low pass filter characteristics-Sallen-key unity gain filter-Sallen-key equal component filter- higher order filters- high pass active filter- band pass filter-single op-amp band pass filter- multistage band pass filter state variable filter- state variable filters-all pass filters -switched capacitor filters-design of biomedical signal conditioning circuits.

Module:3	**Non-Linear circuits**	**4 hours**

Log / antilog amplifiers-comparator - zero crossing detector - sample and hold circuit - precision diode half wave and full wave rectifiers - active peak detector - clipper and clamper - square and triangular waveform generators-Phase changers - sinusoidal oscillators- Computer Aided Analysis of Circuits using Multisim.

Module:4	**Timer and PLL**	**4 hours**

555 timer - monostable and astable operation - applications - 556 voltage controlled oscillator - function generator ICs-functional block diagram - principle of operation - building block of PLL - characteristics - derivations of expressions for lock and capture ranges -frequency synthesis- application of PLL in biomedical systems - analog multiplier and phase detection -wide band width precision analog multiplier MPY 634 and its applications.

Module:5	**A-D and D-A Converters**	**4 hours**

Digital to analog converters - binary weighed and R-2R ladder types – parallel input multiplying type DAC7821

analog to digital converters - continuous - counter ramp-successive approximation-single slope-dual slope -flash type ADC-tracking ADC- DAC/ADC performance characteristics and comparison.		
Module:6	**Voltage Regulators**	**3 hours**
IC Voltage regulators – Three terminal fixed and adjustable voltage regulators – IC 723 general purpose regulator – Monolithic switching regulator - Switching Regulators - DC-DC converters - Low Drop Out (LDO) Regulators.		
Module:7	**Special Function ICs**	**4 hours**
Switched capacitor filter IC MF10 - Frequency to Voltage and Voltage to Frequency converters - Audio Power amplifier - Video Amplifier - Isolation Amplifier - Opto-couplers and fibre optic IC.		
Module:8	**Contemporary issues:**	**2 hours**
	Total Lecture hours:	**30 hours**

Text Books		
1.	Ramakant.A.Gayakwad, "Op-Amps and Linear Integrated Circuits", 2015, 4th edition, Pearson education-India, Bangalore.	
2.	Roy Choudhury and Shail Jain, "Linear Integrated Circuits", 2011, 1st edition, Wiley Eastern Ltd, India.	
Reference Books		
1.	Coughlin and Driscoll, "Operational-Amplifiers and Linear Integrated Circuits", 2011, 6th edition, Pearson education-India, Bangalore.	
2.	Sergio Franco, "Design with operational amplifier and analog integrated circuits", 2014, 3rd edition, Tata McGraw Hill, Noida.	
Mode of Evaluation: CAT, Digital Assignment, Quiz and FAT		
List of Challenging Experiments: (Indicative)		
1.	Design Butterworth 2nd order active LPF and HPF with cut-off frequency of 1.5KHz.	6 hours
2.	Construct an Instrumentation amplifier in differential mode and realize the output of one of the sensor connected to the circuit	6 hours
3.	Design and test a high-Q band pass self-tuned filter for a given centre frequency	6 hours
4.	Design and test a notch filter to eliminate 50 Hz power line noise in the medical equipment like ECG Machine	6 hours
5.	Designing with 12 bit parallel input multiplying DAC 7821	6 hours
Total Laboratory Hours		30 hours
Mode of Evaluation: Continuous Assessments and FAT		
List of Projects: (Indicative)		

1. Design a motion detector using IC 555 timer circuit, which automatically switches on an alarm when someone comes close to it (Detection of theft or an unauthorized person entering a restricted area)
2. Design an automatic headlight switcher circuit using IC 555 which reacts like the human eye to outside light levels and independently turns the light on and off when needed.
3. Design a dual audio signal tracer circuit, to trouble shoot for audio signal in radio and other electronically circuitry.
4. Design a low cost hearing aid using IC 741. Audio signal are sensed by the condenser microphone and amplified by IC741.

5. Design a sequential time for DC motor control for industrial applications which requires rotation of the motors in forward and reverse directions for desired periods.			
Mode of Evaluation: Review I, II, III.			
Recommended by Board of Studies	21-08-2017		
Approved by Academic Council	No. 47	Date	5-10-2017