Kadi Sarva Vishwavidyalaya

Faculty of Engineering & Technology

Electronics and communication Engineering

(Academic Year 2019-20)

Subject Code: EC505-N	Subject Title: INTEGRATED CIRCUITS AND APPLICATIONS
Pre-requisite	

Course Objective:

The educational objectives of this course are

- learn the fundamentals of op-amp and its basic amplifier configurations
- learn the practical op-amp parameters
- analyze and design the op-amp for linear and non-linear application
- analyze and design the op-amp for filter application
- learn and analyze op-amp based ICs and its applications to construct the basic blocks of Analog signal processing

Teaching Scheme (Credits and Hours)

Teaching scheme				Total Credit	Evaluation Scheme					Total Marks
					Theory		IE Marks	CIA Marks	Pract. Marks	
L	T	P	Total							
Hrs	Hrs	Hrs	Hrs		Hrs	Marks				
03	00	02	05	04	03	70	30	20	30	150

Outline Of the Course:

Sr. No	Title of the Unit	Hours
1.	Introduction of operational amplifier	5
2.	An Op-amp with Negative Feedback	5
3.	Practical op-amp parameters	5
4.	General Linear Applications	8
5.	General non-linear applications	8
6.	Active Filters	8
7.	Specialized IC Applications	9
		48

Total hours (Theory): 48
Total hours (Lab):16 *2=32
Total hours: 80

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Detailed Syllabus:

Unit No.	Topics	Lecture Hours	Weightage(%)
1.	**Introduction of operational amplifier** Differential Amplifier based on MOS design, Block diagram representation of a typical op-amp, Schematic Symbol, Dual Power Supply for op-amp., Ideal op-amp., Interpreting datasheet, Ideal voltage transfer curve, Open-loop op-amp configurations	**5**	**15**
2.	**An Op-amp with Negative Feedback:** Voltage-series feedback amplifier, Voltage-shunt feedback amplifier, Differential amplifier.	**5**	**15**
3.	**Practical op-amp parameters:** Measurement of Input Offset Voltage, Input Offset Current, Input Bias Current, Differential Input Resistance, Output resistance, Input Capacitance, Offset Voltage Adjustment Range, Input Voltage Range, Output Offset Voltage Swing, CMRR, Slew rate, PSRR, Gain Bandwidth Products	**5**	**10**
4.	**General Linear Applications:** DC and AC amplifiers, AC amplifiers with single supply voltage, Peaking amplifier, Summing, Scaling and Averaging amplifier, Instrumentation amplifier, Differential input and differential output amplifier, Voltage-to-current converter with floating load and its applications, Current-to-voltage converter, Very high-input impedance circuit, Integrator, Differentiator.	**8**	**15**
5.	**General non-linear applications:** Comparator, Zero Crossing Detector, Schmitt Trigger, Voltage limiters, Clipper and clampers, Absolute value output circuit, Peak detector, Sample and hold Circuit, Precision rectifier, Half/Full Wave, Square, Triangular.& Sawtooth Wave, Log/Antilog Amplifier.	**8**	**15**
6.	**Active Filters:** Classification of filters, Magnitude and frequency scaling, Magnitude and attenuation characteristics of ideal and practical filters, Design parameter Q & _0, Biquad (Universal)filter design, Butter worth Low pass and High pass filters - 1st and 2nd order circuits design, Butterworth pole location, Sallen & Key circuit, Butterworth Band pass Filters- Frequency Transformation, Deliyannis- Friend circuit , Chebyshev filter characteristics,Band reject filters.	**8**	**15**

7.	**Specialized IC Applications:** **a. 555 Timer and its Applications:** Block Diagram, Monostable and Astable Multivibrator, Applications as Frequency Divider,Square Wave Generator. **b.** Free-Running Ramp Generator **c. Phase Locked Loop and Its Applications:** Block Diagram and Operation, Applications as Frequency Multiplier, Frequency Shift Keying. **d. Design of Power Supply:** Simple OP-AMP Voltage regulator, Three terminal Voltage regulators, Fixed and Adjustable Voltage Regulators (78XX, LM317), Heat Sink, Dual Power supply (LM320,LM317), Basic Switching Regulator and its characteristics.	**9**	**15**
	Total	**48**	**100**

Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lecture and laboratory which carries 10 marks in overall evaluation.
- One internal exam will be conducted as a part of internal theory evaluation.
- Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.
- Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.

Learning Outcome:

On successful completion of the course

• The student can identify different areas of Integrated Circuits. Can find the applications of all the areas in day to day life. Can identify the operations, working, construction, material etc. Aspects of Integrated Circuits, Rectifiers, Filters, Multivibrators, Signal Generators etc.

TEXT BOOKS:

Ramakant A. Gayakwad, op-amp and Linear Integrated Circuits, Prentice Hall India

REFERENCE BOOKS:

1. Behzad Razavi, Design of Analog CMOS integrated circuits, Tata Magraw hill
2. Van Valkenburg, Analog filter design, Oxford Publication
3. Sergio Franco, Design with operational amplifier and analog ICs, Tata Magraw hill
4. Robert F. Coughlin, Frederick F. Driscoll, Operational Amplifier and Linear ICs, Prentice Hall India
5. Integrated Circuit, by K.R.Botkar Khanna Publication.

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List of experiments (Not limited to following. Subject teacher may modify the same)**:**

Sr. No.	Experiment Title
1.	To configure op-amp in Inverting amplifier mode and measure gain.
2.	To configure op-amp in Non-Inverting amplifier mode and measure gain.
3.	To configure op-amp IC 741 as a summing amplifier.
4.	To configure op-amp IC 741 as an integrating amplifier.
5.	To configure Operational amplifier as a Differentiator.
6.	To configure op-amp IC 741 as an Instrumentation amplifier.
7.	To configure op-amp IC 741 as a low pass filter and plot its frequency response.
8.	To configure op-amp IC 741 as a High pass filter and plot its frequency response.
9.	To configure op-amp IC 741 as a Schmitt Trigger.
10.	To configure op-amp IC 741 as a Half wave Rectifier.
11.	To configure op-amp IC 741 as a Full wave Rectifier.
12.	Configure IC 555 as an Astable (free running) multivibrator.
13.	Configure IC 555 as Monostable multivibrator.
14.	Find slew rate of op-amp IC 741.
15.	Configure op-amp IC 741 as a waveform generator