COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC204	Analog Integrated Circuits	4-0-0-4	2016

Prerequisite: Nil

Course objectives:

- To equip the students with a sound understanding of fundamental concepts of operational amplifiers
- To know the diversity of operations that op amp can perform in a wide range of applications
- To introduce a few special functions integrated circuits.
- To impart basic concepts and types of data converters

Syllabus: Differential amplifier configurations, Operational amplifiers, Block diagram, Ideal op-amp parameters, Effect of finite open loop gain, bandwidth and slew rate on circuit performance, op-amp applications- linear and nonlinear, Active filters, Specialized IC and their application, Monolithic Voltage Regulators types and its Applications, Data Converters, specifications and types

Expected outcome:

- On completion of this course, the students will have a thorough understanding of operational amplifiers
- Students will be able to design circuits using operational amplifiers for various applications

Text Books:

1. Salivahanan S. ,V. S. K. Bhaaskaran, Linear Integrated Circuits, Tata McGraw Hill, 2008
2. Franco S., Design with Operational Amplifiers and Analog Integrated Circuits, 3/e, Tata McGraw Hill, 2008

References:

1. David A. Bell, Operational Amplifiers & Linear ICs, Oxford University Press, 2nd edition, 2010.
2. Gayakwad R. A., Op-Amps and Linear Integrated Circuits, Prentice Hall, 4/e, 2010.
3. R.F. Coughlin & Fredrick Driscoll, Operational Amplifiers & Linear Integrated Circuits, 6th Edition, PHI,2001
4. C.G. Clayton, Operational Amplifiers, Butterworth & Company Publ. Ltd./ Elsevier, 1971.
5. Roy D. C. and S. B. Jain, Linear Integrated Circuits, New Age International, 3/e, 2010.
6. Botkar K. R., Integrated Circuits, 10/e, Khanna Publishers, 2010.

Course Plan

Module	Course content (54hrs)	Hours	Sem. Exam Marks
I	Differential amplifiers: Differential amplifier configurations using BJT, Large and small signal operations, Balanced and unbalanced output differential amplifiers, Input resistance, voltage gain, CMRR, non ideal characteristics of differential amplifier. Frequency response of differential amplifiers, Current sources, Active load, Concept of current mirror circuits, Wilson current mirror circuits, multistage differential amplifiers.	6	15
	Operational amplifiers: Introduction, Block diagram, Ideal op-	5	

	amp parameters, Equivalent Circuit, Voltage Transfer curve, open loop op-amp configurations, Effect of finite open loop gain, bandwidth and slew rate on circuit performance		
II	Op-amp with negative feedback: Introduction, feedback configurations, voltage series feedback, voltage shunt feedback, properties of Practical op-amp.	3	**15**
	Op-amp applications: Inverting and non inverting amplifier, dc and ac amplifiers, peaking amplifier, summing, scaling and averaging amplifiers, instrumentation amplifier.	4	
FIRST INTERNAL EXAM			
III	Op-amp applications: Voltage to current converter, current to voltage converter, integrator, differentiator, precision rectifiers, log and antilog amplifier, Phase shift and Wien bridge oscillators	6	**15**
IV	Square, triangular and saw tooth wave generators, Comparators, zero crossing detector, Schmitt trigger, characteristics and limitations.	4	**15**
	Active filters, First and Second order Butterworth filter and its frequency response for LPF, HPF, BPF, BSF, and Notch filter.	5	
SECOND INTERNAL EXAM			
V	Specialized IC's and its applications: Timer IC 555 (monostable & astable operation), Voltage controlled oscillator, Analog Multiplier	4	**20**
	PLL, operating principles, Applications: frequency multiplication/division, Frequency synthesizer, AM & FM detection , FM modulator/Demodulator	4	
	Monolithic Voltage Regulators: Three terminal voltage regulators 78XX and 79XX series, IC723 , low voltage and high voltage regulator, Current boosting, short circuit and fold back protection.	4	
VI	Data Converters: D/A converter , specifications , weighted resistor type, R-2R Ladder type, switches for D/A converters, high speed sample-and-hold circuits	4	**20**
	A/D Converters: Specifications, Flash type, Counter ramp type, Successive Approximation type, Single Slope type, Dual Slope type	4	
END SEMESTER EXAM			

Question Paper Pattern

The question paper consists of three parts. Part A covers modules I and II, Part B covers modules III and IV and Part C covers modules V and VI. Each part has three questions. Each question can have a maximum of four subparts. Among the three questions one will be a compulsory question covering both the modules and the remaining two questions will be as one question from each module, of which one is to be answered. Mark pattern is according to the syllabus with maximum 30 % for theory and 70% for logical/numerical problems, derivation and proof.