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| **PCC-EC-205** | Analog Circuits and Design | **3L:0T:2P** | **4 credits** |

###### Course Objectives

###### To understand the concepts, working principles and key applications of linear integrated circuits.

###### To perform analysis of circuits based on linear integrated circuits.

###### To design circuits and systems for particular applications using linear integrated circuits.

**Content of course**

**Multi-stage Amplifiers**

Multi-stage amplifiers using BJT and MOSFET; Small-signal analysis of multi-stage amplifiers; Darlington circuit, Cascode circuit; Design of amplifiers based on given specifications. (Self-study syllabus: Concept of noise in amplifiers, Types of noise, Noise Figure)

**Feedback and Stability**

Feedback concept; General characteristics of negative feedback amplifiers; Gain, input and output resistance with feedback; Method of analysis of feedback amplifier; Voltage series, current series, voltage shunt, and current shunt amplifiers using BJT and MOSFET; Design of feedback amplifiers.

Stability of amplifiers, gain and phase margins, compensation

**Sinusoidal oscillators**

Criterion for oscillation; Barkhausen criteria; LC, RC, Wien bridge, and Crystal oscillators. (Self-study syllabus: Derivations of Frequency and gain criteria)

**Power Amplifiers and output stages**

Power transistors; Power amplifiers; Classes of amplifiers: class-A power amplifiers, class-B power amplifiers, Class-AB push-pull complementary output stages, class-C and class-D; Other power considerations.

**Introduction to OP-AMPs**

Differential amplifier using BJTs and MOSFETs; Ideal Op-Amp; Basic three-stage op-amp circuit using BJT and MOSFET

**Nonideal** **Effects** **in** **Operational** **Amplifier** **Circuits**

**Reference Books:**

1. Donald A. Neamen, Electronic Circuit Analysis and Design, Tata McGraw-Hill.

2. Adel S. Sedra, Kenneth C. Smith, Microelectronic Circuits, Oxford University Press.

3. J. Millman and C. C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems, Tata McGraw-Hill Publishing Company.

4. J. Millman, H. Taub and S. R. Mothiki, Pulse Digital and Switching Waveforms, Tata McGraw-Hill.

5. Robert L. Boylestad, Louis Nashelsky, Electronic Devices and Circuit Theory, PHI publishers.

6. Ramakant Gayakwad, Op-amps and Linear Integrated Circuits, PHI publishers

**Analog Circuits and Design Lab**

Hands-on experiments related to the course contents PCC-EC-212

**Course Outcomes**

At the end of this course students will demonstrate the ability to

1. Understand the fundamentals and areas of applications for the integrated circuits.
2. Analyze important types of integrated circuits
3. Demonstrate the ability to design practical circuits that perform the desired operations
4. Understand the functioning of OP-AMP and design OP-AMP based circuits
5. Understand the differences between theoretical, practical & simulated results in integrated circuits.
6. Select the appropriate integrated circuit modules to build a given application.

**Articulation Matrix (as below)**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| PO/PSO CO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | PSO1 | PSO2 |
| CO 1 | ✓ | ✓ |  | ✓ |  |  |  | ✓ |  | ✓ |  | ✓ |  |  |
| CO2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CO3 |  |  |  |  |  |  | ✓ |  |  |  |  |  |  |  |
| CO4 |  | ✓ | ✓ |  |  |  |  |  |  |  | ✓ |  |  |  |
| CO5 |  |  |  |  | ✓ |  |  |  |  |  |  |  |  |  |

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