



### Op-Amp Practical Applications: Design, Simulation and Implementation Electronics & Communication Engineering

**Instructor Name:** Hardik Jeetendra Pandya

**Institute:** IISc Bangalore

**Department:** Electronics & Communication Engineering

**Course Intro:** : This course is a system design-oriented course aimed to provide exposure on applications of op-amps and its importance in the real world. Since analog circuits play a crucial role in the implementation of an electronic system, this course emphasis On complete system design with initial discussion on circuit design. As part of this course student can build analog systems using analog ICs and study their macro models. Below are some of the course outcomes.   
if~ To expose the operation of the basic building blocks of analog system if~ To understand and analyze the Op-Amps. if~ To understand feedback techniques and its advantage if~ Ability to design amplifiers using Op-Amps if~ Ability to analyze and design filters using Op-Amps, if~ To develop the skill to build and troubleshoot Analog circuits if~ To develop the skill to build complete system using analog circuits

**Pre Requisites:** : Op-Amps fundamentals, Basic Electronics and Circuits and Networks

**Core/Elective:** : Elective

**UG/PG:** : Both

**Industry Support** : NIL

**Reference** : 1. Gray, Hurst, Lewis, and Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley & Sons, 5th edition, 2009 2. Horowitz and Hill, The Art of Electronics, Cambridge Univ. Press, 1999 3. Behzad Razavi, Design of Analog CMOS Integrated Circuits, McGraw-Hill, 2001 4. Phillip E. Allen and Douglas R. Holberg, CMOS Analog Circuit Design, Oxford University Press, 2nd edition, 2002 5. Johan H. Huijsing, Operational Amplifiers â€œ Theory and Design, 3rd edition, Springer 6. Carusone, Johns, and Martin, Analog Integrated Circuit Design, 2nd edition, John Wiley, 2012 7. Razavi, Fundamentals of Microelectronics, John Wiley, 2008 8. Franco Maloberti, Analog Design for CMOS VLSI Systems, Kluwer Academic Publishers, 2001 9. Willy M.C. Sansen, Analog Design Essentials, Springer, 2007

**About Instructor:** Dr. Hardik J. Pandya is a core faculty member in the Department of Electronic Systems Engineering, Division of Electrical Sciences, IISc Bangalore where he is developing Advanced Microsystems and Biomedical Devices Facility for Clinical Research and Biomedical and Electronic (10-6-10-9) Engineering Systems Laboratory to carry out cutting-edge research on novel devices to solve unmet problems in biology and medicine. He is recipient of prestigious Early Career Research Award from Science and Engineering Research Board, Government of India as well as a start-up grant of 228 Lacs from IISc. He has taught Design for Analog Circuits, Analog Integrated Circuits, VLSI technology, and Semiconductor Devices to undergraduate and graduate students from Electronic Engineering, Instrumentation Engineering, and Applied Physics. He seek to understand and exploit novel ways of fabricating microengineering devices using glass,silicon, polymers and integrate with unusual classes of micro/nanomaterials.



### COURSE PLAN

SL.NO	Week	Module Name
1	1	Understanding the Datasheet of Op-Amps
2	2	Introduction to op-amps and discussion on its characteristics by simulation and experiment
3	3	Understand the basics of Hysteresis and the need of hysteresis in switching circuits
4	4	Op-Amp Circuits Analog-to-Digital Converter (ADC)
5	5	Digital-to-Analog Converter (DAC) using Op-Amps
6	6	To design and build a function generator capable of generating square wave and a triangular wave of a known frequency using simulation and experiment by TI analog system lab kit pro
7	7	To design and build a voltage-controlled oscillator using simulation and TI analog system lab kit pro
8	8	To design and build an automatic volume control using simulation and TI analog system lab kit pro
9	9	To design and build a constant current drive circuit for measuring unknown resistance using simulation and Experiment on bread board
10	10	To design and build a temperature controlled system using op-amps as ON-OFF controller and Proportional controller by simulation and Experiment on bread board
11	11	To design and build a signal conditioning circuit for the thermocouple to compensate for temperature correction
12	12	To design and Implement a speed controller of a DC motor using simulation and experiment