

# RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

## New Scheme Based On AICTE Flexible Curricula

### Electronics & Communication Engineering IV-Semester

#### EC405 Analog Circuits

##### COURSE CONTENTS:

**Feedback Amplifier and Oscillators:** Concept of feedback and their types, Amplifier with negative feedback and its advantages. Feedback Topologies.

**Oscillators:** Concept of Positive feedback, Classification of Oscillators, Barkhausen criterion, Types of oscillators: RC oscillator, RC Phase Shift, Wien Bridge Oscillators. LC Oscillator: Hartley, Colpitt's, Clapp and Crystal oscillator.

**Introduction to integrated circuits:** Advantages and characteristic parameters of IC's, basic building components, data sheets

**Operational Amplifier:** Differential amplifier and analysis, Configurations- Dual input balanced output differential amplifier, Dual input Unbalanced output differential amplifier, Single input balanced output differential amplifier, Single input Unbalanced output differential amplifier Introduction of op-amp, Block diagram, characteristics and equivalent circuits of an ideal opamp, Power supply configurations for OP-AMP.

**Characteristics of op-amp:** Ideal and Practical, Input offset voltage, offset current, Input bias current, Output offset voltage, thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio (CMRR), Slew rate and its Effect, PSRR and gain bandwidth product, frequency limitations and compensations, transient response, analysis of TL082 datasheet.

**OP-AMP applications:** Inverting and non-inverting amplifier configurations, Summing amplifier, Integrators and differentiators, Instrumentation amplifier, Differential input and differential output amplifier, Voltage-series feedback amplifier, Voltage-shunt feedback amplifier, Log/ Antilog amplifier, Triangular/rectangular wave generator, phase-shift oscillators, Wein bridge oscillator, analog multiplier-MPY634, VCO, Comparator, Zero Crossing Detector. OP-AMP AS FILTERS: Characteristics of filters, Classification of filters, Magnitude and frequency response, Butterworth 1st and 2nd order Low pass, High pass and band pass filters, Chebyshev filter characteristics, Band reject filters, Notch filter; all pass filters, self-tuned filters, AGC, AVC using op-AMP.

**TIMER:** IC-555 Timer concept, Block pin configuration of timer. Monostable, Bistable and Astable Multivibrator using timer 555-IC, Schmitt Trigger, Voltage limiters, Clipper and

clampers circuits, Absolute value output circuit, Peak detector, Sample and hold Circuit, Precision rectifiers, Voltage-to-current converter, Current-to-voltage converter.

**Voltage Regulator:** simple OP-AMP Voltage regulator, Fixed and Adjustable Voltage Regulators, Dual Power supply, Basic Switching Regulator and characteristics of standard regulator ICs such as linear regulator, Switching regulator and low-drop out regulator. Study of LM317, TPS40200 and TPS7250

#### **TEXT BOOKS:**

1. Ramakant A. Gaikward, "OP- Amp and linear Integrated circuits" Third edition 2006, Pearson.
2. B. Visvesvara Rao Linear Integrated Circuits Pearson.
3. <http://www.nptelvideos.in/2012/11/analog-ics.html>
4. <http://nptel.ac.in/courses/117108107/>

#### **REFERENCES:**

1. David A. Bell: Operational Amplifiers & Linear ICs, Oxford University Press, 2nd edition, 2010.
2. D. Roy Choudhury: Linear Integrated Circuits New Age Publication.
3. B. Somanathan Nair: Linear Integrated Circuits analysis design and application Wiley India Pvt. Ltd.
4. Maheshwary and Anand: Analog Electronics, PHI.
5. S. Salivahanan, V S Kanchana Bhaaskaran: Linear Integrated Circuits", second edition, McGraw Hill.
6. Gray Hurst Lewis Meyer Analysis and design of analog Integrated Circuits fifth edition Wiley India.
7. Robert F. Coughlin, Frederick, F. Driscoll: Operational Amplifiers and Linear Integrated Circuits, sixth edition, Pearson.
8. Millman and Halkias: Integrated electronics, TMH.
9. Boylestad and Nashelsky: Electronic Devices and Circuit Theory, Pearson Education.
10. Sedra and Smith: Microelectronics, Oxford Press.

#### **List of Experiments :**

**Apparatus Required** –Dual Channel Cathode Ray Oscilloscope (0-20 MHz), Function Generator (10MHz and above), Dual Power Supply, LM741, TL082, MPY634, TPS7250, Probes, digital multimeter.

1. To measure and compare the op-amp characteristics: offset voltages, bias currents, CMRR, Slew Rate of OPAMP LM741 and TL082.
2. To determine voltage gain and frequency response of inverting and non-inverting amplifiers using TL082.
3. To design an instrumentation amplifier and determine its voltage gain using TL082.
4. To design op-amp integrator (low pass filter) and determine its frequency response.
5. To design op-amp differentiator (high pass filter) and determine its frequency response.

6. Design 2nd order Butterworth filter using universal active filter topology with LM741
7. To design Astable, Monostable and Bistable multivibrator using 555 and analyse its characteristics.
8. Automatic Gain Control (AGC) Automatic Volume Control (AVC) using multiplier MPY634
9. To design a PLL using opamp with MPY634 and determine the free running frequency, the capture range and the lock in range of PLL
10. Design and test a Low Dropout regulator using op-amps for a given voltage regulation characteristic and compare the characteristics with TPS7250 IC.