JYOTI NIVAS COLLEGE AUTONOMOUS
SYLLABUS FOR 2018 BATCH AND THEREAFTER

Programme: B.Sc. **Semester: III**

ELECTRONICS PAPER III
INTEGRATED CIRCUITS AND DATA ACQUISITION SYSTEMS

Course Code: 18IIIEL3 **No. of Hours: 60**

COURSE OBJECTIVES:
On completion of the following units of syllabus contents, the students must be able to:

- Introduction to Differential Amplifier and its types, improvement of CMRR using Current Mirror circuit.
- Block diagram of op amp, pin configuration of IC 741, characteristics of an ideal and practical op amp.
- Design an inverting and noninverting amplifier circuit and study its characteristics.
- Inverting amplifier- derivations for Av, concept of virtual ground.
- Design a summing amplifier, scaling, subtractor amplifier using non-inverting configuration.
- Study and design of practical differentiator and integrator circuit and determine its output waveform.
- Design a first order low pass, high pass Butterworth filter.
- Discuss oscillator principles, study phase shift and wein-bridge oscillator.
- Study a fixed voltage regulator, adjustable voltage regulator and switching regulator circuit.
- Understand the operation of the 555 timer.
- Study the operating principle of phase locked loop.
- Introduction to general measurement system, characteristics and types of Transducers.
- Discuss the concept of sampling and study D to A and A to D converter circuits and its characteristics.

COURSE OUTCOMES

- Categorize differential amplifier and to design few basic circuits like adder, subtractor and filters
- Understand the working of fixed voltage regulators
- Discuss the working of IC555 and to understand few of its applications
- Understanding of Differential amplifier as the building block of an Operational amplifier is obtained. An indepth knowledge
- of different applications of Operational amplifiers.
- Designing of active filters, differentiator and integrator.
- a sound knowledge of Working, characteristics and comparison of different types of voltage regulators .

UNIT I
INTRODUCTION TO OPERATIONAL AMPLIFIERS 13 HRS

Differential Amplifier: Circuit diagram, types of configurations (mention only), Dual Input Balanced Output Differential Amplifier– working, DC and AC analysis, tail current, expressions for Q point, differential gain, common mode gain, CMRR, input impedance and output impedances.
Current Mirror: Circuit diagram and working, differential amplifier with current mirror– circuit diagram and working (explanation of increase in CMRR).

Operational amplifier – Block diagram,Pin configuration of IC 741, equivalent circuit, Characteristics and comparison of ideal and practical Op amp,Ideal voltage transfer curve.
Op-amp Parameters-input offset voltage, output offset voltage, slew rate and CMRR, compare the specification for mentioned IC- TL 082, 084, LM324. (ASSIGNMENT) Open loop configuration– limitations.
Inverting amplifier- derivations for Av, concept of virtual ground.
Non inverting amplifier-derivations for Av. Voltage follower-circuit and features. Summing amplifier/adder and subtractor-derivation for the output voltage. Averaging amplifier, scale changer, Differential amplifier with one op-amp.
numerical problems.

UNIT II:
OP AMP APPLICATIONS 15 HRS
Integrator and Differentiator: derivation of expression for output voltage, limitations, practical circuit,output waveforms for sine, square and triangular waves. Numerical problems.
Logarithmic amplifier- circuit using transistor and the expression for the output voltage,
Comparators: basic comparator,inverting and non-inverting comparator, zero crossing detector. Comparator characteristics, limitations of op-amp as comparators.
Schmitt trigger.
Oscillators-RC phase shift and Wein-bridge, expression for frequency of oscillations (No derivation).Comparison
Active filters: Definition,advantages of active filters overpassive filters. Comparison of all the active filter's frequency response.
First order low pass and high pass Butterworth filters-expression for voltage gain and cut off frequency,Numerical problems.
Band pass (Wide Band pass), band elimination filters (notch filter) and all pass filters- circuit diagrams, frequency response, applications.

UNIT III
SPECIALPURPOSE INTEGRATED CIRCUITS 12HRS.

Voltage regulators: Definition,Types of voltage regulators-Fixed output voltage regulators(positive and negative), Adjustable output voltage regulators(positive and negative), Switching regulators. Comparison of linear and switching regulators.
IC regulators:
Fixed voltage regulators- positive voltage regulator series (78XX series)-pin identification, Circuit diagram, voltage options. 7805 as a current source, negative voltage regulator series (79XX series)- pin identification, voltage options.
Adjustable positivevoltage regulators- LM 317 series-circuit diagram and working.**Adjustable negative voltage regulator-** LM 337 series. (mention only)
Basic Switching regulators-block diagram and theory, IC-MC 1723, μA78S40 (mention only)

IC 555 Timer:Block diagram,astable and monostablecircuit diagram and operation,equation for frequency and duty cycle.Application- Voltage-Controlled Oscillator.
Numerical Problems.
PLL- introduction, basic principle, block diagram.Example IC- LM 565(mention only),Applications (mention only).

UNIT IV
MEASUREMENT SYSTEMS AND TRANSDUCERS 10HRS

Introduction to general measurement system, characteristics of static & dynamic measurement system.
Transducers: Types, principles of resistive, capacitive and inductive transducers, strain gauge, LVDT (variable inductive transducers), temperature transducers (thermo couple and thermistors), ultrasonic temperature transducer, photoelectric transducers, Pressure Transducers-MIC and Loud Speaker (Construction and working for all).

UNIT V
DATA ACQUISITION AND DATA CONVERTERS 10HRS
Data acquisition: sampling, sampling of analog signals, sample and hold circuit.
A to D conversion: Characteristics of A to D converter- resolution, accuracy, quantization error and conversion time. Successive approximation method, Flash type A/D converter. IC ADC 0804 - pin diagram.
D to A conversion: Characteristics of D to A converter- resolution, linearity, accuracy, settling time and temperature sensitivity. 4-bit binary weighted DAC and R-2R ladder DAC- circuit diagram, working and expressions for the output voltage (derivation for weighted DAC). IC DAC 0808, pin diagram.Numerical Problems.

TEXT BOOKS:

1. Operational amplifiers and linear integrated circuits: Ramakant Gayakwad – Pearson 4th Edition,2015.
2. Electronic principles: A.P Malvino – TMH 5thEdition, 1993.
3. Instrumentation Devices and Systems C.S. Rangan, G.R. Sharma and V S V Mani – TMH – New edition.2015.

REFERENCE BOOKS:

1. Integrated circuits: K.R Botkar – Khanna publishers,10th edition 2005
2. Applied Electronics: R.SSedha,S. Chand Publishers E. Jobey, Mc. Grawhill,2004.
3. Digital Principles and applications: Malvino and Leach –TMH 5thEdition,2004
4. Operational Amplifiers and Linear ICs for VTU (SEM-IV EEE Course-2015)Paperback– 2017by U. A. Bakshiand A.P. Godse.

ELECTRONICS PRACTICAL III

List of Experiments:

1. Non- inverting and inverting operational amplifier – AC response.
2. Non – inverting adder and subtractor.
3. Voltage Regulator using LM 317 and 7800series.
4. Voltage controlled oscillator.
5. Astable multivibrator using IC 555.
6. First order active low pass filter and high pass filter using Opamp.
7. Digital to Analog converter (Binary weighted resistor method).
8. Opamp integrator and differentiator as wave shaping circuits.
9. Wave form generator Using RC Oscillator

Note:

- Minimum of Eight experiments to be performed.
- Four Experimentsto be done using simulation lab (P-spice).
- Four lab class to be used for repetition, individual practice and tests.

Total number of teaching hours per semester:

Theory: **56 Hrs** SRA (Subject related activities) 8 Hrs

Practical: 48 Hrs

Total: 112 Hrs