APPROVED

**[redacted] SYLLABUS FOR B.Sc. PART II (ELECTRONICS) TO BE IMPLEMENTED FROM ACADEMIC SESSION 2022-23**

**B.Sc. PART II - SEMESTER III**

*Course Name:* **Op-Amp, Power Supply, IC 555 and Circuit Maker**

*Subject code:* ***UG-ELE(04)-S3-T***

**Course Objective and Course Outcome Framework**

| SN | Course Objectives | Course Outcomes |
|---|---|---|
| | *Students will try to learn:* | *After successful completion of the course student will be able to:* |
| 1. | To understand the concepts, working principles and key parameters of operational amplifier. | Understand the fundamentals and working principles of operational amplifier. |
| 2. | To perform analysis of operational amplifier circuits based on negative and positive feedback applications. | Demonstrate the ability to design practical circuits based on negative and positive feedback applications that perform the desired operations. |
| 3. | To understand operation of rectifier, filter, regulator and various parameters associated with power supply. | Understand the concept and operation of rectifier, filter, regulator and various parameters associated with power supply. |
| 4. | To understand operation of regulated power supply and apply concepts for the design of regulated power supply. | Analyze and assemble regulated power supply using 78XX and 723 IC. |
| 5. | To understand the operation and use of 555 timer IC. | Analyze and assemble various timer circuits using 555 IC. |
| 6. | To study the analysis of circuit design using circuit maker simulation software. | Understand the behavior of the electronic circuits. |



13.4.2022

## B.Sc. PART II - SEMESTER III

*Course Name:* **Op-Amp, Power Supply, IC 555 and Circuit Maker**

***Subject code: UG-ELE(04)-S3-T***

**Course Outline**

**Unit I**

RC coupled amplifier, Advantages and disadvantages, DC coupled amplifier, Advantages and disadvantages, Difference amplifier, Need of two power supplies, working of difference amplifier, differential mode gain, common mode gain, CMRR., Block diagram of OPAMP, Parameters of OP AMP and characteristics of an ideal OP AMP, Open and closed loop operation.

**Unit II**

Applications of OPAMP: Concept of virtual ground, OP AMP as an inverting amplifier, Sign changer circuit, Non-inverting amplifier, Unity gain amplifier, Adder, Subtractor, Integrator, Differentiator, Comparator, Zero crossing detector, Schmitt trigger.

**Unit III**

Introduction to power supply: Half wave, full wave and bridge rectifier, Concept of filter (capacitive). Introduction to unregulated, regulated power supply, Power supply parameters: Ripple factor, Efficiency, Line regulation, Load regulation, Zener regulator, Regulated power supply design using series pass transistor, short circuit protection.

**Unit IV**

General features of IC regulators, design of fixed and variable power supply, 78xx,79xx , LM 317, Design of dual power supply, LM 317 as variable regulator, Limitations of linear regulator, Switching regulator- (SMPS), Concept of Low Drop Out regulator (LDO).

**Unit V**

Timer IC 555: Pin and functional diagrams of IC 555, Description of functional diagram, Monostable multivibrator using IC 555, applications in monostable mode (missing pulse detector, linear ramp generator, frequency divider and pulse width modulation) and Astable multivibrator using IC 555, Applications in astable mode (FSK generator, pulse position modulator), Schmitt trigger using IC 555.

**Unit VI**

Introduction to circuit maker, basics, accessing tools & features, saving schematic options, file management, drawing a schematic, creating simple RC circuit,

setting up the analysis, running the simulation, mix signal simulation example. Digital logic simulation, setting of parameters, analysis of simple circuits.

## B.Sc. II (SEM III) ELECTRONICS PRACTICALS

***Subject code: UG-ELE(04)-S3-P***

Students are expected to perform at least 5 experiments from section A and 5 experiments from section B.

### Section A

1. Study of Op-amp as inverting and sign changer amplifier.
2. Study of Op-amp as Non-inverting and unity gain amplifier.
3. Op-amp as adder and averaging amplifier.
4. Op-amp as difference amplifier. ( Subtracter)
5. Op-amp as Integrator.
6. Op-amp as Differentiator
7. Op-amp as comparator and zero crossing detector.
8. Op-amp as Schmitt trigger.
9. Study of Half wave rectifier.
10. Study of Full wave rectifier.
11. Study of Full wave Bridge rectifier.
12. Study of Zener regulator.

### Section B

1. Study of 78XX series regulators
2. Study of 79XX series regulators
3. Study of LM317 regulator
4. Study of astable multivibrator using IC555
5. Study of monostable multivibrator using IC555
6. Study of linear ramp generator using IC555
7. Frequency divider using IC555
8. Study transient & AC analysis of RC circuit
9. Study transient & AC analysis of different OP-Amp as comparator
10. Study transient & AC analysis of different OP-Amp as inverting

amplifier

11. Study CE amplifier parameters
12. Study of MOSFET Characteristics

**REFERENCE BOOKS**


1. Principles of Electronics, V. K. Mehta, Rohit Mehta
2. Functional Circuits in Electronics, S. G. Pimpale, Sushama Pimpale, Mcmillan India ltd.
3. Elements of electronics M. K.Bagde, S. P. Singh, Kamal Singh, S.Chand
4. Op-Amp and Linear Circuits, Gaikwad, PHI
5. Electronic Instrumentation, Khedkar
6. Basic Electronics and Linear Cicuits, Bhargava, Kulshreshtha, Gupta, Technical education series
7. Electronic Devices & Circuits I & II, A. P. Godse, U. P. Bakshi Technical Publishers, Pune.
8. Analogue and Digital technique, Navneeth, Kale. Gokhale,
9. Instrumentation devices and circuits, Rangan, Mani, Sharma
10. Linear Integrated Circuit by D. Roy Chaudhary
11. Op-Amps and Linear Integrated Circuits by Ramakant Gaikwad
12. Circuit maker mannual.


**Web Resources**

1. Students are advised to make use of the resources available on the internet. Some useful links related to electronics are given below.
2. M.I.T. open course ware video lectures are available athttp://ocw.mit.edu/OcwWeb/Electrical-Engineering-and-Computer-Science/6-002Spring-2007/VideoLectures/index.htm
3. www.electronics-tutorials.com
4. www.science-ebooks.com/electronics
5. http://computer.howstuffworks.com
6. www.geocities.com/CapeCanaveral/1221/elec1.htm
7. http://101 science.com/eleclinks.htm
8. www.electro-tech-online.com/blogs/gayan-soyza/23-useful-electronic-links.html
9. www.discovercircuits.com/resources/tutorials.html

## B.Sc. PART II - SEMESTER IV

*Course Name:* **OP-AMP Applications & Electronic Instrumentation**

*Subject code:* ***UG-ELE(04)-S4-T***

### Course Objective and Course Outcome Framework

| SN | Course Objectives | Course Outcomes |
|---|---|---|
| | *Students will try to learn:* | *After successful completion of the course student will be able to:* |
| 1. | To analyze the different RC and LC oscillator circuits using OPAMP and to determine the frequency of oscillation. | Assemble the different oscillator circuits using OPAMPs for various frequencies. |
| 2. | To understand the operation and design of various multivibrator, S/H and IA circuits using OPAMP for a given specification. | Know and assemble multivibrator circuits using OPAMP in various configuration to determine its frequency. |
| 3. | To understand A/D and D/A converters and analyze their characteristics and classification. | Classify, analyze and assemble A/D and D/A converters. |
| 4. | To provide basic knowledge about the various types of transducers, sensors, actuators and instrumentation system based on these transducers. | Students will be able to explain principle of operation of various transducers, sensors, actuators and their use in developing electronic instrumentation system. |
| 5. | To provide fundamental concepts of basic electronic and PC based instrumentation system. | Students will be able to describe various functional blocks of basic electronic and PC based instrumentation system. |
| 6. | To provide fundamental knowledge of biomedical instrumentation system and its safety codes. | Students will be able to describe functional blocks of biomedical instrumentation system such as ECG,EEG and EMG and its safety codes. |

## B.Sc. PART II - SEMESTER IV

*Course Name:* **OP-AMP Applications & Electronic Instrumentation**

***Subject code: UG-ELE(04)-S4-T***

### Course Outline

**Unit I**

Concept of feedback: Types- positive and negative feedback, Barkhausen criterion,Oscillators, types (AF and RF), basic oscillator action, L-C oscillator: Colpitts oscillator, RC oscillator using OP Amp ,Phase shift oscillator, Wein bridge oscillator, Oscillator stability, Crystal oscillator, NOT gate based crystal oscillator.

**Unit II**

Advanced applications of OPAMP: Astable multivibrator (asymmetric and symmetric), Monostable multivibrator (simple circuit) , Concept and working of sample and hold circuit, Concept of instrumentation amplifier (three OP Amp circuit) and working.

**Unit III**

Need of D/A and A/D converter, D/A converter and its Parameters: Range,Resolution, Linearity and speed, Types of D/A converter: Weighted type D/A, limitations of weighted type D/A, R-2R or binary ladder D/A converter using Op Amp.

Need for A/D conversion, Sampling theorem, Types of A/D converter: Single slope A/D converters, Dual slope A/D converter, Counter type, Successive approximation type, Flash type, Accuracy and resoltion of A/D concerter.

**Unit IV**

Sensors, Actuators, Transducers, Active and passive transducers, Characteristics (static and dynamic),
Passive : Thermister (NTC & PTC), LM35, L.D.R., Photo-transistor
Active : Piezo-electric transducer
Digital: Pressure sensor (MPXV4006DP).

Block diagram of temperature measurement system using thermister, and LM35, Advantages of LM35 over thermister, Lux meter using LDR, Colorimeter using LDR, Insect repellent using piezo buzzer.

**Unit V**

Block diagram for electronic system, Defining the system characteristics, Concept of calibration, Standards for calibration. Sysytem characteristics, Instrumentation Systems: Analog, Digital, Real, Virtual, Dedicated, Versatile, Stand alone, PC based

instrumentation system.

**Unit VI**

Biomedical Instrumentation: Biometrics, Man-Instrument system and its components, Introduction to physiological system of body, Problems encountered in measurement of living system, Sources and generation of bioelectric potentials, Resting and Action potentials, Block diagram and working of EEG, ECG and EMG, Electrical shock hazards, Precautions, Safety codes in biomedical instrumentation.

## B.Sc. II (SEM IV) ELECTRONICS PRACTICALS

***Subject code: UG-ELE(04)-S4-P***

Students are expected to perform at least 5 experiments from section A and 5 experiments from section B.

### Section A

1. Study of OP-amp based Wein bridge oscillator.
2. Study of OP-amp based Phase shift oscillator.
3. Study of Colpitt's oscillator.
4. Study of Op-amp as astable multi vibrator.
5. Study of Op-amp as Mono stable multi vibrator.
6. Study of Instrumentation amplifier.
7. Study of successive approximation ADC.
8. Study of Flash type ADC.
9. Study of Single slope ADC.
10. Study of Dual slope ADC.
11. Study of Binary weighted DAC.
12. Study of ladder type DAC
13. Study of NOT gate based crystal oscillator.
14. Study of Sample and hold circuit.

### Section B

1. Study transfer characteristics of NTC type thermister
2. Study resolution in characteristics of NTC type thermister
3. Study transfer characteristics of LM 35

4. Study transfer characteristics of Water heater (around 300W)
5. Study of ON/ OFF type thermo-state using LM 35
6. Study transfer characteristics of LDR
7. Study transfer characteristics of Piezo-electric transducer
8. Comparative study of accuracy in 3 ½ digit, 4 ½ digit, 5 ½ digit Multimeters
9. Directivity study of carbon Mic.
10. "Look up table" based o/p using microcontroller IC interface using R.T.C.

## REFERENCE BOOKS


1. Digital and analogue Techniques, G. N. Navaneeth,V. M. Gokhale,R. G. Kale, Kitab Mahal.
2. Digital Principles and Applications, A. P. Malvino, D. P. Leach, McGraw Hill Book Co.
3. Op-Amp and Linear Circuits, Gaikwad, PHI,
4. Principles of Digital Electronics, M. B. Matsagar, V. S. Kale, Vision publication
5. Modern Digital Electronics, R. P. Jain, Tata McGraw Hill publishing co.ltd.
6. Digital Fundamentals, Floyd, Jain, Pearson,
7. 2000 Solved Problems in Digital Electronics, S. P. Bali, Tata McGraw Hill publishing co.ltd.
8. Electronic Circuits and Systems: Analog and Digital, Y.N.Bapat, Tata McGraw Hill Publishing co.ltd.
9. Digital Electronics and Logic Design, B. S. Nair, Prentice Hall
10. Digital Computer Electronics, Malvino, Brown, Tata McGraw Hill
11. Fundamentals of Digital Electronics, C.V.Dhuley and V.M. Ghodki Applied Electronics and Instrumentation, C. M. Dhir, Tata McGraw Hill
12. Digital Instrumentation, Bouwens, Tata McGraw Hill
13. Electronic Instrumentation, Khedkar
14. Modern Electronic Instrumentation and Measurement Techniques, Cooper, Prentice Hall.

## Web Resources

Students are advised to make use of the resources available on the internet. Some useful links related to electronics are given below.

1. M.I.T. open course ware video lectures are available athttp://ocw.mit.edu/OcwWeb/Electrical-Engineering-and-Computer-Science/6-002Spring-2007/VideoLectures/index.htm
2. www.electronics-tutorials.com
3. http ://electronics .howstuffworks .com
4. www.science-ebooks.com/electronics
5. http://computer.howstuffworks.com
6. www.geocities.com/CapeCanaveral/1221/elec1.htm
7. http://101 science.com/eleclinks.htm
8. www.electro-tech-online.com/blogs/gayan-soyza/23-useful-electronic-links.html
9. www.discovercircuits.com/resources/tutorials.html
10. www.electronics-lab.com/