



**St Aloysius College (Autonomous)**  
**Mangaluru**

**Re-accredited by NAAC “A” Grade**  
**Course structure and syllabus of**  
**B.Sc.**

**ELECTRONICS**

**Under NEP Regulations, 2021**

**(2021-22 Batch Onwards)**

ST ALOYSIUS COLLEGE (AUTONOMOUS)  
MANGALURU  
www.stalloysius.edu.in



ST ALOYSIUS COLLEGE (AUTONOMOUS)  
MANGALURU - 575 003  
Phone: 0824-2449700, 2449701  
Fax: 0824-2449705  
Email: principal@stalloysius.edu.in

Re-accredited by NAAC with 'A' Grade with CGPA 3.62/4  
Recognised by UGC as "College with Potential for Excellence"  
Conferred "College with "STAR STATUS" by DBT, Government of India.  
Centre for Research Capacity Building under UGC-STRIDE

Date: 17-08-2022

### NOTIFICATION

Sub: Syllabus of **B.Sc. ELECTRONICS** under NEP Regulations, 2021.  
(As per Mangalore University guidelines)

Ref: 1. Decision of the Academic Council meeting held on 09-07-2022 vide  
Agenda No: 14 (2022-23)  
2. Office Notification dated 17-08-2022

Pursuant to the above, the Syllabus of **B.Sc. ELECTRONICS** under NEP Regulations, 2021 which was approved by the Academic Council at its meeting held on 09-07-2022 is hereby notified for implementation with effect from the academic year **2022-23**.

PRINCIPAL

REGISTRAR

To:

1. The Chairman/Dean/HOD.
2. The Registrar Office
3. Library

Sl. No.	Semester	Title of the Paper	Teaching Hours	Hours /week		Examination Pattern Max. Marks /Paper				Duration of Exam (hours)		Total Marks / paper	Theory Credits	Practical Credits
				Theory	Practical	Theory		Practical		Theory	Practical			
						Exam	IA	Exam	IA					
1	I	ELE-CT1: G 504 DC1.1 FUNDAMENTALS OF ANALOG AND DIGITAL	60	4	4	60	40	25	25	2.5	4	100+50	4	2
		ELE-OE 1.1 Basics of Electronic circuits and PCB Design	36	2	1	40	10	-	-	2	-	50	2	1
2	II	ELE-CT2: G 504 DC1.2 Discrete amplifiers, Operational amplifiers, Combinational circuits and Sequential Circuits	60	4	4	60	40	25	25	2.5	4	100+50	4	2
		ELE-OE 2.1: Renewable Energy and Energy harvesting	36	2	1	40	10	-	-	2*	-	50	2	1
3	III	ELE-CT3: G 504 DC1.3 Power control, Oscillators, wave shaping circuits, Principles of Radio Communication and Digital circuits	60	4	4	60	40	25	25	2.5	4	100+50	4	2
		ELE-OE3.1: Domestic Equipment Maintenance	36	2	1	40	10	--		2	---	50	2	1
4	IV	ELE-CT4: G 504 DC1.4 Power control, Oscillators, wave shaping circuits, Principles of Radio Communication and Digital circuits	60	4	4	60	40	25	25	2.5	4	100+50	4	2
5	V		60	4	4	60	40	2	2	2.5	4	100+50	4	2
			60	4	4	60	40	2	2	2.5	4	100+50	4	2

Semester	Code	Paper Title
I	G 504DC1.1	Fundamentals of analog and digital
	G 504DC2.1P	Practicals - I
	G 504OE1.1	Basics of Electronic circuits and PCB design
II	G 504DC1.2	Discrete amplifiers, Operational amplifiers, Combinational circuits and Sequential Circuits
	G 504DC2.2P	Practicals - II
	G 504OE1.2	Renewable Energy and Energy harvesting
III	G 504DC1.3	Power control , Oscillators, waves shaping circuits, Principles of Radio Communication and Digital circuits
	G 504DC2.3P	Practicals - III
	G 504OE1.3	ELE-OE3.1: Domestic Equipment Maintenance
IV	G 504DC1.4	
	G 504DC2.4P	Practicals - IV
V	G 504DC1.5	Power control , Oscillators, waves shaping circuits, Principles of Radio Communication and Digital circuits
	G 504DC2.5P	Practicals -
	G 504DC16.4	Power control , Oscillators, waves shaping circuits, Principles of Radio Communication and Digital circuits
	G 504DC2.4P	Practicals - VI

## **Preamble**

This model curriculum content for B.Sc (Honours) as per NEP-2020, is intended to enable the graduates to respond to the current needs of the industry and equip them with skills relevant for national and global standards. The framework encourages innovation in teaching-learning process and appropriate assessment of student learning levels.

## **Introduction**

B.Sc. (Honours) is a program which needs to develop a specialized skill set among the graduates to meet the needs of industries.

The curriculum is designed to help learners to analyze, appreciate, understand and critically engage with learning of the subject and also to provide better learning experience. Apart from imparting disciplinary knowledge, the curriculum is aimed to equip the graduates with competencies like problem solving, Applying the concepts and analytical reasoning which provide them high professional competence.

The Department encourages its concerned faculty to make suitable pedagogical innovations, in addition to teaching/learning processes suggested in the model curriculum, so that the Course/Programme learning outcomes are achieved.

## **Significance**

In recent years, has made unprecedented growth in terms of new technologies, new ideas and principles. The research organizations and industries that work in this frontier area are in need of highly skilled and scientifically oriented manpower. This manpower can be available only with flexible, adaptive and progressive training programs and a cohesive interaction among the institutions, universities, and industries. The key areas of study within subject area of comprise: Semiconductor Devices, analog and digital circuit design, microprocessors & Microcontroller systems, Electronic Communications, Medical and Equipment, computer

coding/programming in high level languages etc. and also modern applied fields such as embedded systems, data communication, robotics, VLSI, control systems, etc.

### **Eligibility criteria**

Students who have qualified PUC Science of Karnataka Pre University Education Board or equivalent 10+2, ITI or Diploma in any stream are eligible for opting to B.Sc. / B.Sc. (Hons.) UG program in .

### **Program Objectives**

The overall Objectives of the B.Sc. (Honours) program are to:

- Provide students with learning experiences that develop broad knowledge and understanding of key concepts of and equip students with advanced scientific / technological capabilities for analyzing and tackling the issues and problems in the field of.
- Develop ability in students to apply knowledge and skills they have acquired to solve specific theoretical and applied problems in by providing hands on experience.
- Develop abilities in students to design and develop innovative solutions for benefits of society.
- Provide students with skills that enable them to get employment in industries or pursue Higher studies or research assignments or turn as entrepreneurs.

### **Program outcome**

- Ability to apply knowledge of Logic thinking and basic science for solving related problems
- Ability to perform experiments, as well as to analyse and interpret data.
- Ability to design and manage electronic systems or processes that conforms to a given specification within ethical and economic constraints.
- Ability to identify, formulate, solve and analyze the problems in various subdisciplines of Science.
- Ability to use Modern Tools / Techniques.

**B.Sc. / B.Sc. (Hons.) as per NEP (2021-22 and onwards)**

**SUBJECT:**

**\*Questions from practicals have to be included in theory examinations of Open Electives (Since is a practical oriented subject)**

**Basis for Awarding Theory Internal Assessment Marks:**

Sl No	Particulars	IA Marks
1	Minimum of Two internal Tests	<b>20</b>
2	Assignments/Seminar/Case Study /Project work / Reports on - visits to industries/exhibitions/science centres/active participation in competitions, etc.	<b>20</b>
TOTAL Theory IA Marks		<b>40</b>

**Basis for Awarding Practical Internal Assessment Marks:**

Sl No	Particulars	IA Marks
1	PracticalTest	<b>05</b>
2	Record writing	<b>05</b>
3	Active participation in practical classes	<b>15</b>
TOTAL Practical IA Marks		<b>25</b>

**SEMESTER – I**  
**G 504 DC1.1 FUNDAMENTALS OF ANALOG AND DIGITAL**

**(Credits: Theory – 04, Practical – 02)**

**Total Teaching hours: 60**

**Course Objectives**

Upon completing this course, the student will be able to

1. Understand fundamentals of network analysis.
2. Be familiar with the basic operation of Electronic devices and circuits which are the building blocks of all Electronic circuits and gadgets.
3. Principles of operation of transistors and their applications
4. Learn the number systems and basics of Digital
5. Boolean algebra, Boolean postulates and simplification of Boolean functions
6. understand Logic gates and their applications

**Course Outcomes:**

**At the end of this Course students will be able to**

**CO1: Study and analyze basic networks using network theorems in systematic manner.**

**CO2:** Build simple electronic circuits used in various applications.

**Co3:** Describe the behaviour of basic semiconductor devices

**CO4:** Reproduce the I-V characteristics of diode/BJT devices

**CO5:** Explain the behaviour, characteristics and applications of Varactor diode, LED, Zener diodes.

**CO6:** apply standard device models to explain/calculate critical internal parameters of semiconductor devices.

**CO7:** Understand and represent numbers in powers of base and converting one from the other, carry out simple arithmetic operations.

**CO8:** Understand the basic knowledge of Digital system building blocks, effectively can construct simple digital designs with the knowledge of Boolean algebra.

**UNIT-I**

**Chapter1: Electronic Components:** Classification: Passive and active, linear and nonlinear, unilateral and bilateral elements, Concept of Voltage and Current Sources, Source transformation principle, electric energy and power.



**Resistors:** Fixed and variable resistors, Constructional features of carbon composition, metal film and wire wound resistors. Variable resistors: Potentiometer, rheostat and preset - use of potentiometer as a variable resistor and potential divider.

**Capacitors:** Fixed- various types of fixed capacitors, polar and non polar capacitors- constructional features-electrolytic and non-electrolytic capacitors. Variable capacitors-trimmers and ganged capacitors.

**Inductors-** Fixed inductors, classification based on the frequency operation.

**Transformers-**Principles of operation, types, mention of applications.

5hrs

**Chaptr2: Network Theorems:** Kirchhoff's laws, Mesh analysis, superposition theorem, maximum power transfer theorem, Thevenin's theorem, Norton's Theorem – (2 mesh problems involving maximum of two voltage sources). H-parameters of a two port network. ( Illustrative problems to be worked out wherever required.

5hrs

**Chaptr3: i. DC and AC Circuits:** Transient response of RC, RL and LCR circuits.

**AC Circuits:** Phasors, AC response of R, L, C, RC, RL, and RLC circuits. Series resonant circuit - Bandwidth, quality factor. Parallel resonant circuit, RC integrator and RC differentiator. RC Filters-Low pass, High pass and Band pass filters. (All ac response should be studied using 'j' operator) **5hrs**

## UNIT-II

**Chapter1:PN junction diode:** Ideal and practical diodes, Formation of Depletion Layer, Diode Equation and I-V characteristics-cut-in voltage, static and dynamic resistance, Reverse saturation current, reverse breakdown voltage. Reverse breakdown- Zener and avalanche breakdown. **5hrs**

**Chapter2: Special semiconductor diodes:** Zener diode, Varactor diode , Light emitting diode and photo diode- construction, circuit symbol, characteristics, working and applications of each diode.

**Chapter3: Rectifiers-**Half wave and Full wave (center tap and bridge) rectifiers, expressions for output voltage, output current ,frequency ,PIV, ripple factor and efficiency (mention only), Shunt capacitor and series inductor filter. **5hrs**

## UNIT-III

**Chapter1: Bipolar junction Transistors:** Introduction, structure and working, unbiased transistor-formation of depletion regions, basic biasing schemes. Transistor configurations, Transistor action and its importance, current gains, relationship between current gains, Characteristics of a transistor, Operating point, transistor as a switch. **8hrs**

**Field Effect Transistors (FET):** JFET –Construction, Operation. FET Characteristics- drain and transfer. FET parameters, Relationship between FET parameters, Small signal ac model of FET. Comparison between JFET and BJT.**MOSFETs-** Depletion and Enhancement type-basic structure,

working, drain and transfer characteristics, Advantages of N-channel MOSFETs over p-channel, handling precautions of MOSFETs **7hrs**

#### UNIT IV

**15hrs**

**Chapter1: Number System:** Introduction to Digital , digital signals, need for representing information in digital form. Decimal, Binary, Octal and Hexadecimal number systems. Conversions of numbers from one base to the other. Representation of signed and unsigned numbers. Binary arithmetics. Representation of negative numbers in binary number system. Subtraction of binary numbers by 1's and 2's complement method. **Binary codes:** BCD codes- weighted and non weighted codes. Self complementing codes-8421, 2421, Excess-3, Gray code, cyclic codes. Alphanumeric codes- ASCII and EBCDIC . **5hrs**

**Chapter2: Boolean algebra:** Postulates and Theorems of Boolean algebra. Duality principle in Boolean algebra. De Morgan's theorems-statement and proof. Boolean functions-simplification of Boolean functions using postulates. Logic gates. Universal gates - NOR and NAND gates. Realisation of other gates using only NAND gates. **5hrs**

**Chapter3: Standard Forms Of Boolean Functions** – Standard SOP and POS, realization of Boolean functions using NAND and NOR gates only. Karnaugh map- Simplification of Boolean functions using K-map (up to 4 variables), don't Care conditions. **5hrs**

#### Reference Books:

1. Robert L Boylestad, "Introductory circuit analysis", 5<sup>th</sup> edition., UniversalBook2003.
2. R.S.Sedha, "A Text book of Applied ", 7<sup>th</sup> edition., S. Chand and Company Ltd. 2011
3. A.P. Malvino, "Principles of ", 7<sup>th</sup> edition .TMH, 2011.
4. Electronic devices and circuit theory by Boylestad, Robert Nashelsky
5. David A. Bell " Electronic Devices and Circuits", 5th Edition, Oxford Uni.Press, 2015
6. Thomas L. Floyd, Digital Fundamentals, Pearson Education Asia (1994)
7. Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011, Tata McGraw
8. Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, 2001, PHI Learning.

**Pattern of Question Paper:**

**Time: 2.5hrs. Max. Marks 60**

**Section-A: Short answer Type Questions**

- |                                 |     |        |
|---------------------------------|-----|--------|
| 1. Multiple choice questions    | 6/6 | 1x6 =6 |
| 2. Very short answer questions. | 6/8 | 1x6 =6 |
| 3. Short answer questions       | 4/6 | 2x6=12 |

**Section B:** Analytical/Problem solving/Application type questions 4/6 4x4=16

**Section C:** Descriptive/Analytical/Problem solving questions 2/4 10x2=20

(Maximum of two sub questions)

- Note
- All the sections should cover equal questions from each unit
  - Maximum of 30% problems can be asked

**G 504 DC2.1P: PRACTICALS – I**

**SECTION A. Demonstration Experiments. (ANY SIX EXPERIMENTS TO BE CONDUCTED.)**

- Understanding of Colour coding of resistors and identification of various types of resistors.
- Understanding of coding various types of capacitors and identification of various types of capacitors.
- Understanding and using multimeter for device testing.
- Familiarisation and testing of different types of transistors.
- Understanding soldering technique and hands on experience on soldering.
- Understanding CRO and function generator and measurement of voltage and frequency of the signals using CRO
- Verification of truth tables of NOT, AND and OR gates using TTL ICs.
- Verification of truth tables of NAND and NOR gates using TTL ICs.

**SECTION B: List of Experiments. Any Eight Experiments to be conducted**

- Semi-conductor (RECTIFIER) Diode Characteristics.
- Zener Diode Characteristics
- Characteristics of LED-Comparison of cut-in voltages for different colours (3 diff colours).
- Transistor Characteristics.
- JFET Characteristics.
- Study of Bridge rectifier using diodes.
- Investigation of capacitance and Inductance in ac circuits.
- Realisation of AND, OR, NOT, NOR, XOR, XNOR using only NAND gates
- DC load line of transistor switch.
- DTL AND, OR gates and NOT gate using transistor.

**Scheme of valuation:**

<b>Part A:</b> Identification of circuit Elements and testing Exercise	06 (split up shown)
<b>Part B :</b> One Experiment of Three Hrs Duration	13(split up shown)
Record	06
Internal Assessment	25
	-----
Total	50
	-----

**Scheme of valuation**

**Part A: Based on SECTION-A**

- 1. Writing observations and diagrams required for answering the given question -2 marks**
- 2. Conducting and demonstrating the measurement/testing and facing viva -4marks**

**Total 06**

**PartB:**

Formula/Truth table/specimen graph -----	2
Labelled Circuit diagram/base diagram of key device/ labelled pin diagram	2
Tabular column/Design calculations/selection of components	2
Circuit layout and connections-	1
Obtaining response, recording readings and number of trials-	4
Graph and calculations-	1
Result/accuracy-	1

**Total: 13**

**OPEN ELECTIVE1: G 504 OE1.1**  
**BASICS OF ELECTRONIC CIRCUITS AND PCB DESIGN**  
**(Credits: Theory – 02, Demonstration Lab – 01)**  
**Total Teaching hours: 36**

**Unit-1**

**12 Hours**

**Generation of and distribution of electricity:** Mention of hydro electric generator, diesel generator, thermal generator, wind power, solar, ocean waves. Generation of DC power – Mention of batteries. Single phase, Two phase and Three phase. Transformers. Power transmission and distribution. Domestic electrical wiring – connection from AC line to the meter, sockets, mention of phase neutral and the need of earthing. Mention of electric shock and safety. Mention of power type (ac or dc) and current ratings for home appliances. Mention of tester. Electric motor working principle.

**Unit – 2**

**12 Hours**

**PCB Design:** Types of PCB, Single sided board – double sided – Multilayer boards –Plated through holes technology – Benefits of Surface Mount Technology (SMT) – Limitation of SMT – Surface mount components: Resistors, Capacitor, Inductor, Diode and IC's.

**LAYOUT AND ARTWORK:** Layout Planning – General rules of Layout – Resistance, Capacitance and Inductance – Conductor Spacing – Supply and Ground Conductors – Component Placing and mounting–Cooling requirement and package density–Layout check. Basic artwork approaches– Artwork taping guideline–General artwork rules– artwork check and Inspection.

**Laminates and photo printing:** Manufacture of copper clad laminates – Properties of laminates – Types of Laminates – Manual cleaning process – Basic printing process for double sided PCB's – Photo resists – wet film resists – Coating process for wet film resists – Exposure and further process for wet film resists – Dry film resists. **ETCHING AND SOLDERING:** Introduction – Etching machine – Etchant system. Soldering: Principles of Solder connection – Solder joints – Solder alloys – Soldering fluxes. Soldering Tools: Soldering, Desoldering tools and Techniques – Man Soldering – Solder mask – Safety, health and medical aspects in Soldering practice.

## **Demonstration Experiments:**

### **30 Hours**

1. Understanding voltage, current, frequency etc and use of basic devices and meters used for testing purpose.
2. Types of motors and transformers used in household appliances
3. SMPS: Block diagram and working
4. Inverter-Block diagram, understanding various stages and measurement of voltages at various points
5. PCB design and fabrication
6. PCB testing, soldering and de-soldering

### **Pattern of Question Paper:**

**Time: 2.5hrs. Max. Marks 60**

<b>Section-A:1. Short answer Type Questions</b>	<b>2marks each</b>	<b>5/7</b>	<b>5X2=10</b>
<b>Section B: long answer type questions</b>	<b>4marks each</b>	<b>5/6</b>	<b>5X4=20</b>
<b>Section C: Descriptive/Analytical/Problem solving questions</b>	<b>10marks each</b>	<b>3/5</b>	<b>3x10=30</b>

**(Maximum of two sub questions)**

#### **• Reference books:**

1. Electrical Circuits, K.A. Smith and R.E. Alley, Cambridge University Press.
2. A text book in Electrical Technology - B L Theraja - S Chand & Co.
3. A text book of Electrical Technology - A K Theraja.
4. Performance and design of AC machines - M G Say ELBSEdition.
5. Basic electrical engineering - V K Mehta and Rohit Mehta, S Chand and Company.
6. Walter C.Bosshart "PCB Design and Technology" Tata McGraw Hill, Publications, Delhi. 1983.
7. Clyde F.Coombs "Printed circuits Handbook" IIIEdition McGrawhill KraigMitzner, "Complete PCB Design Using OrCAD Capture and Layout," Elsevier, Amsterdam,
8. Walter C Bosshart, "Printed Circuit Board Design and Technology",1st ed.,McGraw Hill Education

## II SEMESTER

### G 504DC1.2

## DISCRETE AMPLIFIERS, OPERATIONAL AMPLIFIERS, COMBINATIONAL CIRCUITS AND SEQUENTIAL CIRCUITS

(Credits: Theory – 04, Practical – 02)

Total Teaching hours: 60

### Course Objectives

Upon completing this course, the student will become familiar with various working principles of widely used electronic devices, linear and digital ICs which help the students to build small projects and also be able to answer some basic questions that appear in competitive examinations.

### Course Outcomes:

**At the end of this course, students will be able to**

**CO1:** design suitable biasing circuit to a transistor for specific application.

**CO2:** explain performance parameters of any amplifier

**CO3:** understand and appreciate the Fabrication of ICs

**CO4:** understand the Fundamentals of Operational Amplifiers.

**CO5:** interpret the experimental data for better understanding the ICs.

**CO6:** understand linear and nonlinear applications of operational amplifiers.

**CO7:** Analyze combinatorial and sequential circuits

**CO8:** understands and interprets parameters of various Logic families

### UNIT-I

**Chapter1: Transistor biasing circuits:** Stability of Q –point, stability factor, factors affecting Q-point, Thermal runaway. Transistor biasing circuits-Fixed bias, fixed bias with emitter resistor, collector feedback bias, emitter bias and Universal bias. Equation for dc load line, stability of Q-point & design of each biasing circuits to be discussed. **5hrs**

**Chapter2: Small Signal Amplifiers:** Transistor models: h-parameter model, Ebers' Moll model.

Ac load line, coupling and bypass capacitors, CE amplifier-working, Graphical explanation, ac analysis using h parameter model, Expressions for gain, input and output impedance, ac model, frequency response of CE amplifier, Design of CE amplifier, CC and CB amplifiers (qualitative). Application of cc amplifiers in impedance matching, Relative merits of CE, CB and CC amplifiers, Mention of applications CB, CC and CE amplifiers. FET amplifiers - CS amplifier – expression for gain, input and output impedances, frequency response, CD and CG amplifiers (qualitative) **8hrs**

**Chapter3: Multistage Amplifiers:** Need for cascading of amplifiers, coupling schemes, Comparison of different coupling schemes. Two stage CE amplifiers- direct, RC and

transformer coupling, Darlington pair, comparison of Darlington pair and cc amplifier.

**2HRS**

## **UNIT-II**

**Chapter1: Feedback:** Feedback in amplifiers: Concept of feedback, positive feedback and negative feedback, general theory of feedback –expression for the gain of an amplifier with feedback, effects of negative feedback (qualitative). Four types of feedback connection-characteristics of each case (block diagram only) **3hrs**

**Chapter2: IC fabrication techniques:** IC Fabrication Techniques: Monolithic and hybrid Ics, scales of integration. Advantages of ICs. Crystalline and epitaxial growth. Crystalline growth from melted material. Floating Zone Technique. Epitaxial Growth. Metallic films deposition. Basic Principles of Diffusion and ions implantation. Diffusion related processes. Implantation related processes. Lithography techniques. Optical Lithography. Electron and ion beams and X-ray lithography. Chemical etching. Passive components integration-resistor, capacitor and inductor. Integration of active devices-diode, transistor, NMOS and CMOS. **4hrs**

**Chapter2: Operational Amplifiers:** Transistor differential amplifiers- Four configurations of differential amplifier using transistors, Dual input balanced output BJT differential amplifier (qualitative). Concept of common mode gain, differential gain and CMRR. Block diagram of OPAMP, characteristics of an ideal opamp Characteristics of practical OPAMP( IC 741)- Input Offset Voltage , Input Offset Current, Bias current, Input and Output resistance, Slew Rate, CMRR, PSRR and frequency response. Amplifiers in open loop configuration-inverting, non inverting and differential amplifiers, limitations of using op-amp in open loop configuration. **8hrs**

## **UNIT-III**

**Chapter1: Amplifiers using op-amp:** Voltage series feedback amplifier - Derivation of expression for Closed Loop Voltage gain, input and Output Resistance, Voltage follower. Voltage Shunt Feed-back Amplifier - Derivation of expression for closed loop voltage gain, expression for Input and Output Resistance. Current to voltage converter, OPAMP inverter. Differential Amplifier - Derivation of expression for gain. **4hrs**

**Chapter2: General linear applications of Op-amp:** Summing amplifier – using inverting and non-inverting configurations-derivation of expression for output voltage, summing amplifier as adder and averager, Op-amp subtractor, inverter, Integrator and Differentiator- Derivation of expression for output voltage, frequency response, practical circuits. Comparators: Characteristics, OPAMP as comparator, Applications- voltage level detector, zero crossing detector, Inverting and non inverting Schmitt triggers- expression for UTP , LTP and hysteresis voltage **7hrs**



**Chapter3:**Filters using op-amp: Types, advantages over passive filters. Mention of commonly used active filters- Butter worth, Chebyshev and Cauer filters. First order low pass and high pass Butter worth filters- derivation of expression for gain, operation and design. 4hrs

#### **UNIT-IV**

**CHAPTER1: Combinational Logic Circuit:** Design procedure with examples –Half Adder, Full Adder, Half subtractor, Four bit parallel binary adder, Parity Bit Generator, 2 bit magnitude comparator, multiplexers – realization of Boolean functions using 4 to 1 MUX, De-multiplexers - 1 to 4 DEMUX, Code converters, decoders - 2 to 4 line decoders, encoders. 6hrs

**CHAPTER2:Sequential circuits:** Flip Flops – RS Flip Flop – basic type (using NAND gates), pulse and Edge Triggering, clocked RS Flip Flops with timing diagram. D Flip Flop – truth table, timing diagram. JK Flip Flop – truth table, timing diagram, racing in flip-flops, Master slave JK flip flop, T Flip Flops. 6hrs

**CHAPTER3:Logic Families:** Pulse characteristics, Logic Families-classification of digital ICs. Characteristics of logic families, circuit description of TTL NAND gate with totem pole and open collector. TTL IC terminology. CMOS NAND, comparison of TTL and CMOS families 3hrs

#### **Reference Books:**

1. Electronic devices and circuit theory by Boylestad, Robert Nashelsky
2. Electronic Devices Conventional Current Version by Thomas L. Floyd
3. David A. Bell “Electronic Devices and Circuits”, 5th Edition, Oxford Uni. Press, 2015
4. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edn, 2000, Prentice Hall
5. Operational Amplifiers and Linear ICs, David A. Bell, 3rd Edition, 2011, Oxford University Press.
6. R.S.Sedha, “A Text book of Applied ”, 7<sup>th</sup> edition., S.Chand and Company Ltd. 2011
7. Thomas L. Floyd, Digital Fundamentals, Pearson Education Asia (1994)
8. Digital Principles and Applications, A.P. Malvino, D.P. Leach and Saha, 7<sup>th</sup> Ed., 2011, Tata McGraw
9. Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
10. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
11. Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, 2001, PHI Learning.
12. R. L. Tokheim, Digital Principles, Schaum’s Outline Series, Tata McGraw- Hill (1994)
13. Digital , S.K. Mandal, 2010, 1st edition, McGraw Hill

**Pattern of Question Paper:**

**Time: 3hrs. Max. Marks 100**

**Section-A: Short answer Type Questions**

- |                                     |       |          |
|-------------------------------------|-------|----------|
| 1. Multiple choice questions        | 12/12 | 1x12 =12 |
| 2. One sentence answer questions.   | 10/12 | 1x10 =10 |
| 3. Answer in two or three sentences | 10/12 | 1x10=20  |

**Section B:** Analytical/Problem solving/Application type questions 7/10 4x7=28

**Section C:** Descriptive/Analytical/Problem solving questions 3/4 10x3=30

(Maximum of two sub questions)

- Note
- All the sections should cover equal questions from each unit
  - Maximum of 20% problems can be asked

**G 504 DC2.2P**

**PART A (Any 8)**

- Transistor Biasing circuits -fixed bias, emitter feedback bias and universal bias.
- Study of CE amplifier.
- Study of CC amplifier.
- Characteristics operational amplifier.
- Study of inverting, non-inverting and differential amplifiers using Op-amp.
- Low pass filters and high pass filters using op-amp.
- Study of differentiator and integrator using op-amp.
- Study of Comparator and Schmitt trigger using op-amp
- Arithmetic circuits- (i) half adder (ii) half subtractor and (iii) full adder.
- Realization of Boolean functions using multiplexers.

**Part B: Guided Mini project:**

**Project Title “Design, fabrication and testing of a Regulated power supply (RPS)”. The PCB required for the given project should be fabricated in the lab. Once the RPS is fabricated, its performance should be analysed by studying load regulation and source regulation. A project report duly signed by the Batch in charge staff and Head of the Depart is required to be produced during the End semester Practical Examination for Evaluation.**

**Scheme of valuation**

**Practical II – G 504.2P**

<b>Part A:</b>	One Experiment of Three Hrs Duration	13(split up shown)
<b>Part B:</b>	Presentation of Mini project	0 6 (split up shown)
	Record	06
	Internal Assessment	25
		-----
	Total	50
		-----

**Part A: Based on SECTION-A**

Formula/Truth table/specimen graph -----	2
Labelled Circuit diagram/base diagram of key device/ labelled pin diagram	2
Tabular column/Design calculations/selection of components	2
Circuit layout and connections-	1
Obtaining response, recording readings and number of trials-	4
Graph and calculations-	1
Result/accuracy-	1
	<b>Total: 13</b>

**Part B: Valuation of mini Project**

Presentation	-2marks
Viva	-2marks
Project Report(Dissertation)	-2marks
	<b>Total: 06</b>

## ELE-OE1.2: RENEWABLE ENERGY AND ENERGY HARVESTING

G 504 OE1.2

(Credits: Theory – 02, Demonstration Lab – 01)

Total Teaching hours: 36

### Unit-1

12Hours

***Fossil fuels and Alternate Sources of energy:*** Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

***Solar energy:*** Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models, equivalent circuits, and sun tracking systems.

***Wind Energy harvesting:*** Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.

### Unit – 2

12 Hours

***Ocean Energy:*** Ocean Energy Potential against Wind and Solar, Wave Characteristics, and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, OceanBio-mass.

***Geothermal Energy:*** Geothermal Resources, Geothermal Technologies.

***Hydro Energy:*** Hydropower resources, hydropower technologies, environmental impact of hydro power sources. ***Piezoelectric Energy harvesting:*** Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power. ***Electromagnetic Energy Harvesting:*** Linear generators, physics mathematical models, recent applications,; Carbon captured technologies, cell, batteries, power consumption, Environmental issues and Renewable sources of energy, sustainability.

## Demonstration Experiments: 12 Hours

1. Demonstration of training modules on solar energy, wind energy etc.
2. Conversion of vibration to voltage using piezoelectric voltages
3. Conversion of thermal energy into voltage using thermoelectric module.

### Pattern of Question Paper:

Time: 2.5hrs. Max. Marks 60

Section-A:1. Short answer Type Questions	2marks each	5/7	5X2=10
Section B: long answer type questions	4marks each	5/6	5X4=20
Section C: Descriptive/Analytical/Problem solving questions (Maximum of two sub questions)	10marks each	3/5	3x10=30

### Reference Books:

1. Non-conventional energy sources, B.H. Khan, McGraw Hill.
2. Solar energy, Suhas P Sukhative, Tata McGraw - Hill Publishing Company Ltd.
3. Renewable Energy, Power for a sustainable future, Godfrey Boyle, OxfordUniversity Press.
4. Renewable Energy Sources and Emerging Technologies, Kothari et.al., PHI Learning.
5. Solar Energy: Resource Assessment Handbook, P Jayakumar.
6. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
7. [http://en.wikipedia.org/wiki/Renewable\\_energy](http://en.wikipedia.org/wiki/Renewable_energy)
8. Non-conventional energy sources, B.H. Khan, McGraw Hill.
9. Solar energy, Suhas P Sukhative, Tata McGraw - Hill Publishing Company Ltd.
10. Renewable Energy, Power for a sustainable future, Godfrey Boyle, OxfordUniversity Press.
11. Renewable Energy Sources and Emerging Technologies, Kothari et.al., PHI Learning.
12. Solar Energy: Resource Assessment Handbook, P Jayakumar.
13. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
14. [http://en.wikipedia.org/wiki/Renewable\\_energy](http://en.wikipedia.org/wiki/Renewable_energy)

**SEMESTER - III**  
**POWER CONTROL, OSCILLATORS, WAVES SHAPING CIRCUITS,**  
**PRINCIPLES OF RADIO COMMUNICATION AND DIGITAL CIRCUITS**

**Course Objectives:**

1. To understand the structure of various power control devices and realize their applications
2. To understand the principles of oscillators and learn different Oscillators
3. To learn the clippers and clampers using diodes and op-amps.
4. To understand the communication system, Principle and working communication system, means and medium of communication.
5. To understand the Principle and working of different modulation techniques.
6. To understand characteristics of computer memory and learn the different types of memories.
7. To learn the circuits of various memory cells.

➤ **Course Outcomes (COs):**

**After the successful completion of the course, the student will be able to:**

**CO1:** Know the basic concept of breakdown devices.

**CO2:** Understand the principles Oscillators.

**CO3:** Analyse any wave shaping circuit.

**CO4:** Understand the working of various types of Computer memories.

**CO5.** Analyse the working of various memory organization.

**CO6.** Understand the principles of Radio Communications.

**CO7:** Familiar with “AM” and “FM “techniques.

**CO8:** Understand Registers and Counters

**UNIT-I**

**Chapter1: Breakdown devices:**

**Diac:** Construction, equivalent circuit, operation, V-I characteristics, mention of applications

**Triac:** Construction, equivalent circuit, operation, V-I characteristics, mention of applications, power control using triac, phase control circuit using triac- single and double time constant, comparison of SCR and Triac. **5HRS**

**CHAPTER 2:**

**Power amplifiers:** Classification on the basis of placement of Q point- Graphical representation, Single ended power amplifiers-class A resistive load and inductive load - efficiency. Class B push pull amplifier – efficiency. Mention of typical applications. Audio amplifier using IC. **5hrs**

**CHAPTER 3:**

**Voltage regulators:** Block diagram of regulated power supply, Line and Load regulation, Zener diode as voltage regulator – circuit diagram, load and line regulation, disadvantages. Fixed and Variable IC Voltage Regulators (78xx, 79xx, LM317).**5hrs**

## UNIT-II

### Chapter1:

**Oscillators:** Classification, Principles of oscillators-Barkhausen criterion. **1hr**

**RC oscillators**-phase shift oscillator and Wein bridge oscillator using op-amp.

**LC Oscillators:** Principles of generation of oscillations in a tank circuit. Hartley and Colpitt's oscillators using op-amp. Square wave, ramp and triangular waveform generators using op-amp. Crystals as source of oscillations and crystal oscillator **6HRS**

**IC 555**-internal structure, working. Astable and Monostable multivibrators-working, waveforms mention of expression for frequency/pulse width **3HRS**

**Chapter2: Instrumentation Amplifier:** Expression for output voltage, application as temperature indicator, temperature controller. Signal converters-digital to analog and analog to digital converters **2hrs**

**CHAPTER 3: Wave shaping circuits:** Clippers and clampers using diodes and Voltage Multipliers. Voltage limiters- one side and two side limiting using op-amp.**3HRS**

## UNIT III

**CHAPTER 1: Amplitude Modulation:** Need for modulation. Amplitude modulation – Expressions for AM wave, Modulation index, bandwidth, frequency spectrum, power relations, Schemes of AM, Modulation circuits –Collector modulation. Balanced modulator, AM transmitter (Block diagram). **6HRS**

**CHAPTER 2: Frequency modulation:** Expression for FM wave, reactance modulator-varactor diode and FET. Pre – emphasis and de – emphasis (circuits), FM transmitter (block diagram) with AFC. Comparison of AM and FM. phase modulation (Qualitative). **4HRS**

**CHAPTER 3: Antennas:** Introduction – basic action of a dipole antenna - Calculation of electric field intensity at a distance 'r' from a transmitting antenna, total power radiated, radiation resistance, Aperture of an antenna, Bandwidth, Beamwidth, Directivity, Directive gain, efficiency. Resonant antenna, folded dipole, characteristic impedance, parasitic elements-directors and reflectors, Yagi-Uda antenna, parabolic reflector. **5HRS**

## UNIT IV

**CHAPTER 1: Registers:** Serial load and Parallel load shift registers using D -FF. **2hrs**

**CHAPTER 2: Counters:** Synchronous and Asynchronous counters, mod-16 and mod10 (decade) asynchronous counter using T flip flops , mod-16 and mod10 (decade) synchronous counter using T flip flops. Design of synchronous counters using JK flip flops. **5Hrs**

**CHAPTER 3: Memory:** Characteristics of memory. Semiconductor memories – RAM - a bipolar memory cell - Read/Write operation. Dynamic MOS storage Cell and Static MOS cell - Read/Write operation in a Dynamic MOS cell and static memory cell. Read only memory types – ROM, EPROM, and EEPROM. 4 × 4 bit diode ROM – Read operation. Bulk storage devices –Hard disk and optical disks. Flash memory. **8hrs**

### **Reference Books:**

1. Electronic Communication - George Kennedy – 3<sup>rd</sup> edition – TMH edition
2. Satellite Communication – Dr D C Agarwal – Khanna Publishers
3. Electronic Communication – Dennis Roddy & John Coolen – 4<sup>th</sup> edition – PHI.
4. Electronic Communication – Miller, 6<sup>th</sup> edition – PHI.
5. Digital systems, principles and applications – Ronald J Tocci, Neal S Widmer, Printice Hall of India, New Delhi
6. An Introduction to Digital Computer Fundamentals – Rajaraman & Radhakrishnan – 3<sup>rd</sup> edition – PHI publications
7. Digital Design – Thomas L Floyd – 8<sup>th</sup> edition – Pearson Education.
8. Electronic Communication, Modulation and Transmission – Robert J Schoenbeck – Universal Book Stall
9. Wireless communication Technology – Roy Blake – Thomson & Blar

### **PRACTICALS**

#### **SECTION-A (Any 6)**

1. Square wave generator
2. Triangular wave generator
3. Study of zener diode regulator
4. Verification of characteristics table of DFF
5. Verification of characteristics table of JKFF
6. Two bit serial shift register using DFF
7. Two bit serial shift register using DFF

#### **SECTION-B (Any 8)**

1. Series transistor Regulators.
2. Study of adjustable voltage regulator using IC.
3. Study of power amplifier using IC
4. Band pass and band stop filters using op-amp.
5. Amplitude modulation.
6. Study of IF amplifier.
7. Clippers and clampers.
8. Mod-16 ripple counter using JKFF.
9. 4-bit serial shift register using DFF
10. Study of Universal shift register.



**Scheme of valuation:**

<b>Part A:</b> One Experiment of one Hr Duration	06 (split up shown)
<b>Part B :</b> One Experiment of Three Hrs Duration	13(split up shown)
Record	06
Internal Assessment	25
	-----
Total	50
	-----

**Part A:**

Formula/Truth table/specimen graph -----	1
Labelled Circuit diagram/base diagram of key device/ labelled pin diagram	1
Tabular column/Design calculations/selection of components /circuit connections	1
Obtaining response, recording readings and number of trials-	1
Graph and calculations-	1
Result/accuracy-	1
	<b>Total: 06</b>

**Part B: Based on SECTION-B**

Formula/Truth table/specimen graph -----	2
Labelled Circuit diagram/base diagram of key device/ labelled pin diagram	2
Tabular column/Design calculations/selection of components	2
Circuit layout and connections-	1
Obtaining response, recording readings and number of trials-	4
Graph and calculations-	1
Result/accuracy-	1
	<b>Total: 13</b>

## **ELE-OE3.1: DOMESTIC EQUIPMENT MAINTENANCE**

**(Credits: Theory – 02, Demonstration Lab– 01)**

**Total Teaching hours: 36**

### **Unit-1**

**Geysers:** Construction and working, parts and manufacturing process, types. Common faults and their troubleshooting: Dripping geyser overflow, overheating, steam or hot water escaping from overflow, water leaking through the ceiling, no hot water, water not hot enough, poor hot water pressure. Induction cooker: Construction and working, parts and manufacturing process, types.

Common faults and their troubleshooting: Cooker fuse blown, cooker buttons not working, cooktop shuts off while cooking, food not get cooked or heated properly, overheating and uneven heating, display keep flashing, weird noises– crackling, fan noise, humming sound, clicking.

**Microwave Oven:** Working, raw material and manufacturing process, types, Common faults and their troubleshooting: Microwave does not heat, runs then stops, buttons do not work, plate do not spin, bulb does not turn ON during operation, sparking inside, shuts OFF after few seconds **15 Hours**

### **Unit – II**

**Refrigerator:** Working, raw material and manufacturing process, electrical wiring diagram, types of refrigerator. Common faults and their troubleshooting: fridge not cooling, fridge not defrosting, leaking water, freezing food light not working, freezer is cooled but fridge stays warm, dead refrigerator, not enough cooling, keeps running, leakage, makes noise. Replacement procedure for: seal (gasket), evaporator fan motor, PTC relay, thermostat, compressor, bulb.

**Air Conditioner:** Working, raw material and manufacturing process, electrical wiring diagram, types. Common Faults and their troubleshooting: Faults in following parts of AC: Filter, thermostat, refrigerant leaks, breakers, capacitors, compressor, evaporator coils, condenser coils, warm contactor. General faults :AC unit has an odour, shuts ON and OFF repeatedly, does not blow cold air, repeatedly tripping a circuit breaker, indoor unit is leaking water inside the room, outdoor unit is making an unusually loud sound, room is not getting cold enough, AC not turning ON. **15Hrs**

**Demonstration Experiments:****15 Hours**

1. Working of Air Conditioner
2. Working of Refrigerator
3. Working of Geyser
4. Working of Microwave Oven
5. Working of Induction Cooker

**Pattern of Question Paper:****Time: 2.5hrs. Max. Marks 60****Section-A:1. Short answer Type Questions                      2marks each            5/7    5X2=10****Section B: long answer type questions                      4marks each            5/6    5X4=20****Section C: Descriptive/Analytical/Problem solving questions 10marks each 3/5 3x10=30****(Maximum of two sub questions)****References:**

1. Electronic instruments and systems: Principles, maintenance and troubleshooting by R. G. Gupta Tata McGraw Hill
2. Modern electronic equipment: Troubleshooting, repair and maintenance by Khandpur, Tata McGraw Hill
3. Electronic fault diagnosis by G. C. Loveday, A. H. Wheeler publishing

**\*\*\*\*\***