St Aloysius College (Autonomous)

Mangaluru

Re-accredited by NAAC "A" Grade

Course structure and syllabus of

B.Sc.

ELECTRONICS

According to NATIONAL EDUCATION POLICY 2020

Sl No	Semester	Title of thePaper	Teaching Hours	Hours /week		Examination Pattern Max.Marks /Paper				Duration of Exam (hours)		Total Marks / paper	Theory Credits	Practical Credits
						Theory		Practical						
				Theory	Practical	Exam	IA	Exam	IA	Theory	Practical			
1	I	**ELE-CT1: G 504 DC1.1 FUNDAMENTALS OF ANALOG AND DIGITAL ELECTRONICS**	**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**

Semester	Code	Paper Title
I	G 504DC1.1	Fundamentals of analog and digital Electronics
	G 504DC2.1P	Practical-I
	G504OE1.1	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
	G504OE1.2	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**
	G504OE1.3	**ELE-OE3.1: Domestic Equipment Maintenance**

Preamble

This model curriculum content for B.Sc (Honours) Electronics 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) Electronics 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 of Electronics

In recent years, Electronics 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 Electronics comprise: Semiconductor Devices, analog and digital circuit design, microprocessors & Microcontroller systems, Electronic Communications, Medical Electronics 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 Electronics.

Program Objectives

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

- Provide students with learning experiences that develop broad knowledge and understanding of key concepts of Electronics and equip students with advanced scientific / technological capabilities for analyzing and tackling the issues and problems in the field of electronics.
- Develop ability in students to apply knowledge and skills they have acquired to solve specific theoretical and applied problems in Electronics 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 electronics related problems
- Ability to perform electronics experiments, as well as to analyse and interpretdata.
- Ability to design and manage electronic systems or processes that conforms toa given specification within ethical and economic constraints.
- Ability to identify, formulate, solve and analyze the problems in various subdisciplines of electronics.
- Ability to use Modern Tools / Techniques.

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

SUBJECT: ELECTRONICS

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

Basis for Awarding Theory Internal Assessment Marks:

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

Basis for Awarding Practical Internal Assessment Marks:

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

SEMESTER – I

G 504 DC1.1 FUNDAMENTALS OF ANALOG AND DIGITAL ELECTRONICS

(Credits: Theory – 04, Practical – 02) **Total Teaching hours: 60**

Course Objectives

Upon completing the course, ELE-CT1, 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 Electronics
5. Boolean algebra, Boolean postulates and simplification of Boolean functions
6. understand Logic gates and their applications

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, The venin'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 Electronics, 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", 5th edition., UniversalBook 2003.
2. R.S.Sedha, "A Text book of Applied Electronics", 7th edition., S. Chand andCompany Ltd. 2011
3. A.P. Malvino, "Principles of Electronics", 7th 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, 7thEd., 2011, Tata McGraw
8. Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, 2001, PHILearning.

Course Outcomes

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

- Study and analyze basic networks using network theoremsin a

systematicmanner.

- Build simple electronic circuits used in various applications.
- Describe the behaviour of basic semiconductor devices
- Reproduce the I-V characteristics of diode/BJT devices
- Explain the behaviour, characteristics and applications of Varactor diode,Schottky diode, Tunnel diode, LED, LCD and solar cells.
- Apply standard device models to explain/calculate critical internal parametersof semiconductor devices.
- Understand and represent numbers in powers of base and converting one fromthe other, carry out simple arithmetic operations.
- Understand the basic knowledge of Digital system building blocks, effectively can construct simple digital designs with the knowledge of Boolean algebra.

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 (Maximum of two sub questions)	2/4	10x2=20

Note i) All the sections should cover equal questions from each unit

ii) Maximum of 30% problems can be asked

G 504 DC2.1P: PRACTICALS – I

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

1. Understanding of Colour coding of resistors and identification of various types of resistors.
2. Understanding of coding various types of capacitors and identification of various types of capacitors.
3. Understanding and using multimeter for device testing.
4. Familiarisation and testing of different types of transistors.

5. Understanding soldering technique and hands on experience on soldering.
6. Understanding CRO and function generator and measurement of voltage and frequency of the signals using CRO
7. Verification of truth tables of NOT, AND and OR gates using TTL ICs.
8. Verification of truth tables of NAND and NOR gates using TTL ICs.

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

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

Scheme of valuation:

Part A: Identification of circuit Elements and testing Exercise	06 (split up shown)
Part 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 meaurement/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

- **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 ELBSEdtion.
5. Basic electrical engineering - V K Mehta and Rohit Mehta, S

Chand andCompany.
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 **Small signal amplifiers, Operational amplifiers and Combinational circuits**

(Credits: Theory – 04, Practical – 02) Total Teaching hours: 60

Course Objectives

Upon completing the syllabus contents of ELE-CT2, 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.

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 the syllabus contents of ELE-CT2, 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.

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 differerntial 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 substractor, 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 substractor, 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

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

- Apply standard device models to explain/calculate critical internal parametersofsemiconductor devices.
- Explain the behavior and characteristics of power devices such as UJT, SCR,Diac, Triac etc.
- Perform experiments for studying the behavior of semiconductor devices.
- Calculate various device parameters' values from their IV characteristics.
- Interpret the experimental data for better understanding the device behaviour.
- Understand basic logic gates, concepts of Boolean algebra and techniquestoreduce/simplify Boolean expressions
- Analyze combinatorial and sequential circuits

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 Electronics", 7th edition.,S.Chand andCompany 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, 7thEd., 2011, Tata McGraw

(9) Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHILearning 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, TataMcGraw- Hill (1994)
(13) Digital Electronics, 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 (Maximum of two sub questions)	3/4	10x3=30

Note i) All the sections should cover equal questions from each unit

- ii) Maximum of 30% problems can be asked

G 504DC2.2P

PART A (Any 8)

1. Transistor Biasing circuits -fixed bias, emitter feedback biasand universal bias.
2. Study of CE amplifier.
3. Study of CC amplifier.
4. Characteristics operational amplifier.
5. Study of inverting, non-inverting and differential amplifiers using Op-amp.
6. Low pass filters and high pass filters using op-amp.
7. Study of differentiator and integrator using op-amp.
8. Study of Comparator and Schmitt trigger using op-amp
9. Arithmetic circuits- (i) half adder (ii) half substractor and (iii) full adder.
10. 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

Part A:	One Experiment of Three Hrs Duration	13(split up shown)
Part 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
	Total: 13

Part B: Valuation of mini proect

Presentation	-2marks
Viva	-2marks
Project Report(Dissertation)	-2marks
	Total: 06

ELE-OE1.2: Renewable Energy and Energy Harvesting

(Credits: Theory – 02, Demonstration Lab – 01) **Total Teaching hours: 36**

Unit-1 **12 Hours**

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, Ocean Bio-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.

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, Oxford University 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
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, Oxford University 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

SEMIII

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 mermoroies.
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.

C04: Unerstand 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

CHAPTER2:

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

CHAPTER3:

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-Barkhaussen 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 – 3rd edition – TMH edition
2. Satellite Communication – Dr D C Agarwal – Khanna Publishers
3. Electronic Communication – Dennis Roddy& John Coolen – 4th edition – PHI.
4. Electronic Communication – Miller, 6th 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 – 3rd edition – PHI publications
7. Digital Design – Thomas L Floyd – 8th 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:

Part A:	One Experiment of one Hr Duration	06 (split up shown)
Part B :	One Experiment of Three Hrs Duration	13split 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
	Total: 06

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
	Total: 13

ELE-OE3.1: Domestic Equipment Maintenance

(Credits: Theory – 02, Demonstration Lab– 01) Total Teaching hours: 45

Unit-1 15 Hours

Geyser: 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

Unit – 2 15 Hours

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.

Demonstration Experiments: **30 Hours**

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

References:

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

ELE-OE4.1: Consumer Electronics

(Credits: Theory – 02, Demonstration Lab– 01) **Total Teaching hours: 60**

Unit – 1

Audio Systems: PA system, Microphones, Amplifier, Loudspeakers, Radio Receivers, AM/FM, Audio Recording, and reproduction, Cassettes, CD and MP3.

Unit – 2

TV and Video Systems: Television standards, BW/Colour, CRT/HDTV, video system, VCR/VCD/DVD players, MP4 players, set top box, CATV and Dish TV, LCD, Plasma and LED TV, Projectors: DLP, Home Theatres, Remote controls.

Unit – 3

Landline and Mobile Telephony: Basic landline equipment, CL1, cordless intercom/EPABX system, mobile phones: GPRS and Bluetooth, GPS Navigation system, smart phones, Office Equipment: Scanners, Barcode / flat bed, printers, Xerox, Multifunction units (Print, Scan, fax, and copy)

Unit – 4

Electronic gadgets and Domestic Appliances: Digital Clock, Digital Camera, Handicam, Home security system, CCTV, Air conditioners, Refrigerators, washingmachine / Dish washer, Microwave oven, Vacuum cleaners.

Suggested Books:

1. R.P.Bali, Consumer Electronics, Pearson Education (2008)
2. R.G. Gupta, Audio and Video systems, Tata McGraw Hill (2004)

Consumer Electronics Lab:

1. Study of PA systems for various situations – Public gathering, Closed theatre /Auditorium, Conference room, Prepare bill of material (Costing)
2. Installation of Audio/Video systems – site preparation, electrical requirements,cables and connectors
3. Market survey of products (at least one from each module)
4. Identification of block and tracing the system, Assembly and Disassembly ofsystem using toolkit.