



BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI-620024
B.SC. ELECTRONICS

**CHOICE BASED CREDIT SYSTEM–LEARNING OUTCOMES BASED CURRICULUM FRAME
WORK (CBCS - LOCF)**

(Applicable to the candidates admitted from the academic year 2026-2027 onwards)

Sem	Part	Courses	Title	Ins. Hrs.	Credits	Exam	Maximum Marks		
							Int.	Ext.	Total
I	I	Ability Enhancement Course – I (AEC - I)	(Tamil \$ / Other Languages+, #)	6	3	3	30	70	100
	II	Ability Enhancement Course –II (AEC - II)	English Course - I	6	3	3	30	70	100
	III	Core Course -1 (CC - 1)	Electric Circuits & Electronic Devices	4	4	3	30	70	100
		Core Practical - 1 (CP - 1)	Electric Circuits & Electronic Devices Lab	4	4	3	40	60	100
		Allied Course - 1 (AC - 1)	Any one from the list	4	4	3	30	70	100
		Allied Course Practical - 1 (AP-1)	Any one from the list	2	**	**	**	**	**
	IV	Value Education		2	2	3	30	70	100
		Interdisciplinary Course - 1 (IDC - 1) #	One Course from Outside Department	2	2	3	30	70	100
	Total			30	22	--	--	--	700
II	I	Ability Enhancement Course –III (AEC - III)	(Tamil \$ / Other Languages+, #)	6	3	3	30	70	100
	II	Ability Enhancement Course –IV (AEC - IV)	English Course - II	6	3	3	30	70	100
	III	Core Course- 2(CC - 2)	Analog Electronic Circuits	4	4	3	30	70	100
		Core Practical - 2(CP - 2)	Analog Electronic Circuits Lab	4	4	3	40	60	100
		Allied Course – 2 (AC - 2)	Any one from the list	4	4	3	30	70	100
		Allied Course Practical - 1 (AP-1)	Any one from the list	2	4	3	40	60	100
	IV	Skill Enhancement Course - 1(SEC - 1) ##	Naan Mudhalvan Course/SEC (List enclosed)	2	2	3	30	70	100
		Interdisciplinary Course – 2 (IDC - 2) #	One Course from Outside Department	2	2	3	30	70	100
	Total			30	26	--	--	--	800

III	I	Ability Enhancement Course –V (AEC - V)	(Tamil \$ / Other Languages+, #)	6	3	3	30	70	100
	II	Ability Enhancement Course –VI (AEC - VI)	English Course - III	6	3	3	30	70	100
	III	Core Course- 3(CC - 3)	Digital Electronics	4	4	3	30	70	100
		Core Practical - 3 (CP - 3)	Digital Electronics Lab	4	4	3	40	60	100
		Allied Course - 3 (AC - 3)	1. Computer Science I (or) 2. AI & ML I	4	4	3	30	70	100
		Allied Course Practical - 2 (AP-2)	1. Computer Science I Lab (or) 2. AI & ML I Lab	2	**	**	**	**	**
	IV	Skill Enhancement Course - 2 (SEC - 2) ##	Naan Mudhalvan Course/SEC (List enclosed)	2	2	3	30	70	100
		Interdisciplinary Course – 3 (IDC - 3) \$\$	One Course from Outside Department	2	2	3	30	70	100
		Health & Wellness @		--	1	--			100
	Total			30	23	--	--	--	800
I	Ability Enhancement Course –VII (AEC - VII)	(Tamil\$ / Other Languages+, #)	6	3	3	30	70	100	
IV	II	Ability Enhancement Course –VIII (AEC - VIII)	English Course - IV	6	3	3	30	70	100
	III	Core Course- 4(CC - 4)	Linear Integrated circuits	4	4	3	30	70	100
		Core Practical - 4(CP - 4)	Linear Integrated circuits Lab	4	4	3	40	60	100
		Allied Course – 4 (AC - 4)	1. Computer Science II (or) 2. AI & ML II	4	4	3	30	70	100
		Allied Course Practical - 2 (AP-2)	1. Computer Science II Lab (or) 2. AI & ML II Lab	2	4	3	40	60	100
	IV	Skill Enhancement Course – 3 (SEC - 3) ##	Naan Mudhalvan Course/SEC (List enclosed)	2	2	3	30	70	100
		Interdisciplinary Course – 4 (IDC - 4) \$\$	One Course from Outside Department	2	2	3	30	70	100
	Total			30	26	--	--	--	800
		Summer Internship / Industrial Activity during the Summer Vacation after II Year							

V	III	Core Course - 5 (CC - 5)	Electronic Communication Systems	4	4	3	30	70	100
		Core Course - 6 (CC - 6)	Microprocessors and Microcontrollers	5	4	3	30	70	100
		Core Course - 7 (CC - 7)	Instrumentation System	5	4	3	30	70	100
		Core Course - 8 (CC - 8)	Internet of Things	5	4	3	30	70	100
		Core Practical - 5 (CP - 5)	Controller and Communication	5	4	3	40	60	100
	IV	Skill Enhancement Course – 4 (SEC - 4)	Naan Mudhalvan Course/SEC (List enclosed)	2	2	3	30	70	100
		Skill Enhancement Course – 5 (SEC - 5) ##	Naan Mudhalvan Course/SEC (List enclosed)	2	2	3	30	70	100
		Introduction to Disaster Management		2	2	3	30	70	100
		Summer Internship / Industrial Activity @@	(with Viva-Voce)	--	2	--	20	80	100
	Total			30	28	--	--	--	900
VI	III	Core Course - 9(CC - 9)	Power Electronics	4	4	3	30	70	100
		Core Course- 10(CC - 10)	VLSI Design	5	4	3	30	70	100
		Core Course- 11(CC - 11)	Biomedical Electronics	5	4	3	30	70	100
		Core Project Work (CPW) @@	Project Work (with Viva-Voce)	6	4	3	20	80	100
	IV	Value Added Course	General Studies for Competitive Examinations	2	1	--	30	70	100
		Skill Enhancement Course – 6 (SEC - 6)	Naan Mudhalvan Course/SEC (List enclosed)	2	2	3	30	70	100
		Skill Enhancement Course – 7 (SEC - 7) ##	Naan Mudhalvan Course/SEC (List enclosed)	2	2	3	30	70	100
		Environmental Studies		2	2	3	30	70	100
		Gender Studies		2	1	3	30	70	100
		Extension Activities *		--	1	--	--	--	--
	Total			30	25	--	--	--	900
	Grand Total			180	150	--	--	--	4900

ALLIED COURSE

First Year	Second Year
Mathematics	1. Computer Science (or) 2. AI & ML

SKILL ENHANCEMENT COURSE (SEC)

Sl. No.	Title of paper	Sl. No.	MANDATORY Naan Mudhalvan Scheme##
1.	Python Programming	1.	2nd Semester:
2.	Cyber Security	2.	3rd Semester:
3.	Sensor and its applications	3.	4th Semester:
4.	CCTV Systems	4.	5th Semester:
5.	Arduino Programming		
6.	Raspberry Pi Programming	5.	6th Semester:
	LCD TV Servicing		

INTERDISCIPLINARY COURSE (IDC) FOR WHO HAVE OPT TAMIL AS PART-I (for other Department Students only)

1 st Semester	Electrical House Wiring
2 nd Semester	Consumer Electronics
3 rd Semester	Automotive Electronics
4 th Semester	Mobile Phone Servicing

INTERDISCIPLINARY COURSE (IDC)# FOR WHO HAVE NOT OPT TAMIL AS PART - I

Those who have studied Tamil upto 10 th +2 but opt to for other languages in degree	1 st Semester	Special Tamil - I
	2 nd Semester	Special Tamil - II
Those who have not studied Tamil in school level	1 st Semester	Basic Tamil - I
	2 nd Semester	Basic Tamil - II
Those students who opt for either special Tamil (or) Basic Tamil as IDCs, have to choose 2 more IDCs courses in their 3rd and 4th Semester from Outside his/her department.		

INTERDISCIPLINARY COURSE (IDC) \$\$ FOR NCCADETS ONLY	
NCC Course is a Compulsory Course for the NCC Cadets in the 3rd Semester:	NCC Course is a Compulsory Course for the NCC Cadets in the 4th Semester:
Introduction to NCC	1. Special Subject Army (or) 2. Special Subject Navy (or) 3. Special Subject Air force
Those students who opt for NCC Courses as IDCs, have to choose 2 more IDCs courses in their 1st and 2nd Semester from Outside his/her department.	

SUMMARY OF CURRICULUM STRUCTURE OF UG PROGRAMMES

Sl. No.	Part	Types of the Courses	No. of Courses	Credits for each Course	Total Credits	Marks
1.	I	Ability Enhancement Course	4	3	12	400
2.	II	Ability Enhancement Course	4	3	12	400
3.	III	Core Course	11	4	44	1100
4.		Core Practical	5	4	20	500
5.		Allied Course (AC)	4	4	16	400
6.		Allied Course Practical (ACP)	2	4	8	200
7.		Core Project Work (CPW)	1	4	4	100
8.	IV	Skill Enhancement Course (SEC)	7	2	14	700
9.		Interdisciplinary Course (IDC)	4	2	8	400
10.		Value Education	1	2	2	100
11.		Health and Wellness	1	1	1	100
12.		Introduction to Disaster Management	1	2	2	100
13.		Summer Internship / Industrial Activity	1	2	2	100
14.		Value Added Course	1	1	1	100
15.		Environmental Studies	1	2	2	100
16.		Gender Studies	1	1	1	100
17.		EXTENSION ACTIVITIES (NCC / NSS / SPORTS / ANTI DRUG CELL / YRC & Any Other Activities)	--	1	1	--
Total			49	-	150	4900

- \$ For those who have studied Tamil upto 10th +2 (Regular Stream)
- + Syllabus for other Languages should be on par with Tamil at degree level
- # Those who have studied Tamil upto 10th +2 but opt for other languages in degree level under Part - I should study special Tamil and those who have not studied Tamil in the school level should study Basic Tamil in Part – IV under the Interdisciplinary Course.
- ** Examination at the end of the next semester
- ## Naan Mudhalvan Scheme: As per the Naan Mudhalvan Scheme instructions, 5 courses from 2nd to 6th semester should be studied under Skill Enhancement Course.
- \$\$ NCC Course is one of the Choices in the Interdisciplinary Course. Only the NCC Cadets are eligible to choose this course. However, NCC Course is a Compulsory Course for the NCC Cadets.

@ **Health and Wellness: Assessments:**

- Use self-reflective worksheets to assess their understanding
- submit the worksheets to internal audit / external audit
- Every student's activity report should be documented and the same have to be assessed by the Physical Director with Mentor. The evaluation should be for 100 marks. No examination is required.

Scheme of Evaluation:

Part	Description	Marks
A	Report	40
B	Attendance	20
C	Activities (Observation During Practice)	40
Total		100

@@ **Summer Internship / Industrial Activity**

Internship will be carried out during the summer vacation after the second year. Viva-Voce will be conducted by the college and Marks shall be sent to the University and the same will be included in the 5th semester Mark Statement.

Summer Internship / Industrial Activity & Project Work

Scheme of Evaluation:

Description	Marks
Report	80
Viva-Voce	20
Total	100

- * Extension Activities shall be outside instruction hours.

PROGRAM OBJECTIVES

1. To provide high quality education to the students of B.Sc., Electronics course, so that they acquire thorough knowledge in Electronics and be successful in their professional career.
2. To develop the skills of the students to analyze real problems in designing of Electronics circuits with cost-effective solutions for humanity.
3. To impart training to the students to develop their professional knowledge for creating human resource of global standards for the Industry, Research, & Development and Education.
4. To familiarize students with the professional issues in innovation, ethics, issues related to global economy and emerging technology in Electronics field.
5. To promote students' awareness of lifelong learning through an excellent academic environment, prepare them for higher education and provide them opportunity to work in teams on multidisciplinary also.
6. To improve the communication skills of students, prepare them to acquire good leadership skills to lead a team and a good interpersonal relationship for working in a company.

PROGRAM OUTCOMES

B.Sc., Graduates in Electronics will be able to:

1. Apply the knowledge of Mathematics and Science, necessary to solve complex design problems.
2. They can Identify, formulate, and analyze real problems in circuit design and provide solutions which are cost effective to meet the needs of society.
3. Design electronic circuits & systems, conducts experiment, analyze & interpret the data to find new innovative ideas.
4. Use modern engineering tools, software & equipment's to analyze problems and design components.
5. Demonstrate knowledge of professional & ethical responsibilities.
6. Apply knowledge of professional & ethical responsibilities.
7. Exhibit good communication skills in writing reports and documenting complex activities.
8. Understand the contemporary issues involving health, safety and environmental issues.
9. Undertake lifelong learning and pursue higher education and career.
10. Apply leadership skills and develop as an entrepreneur.

Code: **ELECTRIC CIRCUITS & ELECTRONIC DEVICES (Theory)**

Credits: 4

COURSE OBJECTIVES:

1. To introduce basic concepts of Electric circuits and Electronic Devices.
2. To Practice the students with electrical circuits, different laws and circuit analysis.
3. To familiarize AC fundamentals to the students.
4. To develop a construction and characteristics idea of electronic components.
5. To create a thorough understanding of applications of all electronic devices.

UNIT I: INTRODUCTION TO ELECTRICAL COMPONENTS

Resistance: Factors governing the resistivity of a resistor- resistors in series and parallel. Capacitance: Factors affecting the capacity of a capacitor-capacitance in series and parallel-Inductance: Inductance of an inductor -inductors in series and parallel-ohm's law - Transformers: Construction and operation-types-Simple problems.

UNIT II: NETWORK THEOREMS AND ANALYSIS

Kirchhoff's law- mesh current method and node voltage analysis of circuits – short circuit and open circuit analysis.

Thevenin's theorem- Norton's theorem- Super Position theorem – Maximum Power transfer theorem – Milliman's theorem.

UNIT III: FUNDAMENTALS OF AC

Average value-RMS value- RL circuit- RC circuit- RLC circuit analysis. Transient response - Reactance and impedance concepts - single phase and three phase circuit - power factor- real power and reactive power.

UNIT IV: SEMICONDUCTOR THEORY

Classification of solids-conductors, insulators and semiconductors- intrinsic semiconductors - Extrinsic semiconductors: P - type – N- type - PN junction diode- V-I characteristics of diode. Breakdown mechanism – Zener diode – V-I characteristics of Zener diode – Zener diode as a voltage regulator.

UNIT V: CONSTRUCTION AND CHARACTERISTICS OF ELECTRONIC DEVICES

Transistor (BJT) - CB, CE and CC characteristics of a transistor- transistor as an amplifier- construction and characteristics of FET, MOSFET, UJT, SCR and TRIAC.

UNIT VI: EMERGING TRENDS IN ELECTRONIC DEVICES

Applications of Wide-Bandgap (WBG) semiconductors - quantum devices. Advanced Semiconductor Materials & Nanotechnology Wide-Bandgap (WBG) Semiconductors: Moving beyond Silicon to focus heavily on Gallium Nitride (GaN) and Silicon Carbide (SiC) devices. This includes exploring their use in high-power, high-frequency, and RF applications. The study of electron spin instead of just its charge, alongside fundamental

quantum well and quantum dot devices. Emerging Transistor Architectures Fin FET-planar devices- nanosheet transistors -Tunnel FETs -Exploring ultra-low power devices-power constraints and thermal dissipation- organic semiconductors and printable electronics for foldable displays.

COURSE OUTCOMES:

On completion of this course, students will be able to:

CO1: Understand the fundamentals of Electrical components and its necessity.

CO2: Analyze basic electrical circuits with theorems.

CO3: Familiarize with AC and its importance.

CO4: Structure of semiconductor and its usage.

CO5: Apply semiconductor devices for various purposes.

Text Books:

1. "Basic Electronics Engineering" by S.Jayalalitha, D.Susan, Cengage Publications , 1st Edition, 2023, ISBN 97893 55735119.
2. "Basic Electronics" by Dr.S.R. Bhagyashree, 1st Edition, Notion Press Media, private limited -2021 - ISBN 10 16 4290405.
3. "Principles of Electronics" by V.K.Mehta, Rohit Mehta, 2nd Edition, S.Chand Publications, 2020, ISBN-978935 28383 63.

Reference Books:

1. "Grob's Basic Electronics" by Mitchell E Scultz, 10th Edition – 2017, ISBN-13: 97807 063 4329.
2. "Electronic devices and circuits" by David A Bell, 5th Edition, Oxford Publications, ISBN-10: 01 956 9348.

e- book Links:

1. <https://www.gacbe.ac.in/images/E%20books/Bird%20-%20Electrical%20Circuit%20Theory%20and%20Technology%202nd%20Rev.pdf>
2. <https://irdtuttarakhand.org.in/Upload/concepts-in-electric-circuits.pdf>
3. https://books.google.co.in/books?id=8686A5TLsjAC&printsec=copyright&redir_esc=y#v=onepage&q&f=false.

Semester	Course Code			Title of the Paper						
I				ELECTRIC CIRCUITS & ELECTRONIC DEVICES						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	2	3	2	2	3	3	2
CO-2	3	3	3	2	2	1	2	3	3	3
CO-3	3	3	3	2	1	3	2	2	2	3
CO-4	3	3	3	3	2	2	2	2	2	3
CO-5	3	3	3	1	1	2	1	2	3	3

*3-Strong; 2-Medium; 1-Low

**Code: ELECTRIC CIRCUITS & ELECTRONIC
DEVICES LAB
(Practical)**

Credits: 4

COURSE OBJECTIVES:

1. To impart the practical skills to test the circuits
2. To familiarize the basic characteristics of electronic components.

(Any twelve (12) Experiments)

1. Verification of Ohm's law.
2. Verification of Kirchhoff's law.
3. Verification of Super position theorem.
4. Verification of Millman's theorem.
5. Verification of Thevenin's theorem.
6. Verification of Norton's theorem.
7. Find the Transient response of RL circuit.
8. Find the Transient response of RC circuit.
9. Construct Series resonance circuit.
10. Construct Parallel resonance circuit.
11. Study the V-I characteristics of PN junction diode.
12. Study the V-I characteristics of a Zener diode.
13. Study the CB characteristics using BJT
14. Study the CE characteristics using BJT.
15. Study the FET characteristics.
16. Study the UJT and SCR characteristics.

REFERENCES:

1. "H. W Jackson, D. Temple, B. Kelly, K. Craigs and L. Fuentes", Introduction to Electric Circuits: Lab Manual, 10th Ed. (OBU Publishers, 2019).

COURSE OUTCOMES:

On completion of this course, students will be able to:

1. Verify all the basic laws and theorems
2. Characterize the BJT, FET, UJT, etc.

Code: **ELECTRICAL HOUSE WIRING**
(Theory)

Credits: 2

COURSE OBJECTIVES:

1. To introduce the fundamental concepts of electricity and electrical systems.
2. To familiarize students with electrical circuits, wiring systems and distribution methods.
3. To provide practical knowledge of domestic wiring and electrical accessories.
4. To develop awareness of electrical safety practices and testing procedures.
5. To impart hands-on experience in electrical installation and maintenance

UNIT I: FUNDAMENTALS OF ELECTRICITY AND POWER GENERATION

Fundamentals of electricity – Electric current, voltage and resistance – Ohm's Law – Electric power and energy – Kilowatt hour – Wattmeter – Electrical measurements – Methods of electric power generation: Thermal, Hydro and Nuclear power generation – Batteries and DC power sources – Construction and working principle of generators – Experimental study of generator.

UNIT II: ELECTRIC CIRCUITS AND POWER DISTRIBUTION

Electrical symbols and parameters – Series and parallel circuits – AC and DC circuits – Conductors, resistors, inductors and capacitors – Transformer basics – Distribution methods – Single-phase and three-phase systems – Star and delta connections – Basic wiring rules and electrical standards – Standard Wire Gauge (SWG) – Introduction to motors – Experimental study of motors, series and parallel circuits.

UNIT III: BASICS OF ELECTRICAL WIRING SYSTEMS

Introduction to electrical wiring – Types of wiring systems – Wiring accessories – Tools used in electrical wiring – Safety precautions in electrical installations – Color coding of wires as per Indian standards – Introduction to basic wiring diagrams – Reading simple electrical layouts.

UNIT IV: HOUSE WIRING METHODS AND ELECTRICAL ACCESSORIES

Tools used in house wiring – Methods of joining conductors – House wiring methods: Cleat wiring, Wood casing wiring, Tough Rubber Sheathed (TRS) wiring, Conduit wiring, PVC pipe wiring and concealed wiring – Switches – Ceiling rose – Lamp holders – Sockets – Fuse base – Distribution box – MCB and trip switches – Earthing and earth connections – Experimental study of house wiring.

UNIT V: ELECTRICAL DISTRIBUTION BOARDS, PROTECTION AND TESTING

Main board preparation – Distribution boards – Service cut-out and protection devices – Switchboard preparation – Power factor basics – Indian Electricity Rules and IEC/IS standards – Safety precautions – Testing of insulation – Experimental study of main boards, distribution boards and switchboard.

UNIT VI (Optional): ELECTRICAL INSTALLATION, MAINTENANCE AND ENERGY MANAGEMENT

Electrical installation practices – Preventive and corrective maintenance – Identification and rectification of common electrical faults – Energy-efficient electrical systems –

Energy conservation techniques – Load calculation and balancing – Introduction to renewable energy integration in domestic systems – Practical maintenance and fault diagnosis exercises

COURSE OUTCOMES:

On completion of this course, students will be able to:

- CO1:** Understand the fundamentals of electricity and electrical power generation.
- CO2:** Analyze basic electrical circuits and distribution systems.
- CO3:** Identify and use electrical wiring tools and accessories.
- CO4:** Perform simple domestic wiring and electrical installation work safely.
- CO5:** Apply electrical safety standards and testing procedures in practical applications.
- CO6:** Demonstrate the ability to perform basic electrical maintenance, identify faults, apply energy conservation techniques, and ensure efficient operation of electrical systems.

Text Books:

1. "B. L. Theraja, and A K Theraja", A Textbook of Electrical Technology – S. Chand Publications.
2. "V K Mehta & Rohit Mehta", Principles of Electrical Engineering – S. Chand Publications.

Reference Books:

1. Electrical Wiring and Estimating – "Khanna Publishers".
2. Basic Electrical Engineering – McGraw Hill Education.

Semester	Course Code			Title of the Paper						
I				ELECTRICAL HOUSE WIRING						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	2	3	2	1	3	3	2
CO-2	3	3	3	2	1	2	1	3	2	3
CO-3	3	3	3	2	1	3	1	2	2	3
CO-4	3	3	3	3	2	2	1	3	2	3
CO-5	3	3	3	1	1	2	1	2	3	3

*3-Strong; 2-Medium; 1-Low

Code: **ANALOG ELECTRONIC CIRCUITS**
(Theory)

Credits: 4

COURSE OBJECTIVES:

1. To enable design and construction of various circuits with Devices.
2. To enhance the knowledge of the students with advanced circuits.
3. To analyze the transistor circuit with different possible configurations.
4. To develop an application for circuits with characteristics may be studied.
5. To design a suitable Oscillators for audio and video circuits.

UNIT I: RECTIFIERS AND VOLTAGE REGULATORS

Half-wave - full-wave - center-tapped and bridge rectifiers. Ripple factor, efficiency, and form factor - capacitor/inductor filters. Fixed voltage regulators IC 78XX, and IC 79XX series.

UNIT II: BJT AND FET BIASING

Operating point (Q-point), load line analysis - fixed bias, collector-to-base bias, and voltage divider bias. Bias stability and thermal runaway. Stability factor - FET biasing.

UNIT III: AMPLIFIERS AND FREQUENCY RESPONSE

Amplifiers- Cascading Amplifiers - Methods of coupling - RC coupling - direct coupling- transformer coupling - gain calculations. Feedback Amplifiers: The four basic feedback topologies (Voltage/Current, Series/Shunt) and their effects on input/output.

UNIT IV: POWER AMPLIFIERS

Classification - Class A - Class B - Class AB - Class C and efficiency - Push-Pull configurations - cross over distortion - Applications.

UNIT V: OSCILLATORS AND WAVE SHAPING CIRCUITS

Barkhausen criterion - RC phase shift oscillator - Wien bridge oscillators- LC Oscillators: Hartley oscillator - Colpitts oscillator - Crystal oscillators.

Wave Shaping: Clipping and clamping circuits.

UNIT VI: ANALOG CIRCUITS DEVELOPMENT

Handle continuous, variable signals- Handle discrete signals – Mixed-Signal Circuits: Combine both analog and digital components, commonly found in modems and smart sensors.

COURSE OUTCOMES:

On completion of this course, students will be able to:

CO1: Understand the construction details of the basic diode circuits

CO2: Analyze the load line parameters and different configurations of the transistors may be arrived

CO3: Designing of different amplifiers for important applications can be done.

CO4: Power amplifier circuits or designed with high performance.

CO5: Signal generation circuits may be design and troubleshooted.

Text Books:

1. "Principles of Electronics" by V.K.Mehta, Rohit Mehta, 2nd Edition, S.Chand Publications, 2020, ISBN-978935 28383 63.

2. "Electronic principles" by Albert Malvino, David J Bate, Patrick E Hoppe, McGraw Hill Indian edition, 9th edition, 2021, ISBN-978 1260 447 965.

Reference Books:

1. "Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky", 11th Edition, Pearson Education, 2021, ISBN- 9789332542600.

2. Electronic devices and circuits by "Jacob Millman, Christos C Halkias, Satyabrata jit", Oxford University Press replication, 2015, ISBN- 10 - 9789 3392 19543.

E-Book Links:

1. https://fmipa.umri.ac.id/wp-content/uploads/2016/03/Tooley_Electronic_Circuits_-_Fundamentals_and_ApBookZZ.org.pdf

2. https://dl.ojocv.gov.et/admin_/book/Electronic%20Circuits%20Fundamentals%20and%20Application%20sBook%20%282%29.pdf

3. <https://www.allaboutcircuits.com/textbook/>

Semester	Course Code			Title of the Paper						
II				ANALOG ELECTRONIC CIRCUITS						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	2	3	1	1	1	2	2
CO-2	3	3	3	2	2	1	2	3	3	3
CO-3	3	3	3	2	3	1	2	2	2	3
CO-4	3	3	3	3	2	1	2	2	3	3
CO-5	3	3	3	1	2	1	3	2	3	3

**Code: ANALOG ELECTRONIC CIRCUITS LAB
(Practical)**

Credits: 4

COURSE OBJECTIVES:

1. To impart the practical skills on basic analog circuits.
2. To gain practical knowledge on diode circuits and their applications.
3. To practice transistors based elementary amplifier and oscillator circuits.

(Any twelve (12) Experiments)

1. Construct half and full wave rectifier using diodes.
2. Construct Bridge rectifier using diodes.
3. Construct Zener diode Voltage regulator.
4. Construct IC regulated power supply using IC 7809 and 7909.
5. Determination of stability factor of Potential divider bias circuit.
6. Study the characteristics of Base bias circuit.
7. Construct and study the characteristics of Class A amplifier.
8. Construct and study the characteristics of Class B amplifier
9. Construct of Class C amplifier.
10. Construct Voltage shunt feedback amplifier.
11. Design Hartley oscillator.
12. Design Colpitts' oscillator.
13. Construct Schmitt trigger using BJT.
14. Construct Astable multivibrator using BJT.
15. Construct Mono stable multivibrator using BJT.
16. Construct Bistable multivibrator using BJT.

REFERENCES:

1. "K. Craigs and L. Fuentes", Introduction to Electric Circuits: Lab Manual, 10th Ed. (OBU Publishers, 2019).

COURSE OUTCOMES:

On completion of this course, students will be able to:

1. Learn all waveform generation techniques.
2. Gain knowledge of power amplifier circuit ideas.

Code:**PYTHON PROGRAMMING
(Theory)****Credits: 2****COURSE OBJECTIVES:**

1. Presents an introduction to Python, creation of web applications, network applications and working in the clouds
2. Use functions for structuring Python programs
3. Understand different Data Structures of Python
4. Represent compound data using Python lists, tuples and dictionaries

UNIT I: BASICS: Python - Variables - Executing Python from the Command Line - Editing Python Files- Python Reserved Words

UNIT II: CONTROL STATEMENTS: Control Flow and Syntax - Indenting - if Statement - statements and expressions-string operations

UNIT III: FUNCTIONS: Definition - Passing parameters to a Function - Built-in functions- Variable Number of Arguments - Scope Type conversion -Type Coercion- Passing Functions to a Function

UNIT IV: ERROR HANDLING: Run Time Errors - Exception Model - Exception Hierarchy - Handling Multiple Exceptions - Data Streams - Access Modes.

UNIT V: OBJECT ORIENTED FEATURES: Classes, Principles of Object Orientation - Creating Classes - Instance Methods - File Organization

UNIT VI: Contemporary Issues: Expert lectures, online seminars – webinars

COURSE OUTCOMES:

On completion of this course, student will be able to:

CO1: Understand the basic concepts of Python Programming

CO2: Understand File operations, Classes and Objects

CO3: Acquire Object Oriented Skills in Python

CO4: Develop web applications using Python

CO5: Develop Client Server Networking applications

Text Books:

1. Mark Summerfield, Programming in Python 3: A Complete introduction to the Python Language, Addison-Wesley Professional, 2009.
2. Martin C. Brown, PYTHON: The Complete Reference, McGraw-Hill, 2001
3. E. Balagurusamy (2017), “Problem Solving and Python Programming”, McGraw-Hill, First Edition.

Reference Books:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016
2. Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011
3. Wesley J Chun, Core Python Applications Programming, Prentice Hall, 2012

Semester	Course Code			Title of the Paper						
II				PYTHON PROGRAMMING						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	1	3	2	1	2	3	3
CO-2	3	3	3	1	3	2	1	2	3	3
CO-3	3	3	3	1	3	2	1	2	3	3
CO-4	3	3	3	1	3	2	1	2	3	3
CO-5	3	3	3	1	3	2	1	2	3	3

*3-Strong; 2-Medium; 1-Low

Code: **CONSUMER ELECTRONICS**
(Theory)

Credits: 2

COURSE OBJECTIVES:

1. To introduce students to the fundamentals of consumer electronic systems and appliances.
2. To understand the operation of audio, video, display, and home appliance technologies.
3. To familiarize students with modern digital consumer electronics and smart devices.
4. To develop basic troubleshooting and application-level understanding of consumer products.
5. To explore the foundational technologies and architectures driving modern consumer electronics, with a focus on smart ecosystems, connectivity, robotics, and environmental sustainability in hardware design.

UNIT I: FUNDAMENTALS OF CONSUMER ELECTRONICS

Introduction to consumer electronics- Evolution and trends in consumer electronic products- Block diagram approach to electronic systems- Power supplies for consumer equipment- Batteries and charging technologies- Safety precautions and EMI/EMC concepts- Electronic components used in consumer products

UNIT II: AUDIO SYSTEMS AND PUBLIC ADDRESS SYSTEMS

Basics of sound and acoustics-Microphones: types and characteristics- Loudspeakers and speaker systems-Audio amplifiers and tone control circuits- Public Address (PA) systems-Home theater systems and sound bars- Digital audio formats and Bluetooth audio systems

UNIT III: TELEVISION AND VIDEO SYSTEMS

Principles of television systems- Analog and digital TV broadcasting- LCD, LED, OLED, and Smart TV technologies- Set-top boxes and DTH systems- Video signal processing basics- CCTV and video surveillance systems- HDMI and multimedia interfaces.

UNIT IV: HOME APPLIANCES AND KITCHEN ELECTRONICS

Electronic control in home appliances- Washing machines: block diagram and operation-Microwave ovens and induction cooktops- Refrigerators and air conditioners- Vacuum cleaners and water purifiers Energy-efficient appliances and star ratings- Fault diagnosis and basic servicing concepts.

UNIT V: MODERN CONSUMER ELECTRONICS AND SMART DEVICES

Smartphones and tablets: architecture overview- IoT-based consumer products- Smart home automation systems- Wearable electronics- Wireless communication technologies: Wi-Fi, Bluetooth, NFC-Introduction to consumer robotics and AI-enabled devices- E-waste management and sustainability.

UNIT VI (optional): Consumer Electronics Servicing and Troubleshooting (For internal assessment only) Basic servicing tools and instruments – Multimeter and diagnostic

equipment – Common faults in consumer electronic devices – Troubleshooting techniques for audio, video, and home appliances – PCB testing and component replacement – Preventive maintenance practices – Safety precautions during servicing – Introduction to service manuals and fault diagnosis procedures

COURSE OUTCOMES:

On completion of this course, students will be able to:

CO1: Students will be able to explain the basic architecture, components, power systems, and safety aspects of consumer electronic devices.

CO2: Students will be able to describe the working principles and applications of audio reproduction and amplification systems.

CO3: Students will be able to explain television technologies, video systems, and modern multimedia interfaces.

CO4: Students will be able to understand the operation and electronic control mechanisms of common household appliances.

CO5: Students will be able to discuss emerging smart consumer technologies and their societal and industrial applications.

CO6: Students will be able to identify common faults, apply basic troubleshooting techniques, and perform safe servicing practices for consumer electronic systems

Text Books:

1. Consumer Electronics – “S. P. Bali”, Consumer Electronics, Pearson Education. (2005)
2. Audio and Video Systems – “R. G. Gupta”, Audio and Video Systems, Tata McGraw- Hill. (1995)

Reference Books:

1. Consumer Electronics – “S. Gulati”, Consumer Electronics, New Age International.
2. Digital Television Fundamentals – “Michael Robin”, Digital Television Fundamentals, McGraw-Hill.
3. Electronic Communication Systems – “George Kennedy”, Electronic Communication Systems, McGraw-Hill.

Semester	Course Code			Title of the Paper						
II				CONSUMER ELECTRONICS						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	2	3	2	1	2	3	3
CO-2	3	3	3	1	3	2	1	2	3	3
CO-3	3	3	3	1	3	2	1	2	3	3
CO-4	3	3	3	1	3	2	1	2	3	3
CO-5	3	3	3	1	3	2	1	2	3	3

*3-Strong; 2-Medium; 1-Low

Code:

**DIGITAL ELECTRONICS
(Theory)**

Credits: 4

COURSE OBJECTIVES:

1. To gain knowledge of the concepts of number system and Boolean Expressions
2. To discover the functionality of logic gates and arithmetic circuits
3. To demonstrate logical circuits.
4. To analyze the design concepts of sequential circuits.
5. To study about different memories and its allocations.

UNIT I: NUMBER SYSTEMS, CODES, BOOLEAN ALGEBRA

Number System: Binary Numbers, Number base conversions, complements of numbers, Signed binary numbers. Code: Binary code, BCD Code, Excess -3 BCD code, Alpha Numeric Code. Boolean Algebra: Basic definition, Basic theorems and properties, Boolean Functions, Canonical & Standard forms.

UNIT II: LOGIC GATES & ARITHMETIC CIRCUITS

Logic Gates: OR, AND, NOT, NAND, NOR, EX-OR and EX-NOR gates, NAND and NOR as universal gates. Arithmetic Circuits: Half adder - Full adder - Half Subtractor - Full Subtractor - Parallel binary adder - 4 bit binary adder AND Subtractor - BCD adder.

UNIT III: COMBINATIONAL LOGIC CIRCUITS

Combinational circuits, Analysis & Design procedure, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, Magnitude comparator, Decoder, Encoders, Multiplexers.

UNIT IV: SEQUENTIAL LOGIC CIRCUITS

Sequential Circuits: Latches, Flips-Flops - RS, JK, Master-Slave JK, D & T flip flops, Analysis of Clocked sequential circuits, State Reduction & Assignment, Design procedure, Registers & Counters - Registers, Shift Registers, Ripple Counters, Synchronous counters, asynchronous counters.

UNIT V: MEMORY

Memory organization, classification of semiconductor memories, ROM, PROM, DROM, EPROM, EEPROM, RAM, expansion of memory, CCD, Flash memories, Content Addressable memory.

UNIT VI: MODERN TOPICS (For continuous internal assessment only):

Supporting Digital Electronics: Mobile Phones - Calculators and Digital Computers - Smart Card - Analog to Digital converters (ADC) - Digital to Analog converters (DAC).

COURSE OUTCOMES:

On completion of this course, students will be able to:

CO1: Understand the fundamentals of number system, solve Boolean expressions.

CO2: Analyze basic digital circuits.

CO3: Able to design digital circuits with combinational gates.

CO4: Enhanced knowledge about clock driven circuits and designs.

CO5: Analyze, infer and design appropriate digital circuits for real time applications.

Text Books:

1. Digital Electronics by "Atul P. Godse and Dr. Mrs. Deepali A. Godse" Technical publications 2022. ISBN 978-93-5009-701-7.
2. Modern Digital Electronics: "R. P. Jain", McGraw Hill, 5th Edition, 2022, ISBN-13: 9789355321770.
3. Digital fundamentals "Thomas L. Floyd", Pearson Education, 11th Edition, 2014. ISBN 978-0-12-273796-8.
4. Modern Digital Electronics by "R. P. Jain" and "Kishor Sarawadekar", McGraw Hill Education, 5th Edition, 2021. ISBN-13: 978-93-5531-177-0.

Reference Books:

1. Digital Design "M. Morris Mano", "Michael D. Ciletti" Pearson 6th 2018. ISBN-13: 978-9353062019.
2. Fundamentals of Digital Circuits. "Anand Kumar" PHI Learning 4th 2016. ISBN-13: 978-8120352681.
3. Foundations of Analog and Digital Electronic Circuits: "Anant Agarwal" and "Jeffrey Lang", "Morgan Kaufmann"/Elsevier, 1st Edition ISBN-13: 978-1558607354.

e- book Links:

1. Find open-source and free-to-loan digital textbooks at the [Open Library](#)
2. www.technicalpublications.org(free download)
3. https://www.freebookcentre.net/electronics_communication_books/Digital-Electronics-Books-Download.html
4. <https://www.shahucollegelatur.org.in/Department/Studymaterial/sci/it/BCA/FY/digielec.pdf>
5. Link for web: <https://smart.link/sdfez8ejd80if>.

Semester	Course Code			Title of the Paper						
III				DIGITAL ELECTRONICS						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	2	3	2	1	2	3	3
CO-2	3	3	3	1	3	2	1	2	3	3
CO-3	3	3	3	1	3	2	1	2	3	3
CO-4	3	3	3	3	3	2	1	3	3	3
CO-5	3	3	3	1	3	2	1	3	3	3

*3-Strong; 2-Medium; 1-Low

Code:**DIGITAL ELECTRONICS LAB
(Practical)****Credits: 4****COURSE OBJECTIVES**

1. To acquire practical knowledge in basics of logic gates using digital circuits.
2. To construct and test adder, subtractor, multiplexer and demultiplexer circuits.
3. circuits.
4. To design and verify flip-flops, registers, and counters using digital ICs.

(Any twelve (12) Experiments)

1. Study and verify truth tables of AND, OR, NOT, NAND, NOR and XOR gates
2. Design of all logic gates using NAND gate
3. Design of all logic gates using NOR gate
4. Verify Demorgan's theorem.
5. Truth table verification of Half adder and Full adder
6. Truth table verification of Half subtractor and Full subtractor
7. 4:1 Multiplexer and 1:4 Demultiplexer
8. 4x2 Encoder and 2x4 Decoder
9. Design and Implement of J-K Flip flop.
10. Design and Implement of RS Flip Flop
11. Parallel-in and Parallel-out Shift register using 7495 IC
12. Design and Implement a 4 bit shift register using Flip flops
13. Design and Implement a Decade counter
14. Design and Implement the Up-Down counter.
15. Design and Implement the Ring Counter
16. Design and Implement the Ripple Counter.

REFERENCES:

1. S. K. Gupta, Basic Electronics digital and Microprocessor Manual

COURSE OUTCOMES:

On Completion of this course, students will be able to:

1. Design combinational Logic Circuits.
2. Analyze and infer Sequential Logic Circuits.

Code:

**CYBER SECURITY
(Theory)****Credits: 2****COURSE OBJECTIVES:**

1. To introduce the fundamental concepts of cyberspace and the CIA (Confidentiality, Integrity, Availability).
2. To identify various threat actors, software vulnerabilities, and malware threats (viruses, worms, Trojans).
3. To teach the concepts and scopes of ethical hacking, threat modeling, and how to build enterprise information security architectures to proactively defend against attack vectors.
4. To educate on the principles of cyber forensics, the proper handling of digital storage media, and the methodologies for investigating cybercrimes and collecting network-based evidence
5. To provide a deep dive into the architecture of cyberspace, the World Wide Web, the internet, and complex network architectures.

UNIT I: BASICS OF CYBER SECURITY

Introduction to Cyber Security - Importance and challenges in Cyber Security
Cyberspace – Cyber Security of Critical Infrastructure

UNIT II: VULNERABILITY IN CYBER SPACE AND SECURITY

Types of Hackers- Hackers and Crackers - Cyber-Attacks and Vulnerabilities- Malware threats- Sniffing - Gaining Access - Hiding Files - Covering Tracks- Worms – Trojans Viruses- Backdoors. Vulnerabilities- Overview, Vulnerabilities in Software, System administration, Threat Actors, Attacks, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications.

UNIT III: ETHICAL HACKING AND SOCIAL ENGINEERING

Ethical Hacking Concepts and Scopes- Threats and Attack Vectors - Information Assurance- Threat Modeling- Enterprise Information Security Architecture

UNIT IV: CYBER FORENSICS AND AUDITING

Introduction to Cyber Forensics- Computer Equipment and associated storage media Role of forensics Investigator- Forensics Investigation Process - Collecting Network based Evidence

UNIT V: ARCHITECTURE OF CYBERSPACE

Defining Cyber space and Overview of Computer and Web-technology, Architecture of cyberspace, Complex Network Architectures, Internet, Worldwide web

UNIT VI: CONTEMPORARY ISSUES

Expert lectures, online seminars – webinars

COURSE OUTCOMES:

On completion of this course, students will be able to:

CO1: Students will be able to distinguish between different types of hackers, identify security loopholes in software and broadband systems.

CO2: Understand how malicious code attacks organizational data.

CO3: Students will possess the foundational knowledge to legally and ethically test system defenses, model potential threats, and design robust security architectures to prevent unauthorized access.

CO4: Students will be equipped with the skills to act as a forensics investigator, successfully execute investigation processes, and retrieve forensically sound evidence from compromised networks.

CO5: Students will develop a clear, structural understanding of how modern web technologies function, enabling them to better secure and navigate interconnected digital environments.

Text Book(s)

1. “Donaldson, S., Siegel, S., Williams, C.K., and Aslam, A”. (2015). —Enterprise Cyber security -How to Build a Successful Cyber defense Program against Advanced Threats, Apress, 1st Edition.
2. “Franke, Don” Cyber Security Basics: Protect your organization ... (Paperback) Nina Godbole, Sumit Belapure, (2011). —Cyber Security, Wiley.

Reference Books

1. “Roger Grimes”, —Hacking the Hacker, Wiley, 1st Edition, 2017.
2. “Yuri Diogenes and Erdal Ozkaya” (2018). Cyber security– Attack and Defense Strategies: 2nd Edition Paperback.

Semester	Course Code			Title of the Paper						
III				CYBER SECURITY						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	1	3	2	1	2	3	3
CO-2	3	3	3	1	3	2	1	2	3	3
CO-3	3	3	3	1	3	2	1	2	3	3
CO-4	3	3	3	1	3	2	1	2	3	3
CO-5	3	3	3	1	3	2	1	2	3	3

*3-Strong; 2-Medium; 1-Low

Code: **AUTOMOTIVE ELECTRONICS**
(Theory)

Credits: 2

COURSE OBJECTIVES:

1. To introduce the fundamentals of automotive electrical and electronic systems.
2. To understand semiconductor devices and electronic circuits used in automobiles.
3. To study automotive instrumentation, sensors, and measurement systems.
4. To analyze electronic engine control and fuel management systems.
5. To understand automotive safety, diagnostics, and communication protocols.
6. To explore advanced automotive electronics used in electric and intelligent vehicles

UNIT I: INTRODUCTION TO AUTOMOTIVE ELECTRICAL SYSTEMS

Use of electronics in automobiles – Physical configuration of an automobile – Evolution of electronics in automobiles – Automotive electrical architecture – Spark pulse generation – Ignition timing systems – Electronic braking systems – Electronic steering control.

UNIT II: FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS

Semiconductor devices – Diodes and rectifier circuits – Bipolar junction transistors – Transistor amplifier circuits – Operational amplifiers – Summing amplifiers – Introduction to binary systems – Basics of digital electronics and logic circuits.

UNIT III: AUTOMOTIVE INSTRUMENTATION AND MEASUREMENT SYSTEMS

Automotive instrumentation systems – Measurement principles – Basic measurement systems – Sensors and transducers – Display systems and actuators – Signal conditioning – Introduction to digital signal processing – Fundamentals of automotive control systems.

UNIT IV: ELECTRONIC ENGINE CONTROL SYSTEMS

Need for electronic engine control – Exhaust emission control – Fuel economy optimization – Federal government emission test procedures – Concepts of electronic engine control systems – Inputs and outputs of engine controllers – Engine performance parameters – Effect of spark timing – Electronic fuel control systems.

UNIT V: AUTOMOTIVE SAFETY AND DIAGNOSTIC SYSTEMS

Occupant protection systems – Airbag deployment systems – Electronic braking control – Electronic control system diagnostics – On-board diagnostics (OBD) – Controller Area Network (CAN) protocol – Diagnostic trouble codes and fault code interpretation.

UNIT VI: ADVANCED AUTOMOTIVE ELECTRONICS (for internal assessment only)

Electronic transmission control – Hybrid and electric vehicle electronics – Battery management systems – Advanced driver assistance systems (ADAS) – Intelligent vehicle systems – Future trends in autonomous and connected vehicles.

COURSE OUTCOMES:

On completion of this course, students will be able to:

CO1: Explain the architecture and operation of automotive electrical and ignition systems.

CO2: Analyze semiconductor devices and electronic circuits used in automotive applications.

CO3: Apply principles of instrumentation, sensors, and signal processing in automotive systems.

CO4: Interpret the working of electronic engine control and fuel management systems.

CO5: Evaluate automotive safety systems, diagnostics, and vehicle communication protocols.

CO6: Understand advanced automotive electronics including electric vehicles and intelligent automotive systems.

Text Books:

1. “William B. Ribbens”, Understanding automotive electronics, 1998, Newnes publishers

References:

1. “Ronald Jurgen” – *Automotive Electronics Handbook*, McGraw Hill Professional, 1999
2. “Robert Bosch” – *Automotive Handbook*, Wiley publishers, 2018

Semester	Course Code			Title of the Paper						
III				AUTOMOTIVE ELECTRONICS						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	2	3	2	1	2	2	3
CO-2	3	3	3	2	3	2	1	2	3	3
CO-3	3	3	3	2	3	2	1	2	3	3
CO-4	3	3	3	3	3	2	1	2	2	3
CO-5	3	3	3	1	3	2	1	2	3	3

*3-Strong; 2-Medium; 1-Low

Code: **LINEAR INTEGRATED CIRCUITS**
(Theory)

Credits: 4

COURSE OBJECTIVES:

1. To grasp the basic concepts of op-Amp.
2. To learn about the applications of operational amplifier. To assess the concept of analog multiplier.
3. To know about the conversion theory of ADC and DAC.
4. To deduce the linear and non-linear applications of op-Amp and IC 555.

UNIT I: BASICS OF OPERATIONAL AMPLIFIERS

Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, Basic information about op-amps - Ideal Operational Amplifier - General operational amplifier stages - and internal circuit diagrams of IC 741.

UNIT II: APPLICATIONS OF OPERATIONAL AMPLIFIERS

Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I to-V inverters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Anti logarithmic amplifier, Comparators, Schmitt trigger, Low-pass, high-pass and band-pass Butterworth filters.

UNIT III: ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERSION & CONVERTERS

Analog and Digital Data Conversions, D/A converter - specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode R - 2R Ladder types - switches for D/A converters, high speed sample-and-hold circuits, A/D Converters - specifications - Flash type - Successive Approximation type - Single Slope type - Dual Slope type - A/D Converter using Voltage-to-Time Conversion - Over-sampling A/D Converters.

UNIT IV: WAVEFORM GENERATORS AND IC REGULATORS

Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, IC Voltage regulators - Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switching regulator.

UNIT V: IC 555 AND APPLICATIONS

555 Timer: Functional block diagram, Monostable operation, applications in Monostable mode, missing pulse detector, linear ramp generator, frequency divider, pulse width modulation, Astable operation, applications in Astable mode, 555 timer as Schmitt trigger

UNIT VI: APPLICATIONS (For continuous internal assessment only):

Any application using LIC: Voltage Comparator, Voltage Follower, Decorative LED strips using Astable multivibrators

COURSE OUTCOMES:

On completion of this course, students will be able to:

- Design linear and nonlinear applications of Op-Amps
- Design applications using analog multiplier and PLL Design
- Design ADC and DAC using Op-Amps
- Generate waveforms using Op-Amp Circuits
- Analyse special function ICs.

Text Book:

1. Op-Amps and Linear Integrated Circuits “Ramakant A. Gayakwad” Pearson Education 4th Edition (2015/2021) ISBN 81-7808-501-1.
2. Linear Integrated Circuits “D. Roy Choudhury, Shail B. Jain” New Age International Pvt Ltd, 7th Edition (2023-2024).

Reference Books:

1. Operational Amplifiers & Linear Integrated Circuits “Ramakant A. Gayakwad” Pearson 4th Edition (2015) ISBN: 9789332549913.
2. Linear Integrated Circuits “S. Salivahanan, V.S. Kanchana Bhaskaran” McGraw Hill 3rd Edition (2018) ISBN, 9353160499.
3. Design with Operational Amplifiers and Analog Integrated Circuits “Sergio Franco” McGraw Hill 4th Edition (2014) ISBN 0-07-232084-2.

e- book Links:

1. <https://maheshelectronics.files.wordpress.com/2015/06/linear-integrated-circuit-2nd-edition-d-roy-choudhary.pdf>
2. <https://www.scribd.com/document/571983342/Op-Amp-and-Linear-Integrated-Circuit-by-Ramakant-A->

Semester	Course Code			Title of the Paper						
IV				LINEAR INTEGRATED CIRCUITS						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	2	1	2	1	2	2	3
CO-2	3	3	3	2	1	2	1	2	3	3
CO-3	3	3	3	2	1	2	1	3	3	3
CO-4	3	3	3	2	2	2	1	3	2	3
CO-5	3	3	3	3	2	2	1	2	3	3

*3-Strong; 2-Medium; 1-Low

Code: **LINEAR INTEGRATED CIRCUITS LAB**
(Practical)

Credits: 4

COURSE OBJECTIVES:

1. To provide the practical knowledge of linear Integrated Circuits

(Any twelve (12) Experiments)

1. Construct Inverting, Non inverting and differential amplifiers.
2. Design Integrator using Op-Amp
3. Design Differentiator using Op-Amp
4. Design Instrumentation amplifier using Op-Amp
5. Construct Active low-pass, High-pass and band-pass filters using Op-Amp
6. Design Analog multiplier using Op-Amp
7. Design Comparator using Op-Amp
8. Design Logarithmic Amplifier using Op-Amp
9. Design Anti-Logarithmic Amplifier using Op-Amp
10. Design Astable Multivibrator using Op-amp
11. Monostable Multivibrators using Op-amp
12. Construct Schmitt Trigger using op-amp.
13. Construct A/D Converter.
14. Construct R-2R Ladder Type D- A Converter using Op-amp.
15. Construct Sine Wave, Triangular Wave and Saw Tooth Wave Generator.
16. Construct Astable and Monostable Multivibrators using NE555 Timer

REFERENCES:

1. D. Roy Choudhry and S. Jain, Linear Integrated Circuits, 5th Ed. (New Age International Pvt. Ltd., 2018)

COURSE OUTCOMES:

On completion of this course, students will be able to:

1. To design op-Amp circuits for different applications
2. Analyze and infer timing circuits for real time applications.

Code: **SENSOR AND ITS APPLICATIONS**
(Theory)

Credits: 2

COURSE OBJECTIVES:

5. To introduce the students about basics of sensors.
6. To provide the details of different types of sensors.
7. To get the knowledge of new types of sensors.
8. To analyze the working of sensor and know the implementation procedure.
9. To know the working of MEMS.

UNIT I: BASICS OF SENSORS

Physical sensors – Chemical sensors and Bio-sensors- Technology limitation- Traditional design approach-Combo sensors.

UNIT II: FINGERPRINT SENSORS

Introduction- Spoofing techniques in Fingerprint sensors-Finger print sensing technologies-optical sensors-FTIR-multispectral imaging-3D touchless imaging-TFT-Electro-optical sensors.

UNIT III: BIO-SENSORS

Principle of bio-sensors- materials and methods-Electrodes-Materials-Nanoparticles and Electrode preparations – detections-GDH coating on GCE,Pt,Au electrode for H₂O₂ and Nitrite preparation-Stability of bio-sensor with time.

UNIT IV: BIO-MIMETIC SYSTEM FOR CLASSIFICATION AND AUTHENTICATION FOR BEVERAGES

Introduction- Electronic nose- E-nose sensor-Metal-oxide semiconductor sensors- Piezo-electric crystal sensors- Electronic Tongue-sensing principles.

UNIT V: MEMS SENSORS

MEMS-MEMS in surgical fields-MEMS based micro-machine cutting tools-MEMS based catheters- MEMS based Endoscopy-MEMS based Tactile sensing.

UNIT VI: MAGNETIC BEAD BASED BIOSENSOR (For internal assessment only)

Introduction- Materials and methods- Adiponectin-super magnetic beads-Magnetic Particle Assay (MPA).

COURSE OUTCOMES:

On completion of this course, students will be able to:

1. Students will be able to understand the working of sensors.
2. They will be able to design the sensor.
3. Students will get the knowledge various types of sensors.
4. They will be able to identify the right choice of sensing devices.
5. They will be able to apply the sensors for the different applications.

Text books:

1. “Sergey Yurish”, Sensors and Bio-sensors, MEMS Technologies and its applications, 2014, IFSA Publishing.
2. “Dr. Clarence W. de. Silva”, Sensor systems: Fundamentals and Applications, 2017, CRC Press.

Reference books:

1. “Padranabis .D”, Sensors and Transducers, 2nd edition, 2003, PHI Publications.
2. “Water Lang”, Sensors and Measurement systems, 2nd edition, 2024, River Publishers. Online link:
1. Preview: Sensors and Actuators | SWAYAM

Semester	Course Code			Title of the Paper						
IV				SENSOR AND ITS APPLICATIONS						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	1	1	2	1	2	2	3
CO-2	3	3	3	1	1	2	1	2	3	3
CO-3	3	3	3	1	1	2	1	2	3	3
CO-4	3	3	3	3	2	2	3	3	2	3
CO-5	3	3	3	3	2	2	1	2	3	3

*3-Strong; 2-Medium; 1-Low

Code: **MOBILE PHONE SERVICING**
(Theory)

Credits: 2

COURSE OBJECTIVES:

1. To understand smartphone architecture and components.
2. To learn safe servicing and maintenance procedures.
3. To perform basic hardware and software troubleshooting.
4. To develop practical knowledge in smartphone repair and maintenance.
5. To Analyze and troubleshoot smart phone problems and prevent maintenance.

UNIT I: BASICS OF SMARTPHONES AND COMPONENTS

Introduction to smartphones- Physical structure of a smartphone-Main internal components of smartphones-Basic functioning of smartphones- Types of smartphone operating systems- Major smartphone brands and models- Tools and equipment for smartphone maintenance-Basic safety procedures during maintenance.

UNIT II: SMARTPHONE DISASSEMBLY AND ASSEMBLY

Smartphone disassembly and assembly procedures- Preparing the work environment- Removing back cover and battery- Unscrewing and handling internal parts- Disconnecting flex cables-Removing and replacing motherboard components- cleaning and sanitizing smartphones- Reassembling and testing smartphone operation.

UNIT III: SMARTPHONE HARDWARE REPAIR TECHNIQUES

Identification and replacement of damaged components - Soldering and unsoldering techniques- Screen replacement procedures - Battery replacement techniques - Button repair and troubleshooting- Charge connector repair- Camera and speaker repair- Testing and troubleshooting procedures

UNIT IV: SMARTPHONE SOFTWARE MAINTENANCE

Smartphone operating system maintenance -Data backup and restoration - Software and firmware updates - Factory reset and recovery modes- Cache cleaning and storage management- Virus and malware removal-Battery optimization techniques- Connectivity troubleshooting: Wi-Fi and Bluetooth Security settings and privacy configuration.

UNIT V: TROUBLESHOOTING AND PREVENTIVE MAINTENANCE

Identification of common smartphone problems - Preventive maintenance techniques - Internal smartphone cleaning - Performance optimization tips- Smartphone testing and function checks - Service center procedures and customer handling- E-waste management and safe disposal practices.

UNIT VI: ADVANCED MOBILE DIAGNOSTICS AND EMERGING MOBILE TECHNOLOGIES

(For internal assessment only):

Mobile flashing and firmware installation tools – Foldable and smart wearable device servicing basics – Data recovery techniques – Emerging trends in mobile repair technology.

COURSE OUTCOMES:

On completion of this course, students will be able to:

CO1: Students will be able to identify smartphone components, operating systems, and servicing tools with proper safety practices.

CO2: Students will be able to safely disassemble, assemble, clean, and test smartphones using standard servicing procedures.

CO3: Students will be able to perform basic smartphone hardware repairs and component replacement operations.

CO4: Students will be able to maintain smartphone software, optimize performance, and troubleshoot software-related issues.

CO5: Students will be able to diagnose common smartphone faults and apply preventive maintenance and servicing practices.

CO6: Students will be able to perform advanced mobile diagnostics, apply firmware servicing tools, and understand emerging mobile technologies and their servicing requirements.

Text Books:

1. "R.S. Khandpur", Mobile Phone Repairing and Maintenance, McGraw Hill Education (India)2018.
2. "Ram Babu Sao", Perfect Mobile Repairing Handbook: Smartphones Repairing Handbook,2022.

References:

1. "Joan Meturo", Mobile Phone Repair and Maintenance : Mobile Phone Repair and Maintenance , 2015.
2. "Seth Iradukunda", Learn to repair all mobile phones: After learning start repair, 2022.

Semester	Course Code			Title of the Paper						
IV				MOBILE PHONE SERVICING						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	1	1	2	1	2	2	3
CO-2	3	3	3	1	1	2	1	2	2	3
CO-3	3	3	3	1	1	2	1	3	3	3
CO-4	3	3	3	3	2	2	3	2	3	3
CO-5	3	3	3	3	2	2	1	3	3	3

*3-Strong; 2-Medium; 1-Low

Code:

**ELECTRONIC COMMUNICATION
SYSTEMS
(Theory)**

Credits: 4

COURSE OBJECTIVES:

1. To acquire knowledge on Electronic Communication systems and their applications
2. To learn about the applications of Analog Pulse Modulation and Digital Pulse modulation.
3. To study about the concept of Receivers and Noise.
4. To Analyze Analog Pulse Modulation schemes
5. To Evaluate Digital Modulation schemes

UNIT I: AMPLITUDE MODULATION

Introduction to Communication Systems - Communication transceiver - Need for Modulation - Definition of Amplitude modulation - Mathematical Expression of AM wave - Modulation Index - frequency spectrum of AM wave - Power relations in AM wave - Types of AM: DSB - SC - AM, SSB - AM- AM Linear Modulators - AM demodulators.

UNIT II: ANGLE MODULATION

Definition of Frequency and Phase Modulation - Mathematical representation of FM and PM - Frequency spectrum of FM - Bandwidth of FM - Narrow Band and Wide Band FM - Generation of FM - Direct and indirect method - FM Demodulation - Generation of PM from FM.

UNIT III: RECEIVERS AND NOISE

Block diagram of receivers - Types - Characteristics of receivers- Super heterodyne receiver - Choice of IF frequencies - AGC - Introduction and Classification of noise-Atmospheric noise-Thermal noise-Shot noise-Addition of noise due to several sources-Signal to Noise ratio-Noise figure

UNIT IV: ANALOG PULSE MODULATION

Sampling process - Pulse Amplitude Modulation - Bandwidth - Noise trade off - Aliasing - Pulse Width Modulation: Generation and Detection - Applications - Pulse Position Modulation - Generation and Detection.

UNIT V: DIGITAL PULSE MODULATION

Pulse Code Modulation - Block diagram - Quantization - Step size and error calculation - Applications- Differential pulse code modulation - delta modulation - ASK, FSK and PSK

UNIT VI: CURRENT CONTOURS (For continuous internal assessment only): Antenna and Wave Propagation: EM waves - Free space propagation - Surface (Ground) wave propagation - Sky wave propagation - Space wave propagation -Introduction to Antennas - Antenna Parameters - Types of Antennas - Effects of Height - Feed point - Impedance matching.

COURSE OUTCOME:

On completion of this course, students will be able to:

CO1: Understand the basics of Analog and Digital communication systems

CO2: Acquire knowledge on various modulation techniques

CO3: Inculcate different types of transmitters and receivers

CO4: Analyze noise factors in communication systems

CO5: Apply the Electromagnetic concepts in understanding antenna

CO6: Assess and create Communication modules and adapt for Entrepreneurship and Higher Education

Text Books:

1. "Kennedy and George Davis", Electronic Communication Systems, 6th Edition, McGraw Hill Education, 2017. ISBN-978-9352606606.
2. "Wayne Tomasi", Electronic Communication Systems, 5th Edition, Pearson education, 2008. **ISBN-13:** 978-8131719534.
3. "Bernard Sklar", Digital Communications Fundamentals and Applications, 3rd Edition, Prentice Hall, 2021. ISBN-13. 978-0134588568
4. "Haykin and M. Moher", Communication systems, 5th Ed. (Wiley, 2009) ISBN-13: 978-0471697909
5. "R. P. Singh and S. D. Sapre", Communication Systems Analog and Digital (Tata McGraw Hill, 2017) ISBN: 9781259004605

Reference Books:

1. "H. Taub and D. L. Schilling", Principles of communication, 4th Ed. (McGraw Hill, 2017) **ISBN:** 9781259029851.
2. "K.D. Prasad", Antenna and Wave Propagation (Satya Prakashan, 2012). **ISBN-13:** 978-8176840255

E-book links:

1. https://onlinecourses.nptel.ac.in/noc20_ee69/
2. <https://www.vlab.co.in/ba-nptel-labs-electronics-and-communications>
3. <https://www.circuitstoday.com/basic-terminologies-electronic-communication>

Semester	Course Code			Title of the Paper						
V				ELECTRONIC COMMUNICATION SYSTEMS						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	2	3	3	1	2	2	2	2	3	2
CO-2	3	2	2	3	2	3	2	3	2	2
CO-3	2	2	3	3	3	3	2	2	2	2
CO-4	2	3	2	3	1	2	2	3	3	2
CO-5	2	3	2	3	2	2	3	2	2	3

*3-Strong; 2-Medium; 1-Low

Code:

**MICROPROCESSORS AND
MICROCONTROLLERS
(Theory)**

Credits: 4

COURSE OBJECTIVES:

1. To acquire the fundamental of Intel microprocessor 8085 and advanced processors
2. To acquire knowledge on Hardware Architecture of 8051
3. To study on-chip peripherals of 8051 Microcontrollers
4. To learn Programming with 8051 Microcontrollers
5. To interface and Infer I/O devices with Microcontroller

UNIT I: INTRODUCTION TO INTEL MICROPROCESSOR

Overview of microprocessors - Architecture of 8085 microprocessor, ALU Timing and control unit – registers - Address bus and data bus – Pin configuration – Intel 8085 instructions - machine cycle - data flow- timing diagram – Addressing modes-Comparative study of Intel 8086, 286, 386, 486 & Pentium processors - Dual core -i3, i5 and i7 Processors.

UNIT II: INTRODUCTION TO 8051 MICROCONTROLLER

Introduction to Microcontrollers - Differences between Microcontrollers and Microprocessors - Architecture of 8051 - Pin description of 8051 - Registers - SFR- Flags and PSW - Internal ROM and RAM - Ports and Circuits.

UNIT III: ON-CHIP PERIPHERALS OF 8051

Timers of 8051 - Timer programming in various modes- Timer as Counter - Basics of serial communication - RS232 and MAX 232 IC connection - Modes and baud rates of serial communication- Serial communication registers -Serial communication programming - Introduction to Interrupts - 8051 Interrupts-Interrupt Enable and Priority registers - Internal and external interrupts programming-Parallel port programming

UNIT IV: EMBEDDED PROGRAMMING

Introduction to Embedded C Programming - Difference between ASM and Embedded C programming - Structure of Embedded C Program - C Directives - Variables in Embedded C - Operators in Embedded C - Looping structure in Embedded C - C Functions- Arrays

UNIT V: APPLICATIONS OF MICROCONTROLLERS

Basics of Interfacing I/O devices with 8051- Interfacing LED, Seven Segment Display - LCD - ADC and DAC interfacing - Interfacing Matrix keyboard - Interfacing sensors with 8051 - DC motor speed control by 8051 - Stepper motor Interfacing with 8051 for direction and angle control

UNIT VI: CURRENT CONTOURS (For continuous internal assessment only): Introduction to Keil μ Vision IDE:- User interface - creating

Applications - Debug Commands - Debug Functions - Simulation - Flash Programming - Utilities - command line.

COURSE OUTCOMES:

On completion of this course, student will be able to

CO1: Acquire knowledge on Hardware architecture of 8051 microcontroller

CO2: Understand the instruction set and addressing modes 8051 microcontroller

CO3: Analyze on-chip peripherals of 8051

CO4: Mind-Map peripheral interfacing with 8051 for various applications

CO5: Create and write Assembly and Embedded C programs for 8051 microcontroller

CO6: Examine real time problems, solve with Microprocessor and Microcontroller by employing modern tools.

Text Books:

1. “Krishna kant”, Microprocessors and microcontrollers: Architecture, Programming and system Design, 8085, 8086, 8051, 8096, (PHI, 2013) **ISBN-13:** 978-8120348530
2. “M. A. Mazidi, J. G. Mazidi” and “R. D. McKinlay”, The 8051 Microcontroller and Embedded Systems: Using Assembly and C, 2nd Ed. (Pearson Education, 2007) **ISBN-13:** 978-8131710265
3. “K. J. Ayala”, The 8051 Microcontroller architecture, programming and application (Delmar Cengage Learning, 2004) **ISBN-13:** 978-0314201881
4. “K. Qian, D. D. Haring and L. Cao”, Embedded Software Development with C, 1st Ed. (Springer, 2009) **ISBN-13:** 978-1441909893

Reference Books:

1. Keil μ Vision 5 user manual
2. ” Ramesh S. Gaonkar”, Microprocessor Architecture, Programming and Application with the 8085, 6th Edition, Penram International Publishing, Mumbai, 2013. **ISBN-13:** 978-8187972884.
3. 16-bit Microprocessor Design and Implementation on FPGA by
4. “Muhammad Ahmed”, “Mansoor Naseer” , “Arslan Malik” (2012) **ISBN-13:** 978-3659151026.
5. M. J. Pont, Programming Embedded Systems II: A 10 week course using C **ISBN-13:** 978-8131715895.

E-book links:

1. <https://www.youngwonks.com/blog/What-is-A-Microprocessor-And-What-Are-Applications>
2. <https://www.javatpoint.com/microprocessor-applications>
3. <https://www.watelectronics.com/What-is-a-microprocessor-architecture-types-its-applications/>
4. <https://www.classcentral.com/course/youtube-8051-microcontroller-lecture>

Semester	Course Code			Title of the Paper						
V				MICROPROCESSORS AND MICROCONTROLLERS						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	1	2	2	1	1	3	3
CO-2	3	3	3	1	2	2	1	1	3	3
CO-3	3	3	3	1	2	2	1	1	3	3
CO-4	3	3	3	3	3	2	1	3	3	3
CO-5	3	3	3	3	3	3	1	3	3	3

*3-Strong; 2-Medium; 1-Low

Code: **INSTRUMENTATION SYSTEM**
(Theory)

Credits: 4

COURSE OBJECTIVES:

1. To understand the electrical quantities of instruments and their measuring methods.
2. To acquire knowledge on the designing aspects and performance criterion of measuring instruments.
3. To infer the working principle of oscilloscope.
4. To List and discuss the basics of various transducers.
5. To Analyze various types of AC bridges in instruments

UNIT I: PERFORMANCE CHARACTERISTICS OF INSTRUMENTS

Static characteristics, Accuracy, Resolution, Precision, expected value, Error and Sensitivity - Errors in measurement and Dynamic characteristics: Speed of Response, Fidelity, Lag and Dynamic Error - Voltmeters: Multi-range, Range Extension, Solid State and Differential Voltmeters - Ammeters: Shunt and Thermocouple type Ammeter - Ohmmeters: Series type, Shunt type, Multimeter for Voltage, Current and Resistance Measurements - Digital Multimeters: Block diagram and Specifications

UNIT II: SIGNAL GENERATORS

Fixed and Variable, AF Oscillators, Standard and AF Sine and Square Wave Signal Generators, Function Generators, Square Pulse, Random Noise and Sweep
- Wave Analyzers: Harmonic Distortion Analyzers, Spectrum Analyzers and Digital Fourier analyzers.

UNIT III: CATHODE RAY OSCILLOSCOPES

CRT Features, Vertical Amplifiers, Horizontal deflection system, Sweep, Trigger Pulse, Delay line, Sync Selector Circuits, Simple CRO, Triggered Sweep CRO, Dual Beam CRO, Measurement of Amplitude and Frequency - Dual Trace Oscilloscope, Sampling Oscilloscope, Storage Oscilloscope, Digital Storage Oscilloscope, Standard Specifications of CRO, Probes for CRO (Active and Passive), Attenuator type.

UNIT IV: AC BRIDGES

Measurement of inductance: Maxwell's bridge, Anderson Bridge - Measurement of Capacitance: Schering Bridge - Kelvin's Bridge, Wheatstone Bridge and Wein Bridge - Errors and Precautions and Related Problems - Q-Meter - Bridges: Wheat Stone Bridge, Kelvin Bridge and Maxwell Bridge.

UNIT V: ACTIVE AND PASSIVE TRANSDUCERS

Resistance, Capacitance, Inductance, Strain Gauges, LVDT, Piezo Electric Transducers, Resistance Thermometers, Thermocouples, Thermistors and Sensistor - Basic Hall Effect Sensors - Calibration and Standards and

Data Acquisition Systems.

UNIT VI: CURRENT CONTOURS (For continuous internal assessment only): Distinguish between Analog and Digital Meters - Identify the industrial and laboratory applications of instruments.

COURSE OUTCOMES:

On completion of this course, student will be able to:

CO1: Understand the operation of various Instruments.

CO2: Perform experiments to determine various types of errors in measurements.

CO3: Practice for design of testing and measuring set up for electronic systems

CO4: Predict the errors in measurement, list the characteristics of instrumentation and use to solve the problems in instruments.

CO5: Apply electronic instruments in various applications of real time problems.

CO6: Analyze the function of various scopes

Text Books:

1. "H. S. Kalsi", Electronic instrumentation 2ndEd. (Tata Mc Graw Hill, 2004). **ISBN** 0-07-058370-6.
2. "A.D. Helfrick and W.D. Cooper", Modern Electronic Instrumentation and Measurement Techniques 5th Ed. (PHI, 2002). **ISBN-13** 978-8120307520.
3. "A. K. Sawhney", *A course in Electrical and Electronic Measurements and Instrumentation*, 4th edition, Educational and Technical Publisher, 2015. **ISBN-13:** 978-8177001006.
4. "R. A. Witte", Electronic Test Instruments, Analog and Digital Measurements, 2nd Ed. (Pearson Education, 2004) **ISBN-13:** 978-0130668301.
5. Electrical Measurements and Measuring Instruments -2007 by "Rajput R.K". **ISBN 8121929636, 9788121929639**

Reference Books:

1. Electrical Measurement and Measuring Instruments – "E.W Golding & F.C Waddis", 2011. **ISBN** 978-8190630726.
2. Electrical and Electronics Measurements and Instrumentation by "Prithwiraj Purkait, Budhaditya Biswas", "Chiranjib Koley" -2017 **ISBN:** 978-9385676017.

e-book links:

1. https://onlinecourses.nptel.ac.in/noc19_ee44/preview
2. <https://instrumentationtools.com/what-is-a-transducer/>
3. <https://www.seia-conference.com/>
4. <https://www.edibon.com/en/mechatronics-automationcompumechatronics/mechatronics/electronics/sensors-and-electronic-instrumentation>
5. https://www.mdpi.com/journal/sensors/special_issues/SEIA_2020.
6. <https://instrumentationtools.com/what-is-a-transuder/>

Semester	Course Code			Title of the Paper						
V				INSTRUMENTATION SYSTEM						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	1	2	2	1	1	2	3
CO-2	3	3	3	3	2	2	3	1	2	3
CO-3	3	3	3	1	2	2	1	1	2	3
CO-4	3	3	3	2	2	2	1	2	3	3
CO-5	3	3	3	3	2	3	3	3	3	3

*3-Strong; 2-Medium; 1-Low

Code: **INTERNET OF THINGS**
(Theory)

Credits: 4

COURSE OBJECTIVES:

1. To enable the students to study about Internet of Things and create thirst to emerge as IoT designers
2. To understand the technology of IoT and design principles of IoT
3. To Acquire knowledge of IoT Privacy, Security, Vulnerabilities Solutions and Business Models and Processes
4. To educate students about various IoT Connectivity principles
5. To make students to distinguish types and protocols of IoT

UNIT I: INTERNET OF THINGS: OVERVIEW

Internet of Things - IoT Conceptual Framework - IoT Architectural View - Technology Behind IoT - Sources of IoT - M2M Communication - Examples of IoT

UNIT II: DESIGN PRINCIPLES DESIGN PRINCIPLES FOR CONNECTED DEVICES

IoT/M2M System Layers and Design Standardization - M2M - Difference between IoT and M2M - Communication Technologies - Data Enrichment, Data Consolidation and Device Management at Gateway - Ease of Designing and Affordability.

UNIT III: IOT CONNECTIVITY PRINCIPLES

Web Connectivity for Connected Devices Network using Gateway - Internet Connectivity - Internet - Based Communication - IP Addressing in the IoT - Media Access Control - Application Layer Protocols: HTTP, HTTPS, ETP, Telnet and Others.

UNIT IV: SENSORS, PARTICIPATORY SENSING, RFID, AND WIRELESS SENSOR NETWORKS

Sensor Technology - Participatory Sensing, Industrial IoT and Automotive IoT - Actuator - Sensor Data Communication Protocols - Radio Frequency Identification Technology - Wireless Sensor Networks Technology

UNIT V: CASE STUDIES ILLUSTRATING IOT DESIGN

Home Automation - Smart Lighting - Home Intrusion Detection - Smart Parking - Weather Monitoring System - Air Pollution Monitoring - Forest Fire Detection - Smart Irrigation - IoT Printer

UNIT VI: CURRENT CONTOURS (For continuous internal assessment only) IoT Privacy, Security, Vulnerabilities Solutions, Business Models and Processes: Security Models, Profiles and Protocols for IoT - Vulnerabilities, Security Requirements and Threat Analysis - Business Models and Business Model Innovation - Value creation in the IoT -

Business Model Scenarios for IoT.

COURSE OUTCOMES:

On completion of this course, student will be able to

CO1: Understand the basic concepts and architecture of IoT System

CO2: Learn the Design Principles for connected Devices

CO3: Apply various protocols for designing IoT systems

CO4: Analyze various IoT protocols

CO5: Interface I/O Devices and Sensor Modules

CO6: Develop and Design IoT based real time Projects

Text Books:

1. "A. Bahga and V. Madisetti", Internet of Things: a Hands-on Approach (University Press, 2018) ISBN-13 978-0996025522.
2. "R. Kamal", Internet of Things: Architecture and Design Principles (Mc Graw Hill Education, 2017) ISBN-13: 978-93-5260-522-4
3. "H. Chaouchi", The Internet of Things: Connecting Objects to the Web (Wiley Publication, 2010) . ISBN-13. 978-1848211407.
4. "O. Hersent, D. Boswarthick, and O. Elloumi", The Internet of Things: Key Applications and Protocols (Wiley Publications). ISBN-978-1-119-99435-0.
5. "P. Raj and A. C. Raman", The Internet of Things: Enabling Technologies, Platforms, and Use Cases, (CRC Press) ISBN-13 978-1032509266.

Reference Books:

1. "C. Pfister", Getting Started with The Internet of Things (O'Reilly, 2011). ISBN-13. 978-1449310196.
2. Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry (2016) by "Maciej Kranz". ISBN13. 9781119285663.
3. The Internet of Things (2015) The MIT Press, by "Samuel Greengard". ISBN: 9780262527736.

e-book links:

1. <https://www.edx.org/learn/iot-internet-of-things>
2. <https://www.geeksforgeeks.org/computer-networks/introduction-to-internet-of-things>
3. <https://nptel.ac.in/courses/106105166>

Semester	Course Code			Title of the Paper						
V				INTERNET OF THINGS						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	1	2	2	2	1	2	3
CO-2	3	3	3	2	2	2	2	1	2	3
CO-3	3	3	3	3	3	2	2	1	2	3
CO-4	3	3	3	2	2	2	2	2	3	3
CO-5	3	3	3	3	3	2	2	3	3	3

*3-Strong; 2-Medium; 1-Low

**Code: CONTROLLER AND COMMUNICATION
(Practical)**

Credits: 4

COURSE OBJECTIVES:

1. To provide the basic knowledge of different type of Modulation and Demodulation Techniques.
2. To acquire lab experience of Microcontrollers.
3. To get the hands-on experience of Simulation software used in Electronics
4. To design and test various analog and digital communication circuits
5. To develop Assembly Language Programs for interfacing I/O devices with Microcontroller

(Any twelve (12) Experiments)

A. COMMUNICATION LABORATORY

1. Study of Amplitude Modulation and Demodulation
2. Study of Frequency Modulation and Demodulation
3. Study of Pulse Amplitude Modulation
4. Study of Pulse width Modulation
5. Study of Pulse Code Modulation
6. AM Transmitter/Receiver
7. FM Transmitter/Receiver
8. Study of ASK, FSK and PSK

B. MICROCONTROLLER (8051) LABORATORY

1. Perform Arithmetic Operations in 8051 MC
2. Perform Logical Operations in 8051 MC
3. Interface KEY and LED with 8051 MC
4. Interface LCD with 8051 MC
5. Interface DAC with 8051 MC
6. Interface ADC with 8051 MC
7. Interface Stepper motor with 8051 MC
8. Interface Serial port using RS232.

C. ELECTRONICS SIMULATION LAB

1. Study the Characteristics of Power devices using LT Spice
2. Study the operation of Lamp dimmer using TRIAC using LT Spice
3. Create and Study the performance of Amplitude Modulation using SCILAB
4. Create and Study the performance of Frequency Modulation using SCILAB
5. Create and test LED Blinky program using TinkerCad
6. Create and test sensor interfacing program using TinkerCad

REFERENCES:

1. Advanced Electronic Communications Systems with Digital Communication Laboratory Manual Using VisSim - 2012 by M. Tavaholi Wayne Tomasi
2. <https://www.youtube.com/watch?v=Kehd7aH4rug>

3. <https://www.scilab.org/scilab-for-beginners-tutorial>
4. <https://www.analog.com/en/resources/design-tools-and-calculators/ltspice-simulator.html>

COURSE OUTCOMES:

On the successful completion of the Practical, students will be able to

CO1: Perform experiments relevant with Microcontrollers

CO2: Practice for design of testing and measuring set up for electronic communication systems

CO3: Do interfacing and associated Programming with Microcontrollers

CO4: Learn and practice with LTSpice software

CO5: Simulate Communication Experiments using SCILAB

CO6: Simulate Microcontroller Experiments in TinkerCad

Code:**CCTV SYSTEMS
(Theory)****Credits: 2****COURSE OBJECTIVES:**

1. To understand the physical components, construction, and specifications of CCTV cameras, lenses, and Digital Video Recorders (DVRs).
2. To learn how to construct, install, software-configure, and securely operate a reliable video surveillance system.
3. To identify threat actors, malware, and vulnerabilities present in cyberspace and critical infrastructure.
4. To introduce ethical hacking methodologies and the fundamentals of cyber forensics investigations.
5. To setup CCTV surveillance system.

UNIT I: BASICS OF SECURITY SURVEILLANCE AND FUNCTIONS OF VIDEO SURVEILLANCE SYSTEM: Overview of the components used in the CCTV, detail construction of the camera and the detail construction of the DVR, Constructing of a video surveillance system

UNIT II: TYPES OF CAMERA & THEIR FUNCTIONS: Types of cameras –bullet, dome and PTZ and the IP cameras as per the function and requirement

UNIT III: LENS & SENSORS: Classification of the lens and the image sensor, its working and specification, Different types of lens and their utility.

UNIT IV: DVR AND INSTALL THE CCTV CAMERA: Overview of the DVR its parts data cables, basic classification of the DVR board and connecting terminals

UNIT V: SETUP THE CCTV SURVEILLANCE SYSTEM: Overview of the software, different feature of the software and the setting of the software for the backup and monitoring system

UNIT VI: CONTEMPORARY ISSUES:

Expert lectures, online seminars – webinars

COURSE OUTCOMES:

On completion of this course, students will be able to:

CO1: Students will be able to design, wire, configure, and operate CCTV networks using appropriate cameras (bullet, dome, PTZ) and DVR software.

CO2: Students can recognize, classify, and mitigate malware, viruses, worms, and common cyber-attacks targeting organizational data.

CO3: Students will understand the scope of ethical hacking, threat modeling, and Enterprise Information Security Architecture.

CO4: Students will grasp the foundational processes of cyber forensics, digital evidence collection, and auditing procedures.

Text Books:

1. "J. Paul Guyer", An Introduction to CCTV Security Systems, Kindle Edition.
2. "Herman Kruegle", CCTV Surveillance Video Practices and Technology, 2nd Edition - December 2,2006.

Reference Books:

1. "Thomas Hill", CCTV Handbook: Buying, Installing, Configuring, & Troubleshooting A User's Guide to CCTV Security, 10 Jul 2020, Independently Published.

Semester	Course Code			Title of the Paper						
V				CCTV SYSTEMS						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	1	3	2	1	2	3	3
CO-2	3	3	3	1	3	2	1	2	3	3
CO-3	3	3	3	1	3	2	1	2	3	3
CO-4	3	3	3	1	3	2	1	2	3	3
CO-5	3	3	3	1	3	2	1	2	3	3

*3-Strong, 2-Medium; 1-Low

Code:**ARDUINO PROGRAMMING
(Theory)****Credits: 2****COURSE OBJECTIVES:**

1. To understand the structural architecture and execution flow of an Arduino sketch.
2. To Implement standard C data types, variables, and constants.
3. To formulate complex logical decisions using conditional statements.
4. To differentiate between analog and digital sensor communication
5. To configure the ESP8266 NodeMCU module for wireless networking.

UNIT I: INTRODUCTION AND REQUIREMENTS: Arduino Sketch Structure and Flow**UNIT II: PROGRAMMING FUNDAMENTALS WITH C USING ARDUINO IDE:**

Arduino IDE- Data Types / Variables / Constant – Operators

UNIT III: CONTROL: Conditional Statements and Loops– Strings**UNIT IV: SENSORS AND ACTUATORS:** Analog and Digital Sensors – Interfacing temperature sensor with Arduino – Interfacing LED and Buzzer with Arduino**UNIT V: SENDING SENSOR DATA OVER INTERNET:** Introduction to ESP8266 NODEMCU

WiFi Module – NODEMCU to transmit data from temperature sensor to Open Source IoT cloud platform.

UNIT VI: CONTEMPORARY ISSUES: Expert lectures, online seminars – webinars**COURSE OUTCOMES:**

On completion of this course, students will be able to:

CO1: Configure environment initialization tasks successfully.**CO2:** Utilize math, comparison, and logical operators correctly.**CO3:** Build looping structures and manipulate strings efficiently.**CO4:** Interface temperature sensors, LEDs, and buzzers physically.**CO5:** Stream real-time localized data to open-source IoT platform**Text Books:**

1. " Brian Evans", Beginning Arduino Programming, Apress Berkeley, CA, Brian Evans 2011
2. "Boris Adryan", Dominik Obermaier, Paul Fremantle, "The Technical Foundations of IoT", Artech Houser Publishers, 2017.

Reference Books:

1. "Michael Margolis", "Arduino Cookbook", O'Reilly, 2011
2. "Boris Adryan, Dominik Obermaier, Paul Fremantle", "The Technical Foundations of IoT", Artech Houser Publishers, 2017.
3. "Marco Schwartz", "Internet of Things with ESP8266", Packt Publishing, 2016.

Semester	Course Code			Title of the Paper						
V				ARDUINO PROGRAMMING						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	1	3	2	1	2	3	3
CO-2	3	3	3	1	3	2	1	2	3	3
CO-3	3	3	3	1	3	2	1	2	3	3
CO-4	3	3	3	1	3	2	1	2	3	3
CO-5	3	3	3	1	3	2	1	2	3	3

*3-Strong; 2-Medium; 1-Low

Code:

**POWER ELECTRONICS
(Theory)****Credits: 4****COURSE OBJECTIVES:**

1. To identify the various Power Electronic devices.
2. To understand the Operation, characteristics and performance parameters of controlled rectifiers.
3. To know the Operation, switching techniques and basics topologies of DC-DC switching regulators.
4. To comprehend the Operation of AC voltage controller and various configurations.
5. To analyze the types of inverters and their functionalities

UNIT I: POWER SEMICONDUCTOR DEVICES

Study of switching devices, SCR, TRIAC, GTO, BJT, MOSFET, IGBT and IGCT-Static characteristics: SCR, MOSFET and IGBT - Triggering and commutation circuit for SCR - Introduction to Driver and Snubber circuits.

UNIT II: PHASE-CONTROLLED CONVERTERS

2-pulse, 3-pulse and 6-pulse converters- Performance parameters -Effect of source inductance- Firing Schemes for converter-Dual converters, Applications - Light dimmer, Excitation system, Solar PV systems.

UNIT III: DC TO DC CONVERTERS

Step-up and Step-down Chopper - Control strategy - Introduction to types of choppers - A, B, C, D and E -Switched mode regulators- Buck, Boost, Buck-Boost regulator, Introduction to Resonant Converters, Applications - Battery operated vehicles.

UNIT IV: INVERTERS

Single phase and three phase voltage source inverters (both 1200 mode and 1800 mode) - Voltage & Harmonic control - PWM techniques: Multiple PWM, Sinusoidal PWM, Modified sinusoidal PWM - Introduction to space vector modulation - Current source inverter,

UNIT V: AC TO AC CONVERTERS

Single phase and Three phase AC voltage controllers - Control strategy - Power Factor Control - Multistage sequence control - single phase and three phase Cyclo converters - Introduction to Matrix converters, Applications - welding.

UNIT VI: CURRENT CONTOURS (For continuous internal assessment only):

Switching Techniques & Applications: Identify the different types of power semiconductor devices and their switching concepts - Compare the different modulation techniques of pulsewidth modulated inverters and understand harmonic reduction methods - analyze the various single phase and three phase power converter circuits and understand their applications.

COURSE OUTCOMES:

On completion of this course, student will be able to:

- CO1:** Acquire knowledge about fundamental concepts and techniques used in power electronics.
- CO2:** Identify basic requirements for power electronics based design application.
- CO3:** Analyze AC-AC and DC-AC converters.
- CO4:** Choose the converters for real time applications.
- CO5:** investigate Power Electronic circuit problems and solve the same
- CO6:** design and construct the Power Electronics projects

Text Books:

1. "Muhammad H. Rashid", *Power Electronics*, 4th Edition, Pearson, 2017. **ISBN 978-0-13-312590-0**
2. "P. S. Bimbhra", *Power Electronics*, 3rd Ed. (Khanna Publishers, 2003). ISBN 81-7409-056-8.
3. "J. Vithayathil", *Power Electronics, Principles and Applications*, 6th Reprint (McGraw Hill Series, 2013). ISBN-13. 978-0070675551
4. "P. T. Krein", *Elements of Power Electronics* (Oxford University Press, 2004). **ISBN:** 9780199388417.

Reference Books:

1. "L. Umanand", *Power Electronics Essentials and Applications* (Wiley, 2010). **ISBN-13**, 978-8126519453.
2. "J. Gnanavadivel", *Power Electronics*, 4th Ed. (Anuradha Publications, 2015). ISBN 978-8184722819.
3. "M.D. Singh and K.B. Khanchandani", *Power Electronics*, (Mc Graw Hill India, 2013). **ISBN-13**: 978-0-07-058389-4.
4. "Branko L. Dokić and Branko Blanuša", *Power Electronics Converters and Regulators*, 3rd Edition, Springer, 2015. ISBN-13. 978-3319382791.

E-book Links:

1. <https://ieexplore.ieee.org/document/515001>
2. <https://www.powerelectronics.com/>
3. https://www.tutorialspoint.com/power_electronics/index.htm
4. https://onlinecourses.nptel.ac.in/noc19_ee37/preview

Semester	Course Code			Title of the Paper						
VI				POWER ELECTRONICS						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	1	3	2	1	2	3	3
CO-2	3	3	3	1	3	2	1	2	3	3
CO-3	3	3	3	1	3	2	1	2	3	3
CO-4	3	3	3	1	3	2	1	2	3	3
CO-5	3	3	3	3	3	2	1	2	3	3

*3-Strong; 2-Medium; 1-Low

Code:

VLSI DESIGN
(Theory)

Credits: 4

COURSE OBJECTIVES:

1. To make the students Understand the basics of VLSI technology.
2. To explain the students and make them compare various semiconductor devices used in VLSI.
3. To train students to study applications of the VLSI system.
4. To enhance the ability of students to understand the basic concepts of VHDL programming
5. To Apply and test various digital circuits using VHDL programming

UNIT I: POWER SEMICONDUCTOR DEVICES

Structure of MOSFET: Enhancement mode MOSFET - Depletion Mode MOSFET - MOS Transistor Theory: Figure of merit - MOS Device design equations - equivalent circuits of MOSFETs - Basic structure of CMOS.

UNIT II: BASIC MOS AND CMOS, AND BIPOLAR LOGIC CIRCUITS

Pass Transistor (or) Transmission gate- Inverters: The n-MOS Inverter - MOSFET as a resistance-determination of pull-up to pull-down ratio for an n-MOS inverter by another n-MOS inverter - pull-up to pull-down ratio for an n-MOS inverter driven through one or more pass transistors - Different forms of pull-up-BICMOS Inverter -Tristate Inverter - Differential Inverter- Bipolar logic circuits - DTL – ECL - Integrated injection logic

UNIT III: APPLICATIONS OF CMOS

An Increment / Decrement circuit-Shift Registers: Left / Right Register- Serial / Parallel Registers - Comparators for a two bit number - Two Phase non-overlapping clock generator

UNIT IV: VHDL PROGRAMMING

VHDL - basic Terminology - Entity Declaration - Architecture body - Configuration Declaration - Package Declaration - Basic Language elements: Identifiers-Data Objects - Data types, Operators: Behavioral Modeling: Entity Declaration - Architecture Body - Process statement - Wait statement - If - Case - Null - Loop - Exit - Next -Multiple Process - Postponed Processes.

UNIT V: DATA FLOW MODELLING

Concurrent Signal Assignment statement - concurrent verses sequential signal assignment - Multiple drivers - Block Statement - Concurrent Assertion statement - Value of a signal.

UNIT VI: CURRENT CONTOURS (For continuous internal assessment only): Simulations: Gate level modelling and simulation - Switch level modelling and simulation - Combinational logic synthesis -Binary decision diagram - Two level logic synthesis.

COURSE OUTCOMES:

On completion of this course, student will be able to:

- CO1:** Explain the fundamental concepts of Integration Technology
- CO2:** Classify different semiconductor devices used in VLSI system
- CO3:** Examine different VLSI Circuits
- CO4:** Analyze the applications of VLSI Design
- CO5:** Summarize the terms and modeling in VHDL programming
- CO6:** Apply and test various digital circuits using VHDL programming

Text Books:

1. "D. K. Roy", Principles of VLSI (Galgotia Publication Limited, 2005)
2. "Q. Neil and H. E. Weste", Principles of CMOS VLSI Design (Addison-Wesley Publishing Company, 1993)
3. "J. M. Rabey, A. Chandrakasan" and "B. Nikolic", Digital Integrated Circuits: A Design Perspective, 2nd Ed. (Pearson Education India, 2016)
4. "D. A. Pucknell and K. Eshraghian", Basic VLSI design, 3rd Ed. (PHI)
5. "W. Wolf", Modern VLSI design, 4th Ed. (PHI, 2009)

Reference Books:

1. "M. Carver and C. Lynn", Introduction To VLSI Systems (BS Publications, 2003)
2. "J. M. Rabey", Digital Integrated Circuits (Pearson Education, 2003)
3. "S. Brown and Z. Vranesic", Fundamentals of Digital Logic Design with VHDL (Tata McGraw-Hill, 2007).
4. "Douglas L perry", VHDL programming by example, McGraw Hill, 2008

e-book link:

1. <https://nptel.ac.in/courses/117106092>
2. <https://www.vlsisystemdesign.com/scaling.php>
3. <https://www.scribd.com/document/222797677/Scaling-Factors-and-scaling-parameters>
4. <https://vhdlwhiz.com/basic-vhdl-tutorials/>

Semester	Course Code			Title of the Paper						
VI				VLSI DESIGN						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	1	2	2	1	2	3	3
CO-2	3	3	3	1	2	2	1	2	3	3
CO-3	3	3	3	1	2	2	1	2	3	3
CO-4	3	3	3	3	3	2	2	3	3	3
CO-5	3	3	3	3	3	2	2	3	3	3

*3-Strong; 2-Medium; 1-Low

Code: **BIOMEDICAL ELECTRONICS**
(Theory)

Credits: 4

COURSE OBJECTIVES:

1. To acquire knowledge on Bio-Medical Instruments, their functions and Applications
2. To understand the Specialized Medical Equipment
3. To learn the basic concept of Physiological Assisting Devices
4. To infer about various Bio-recorders
5. To identify and explain the concepts of various Biomedical devices

UNIT I: PHYSIOLOGICAL SYSTEMS AND BIO-ELECTRIC POTENTIALS

Introduction - Cell, Tissues and organs - Various Physiological systems of human body - Half-Cell Potential-Resting and Action Potentials - Bio-Electric Potentials.

UNIT II: INTRODUCTION TO BIO-MEDICAL INSTRUMENTS

Components of Bio-Medical Instruments - Design of Medical Instruments - Electrodes - Types of Electrodes - Transducers - Types of Transducers - Transducers used for medical Applications - Bio-Signal Acquisition: Bridge and Medical Pre-Amplifiers - Filters

UNIT III: BIO-POTENTIAL RECORDERS

Characteristics of Recording Systems - Electrocardiography (ECG) - Electroencephalography (EEG) - Electromyography - Electro retinography - Phonocardiography

UNIT IV: PHYSIOLOGICAL ASSISTING DEVICES

Pacemakers - Types of Pacemakers - Defibrillators - Electrotherapy - Nerve and muscle Stimulators - Microwave Diathermy - Heart - Lung Machine - Haemo - Dialysis

UNIT V: SPECIALIZED MEDICAL EQUIPMENT

Blood Cell Counter - Electron Microscope - Photometers - Digital - Thermometers - Audiometers - Angiography - X-Ray Machine - Magnetic Resonance Imaging

UNIT VI: CURRENT CONTOURS (For continuous internal assessment only):

Bio-Telemetry: Introduction - Elements of Bio-Telemetry System - Design of Bio-Telemetry System - Radio Telemetry Systems - Problems in implant telemetry - Uses of Bio-Telemetry

COURSE OUTCOMES:

On completion of this course, student will be able to

CO1: Learn the basics of human Physiological Systems

CO2: Acquire knowledge on different Bio-Medical Instruments

- CO3:** Interpret various Human Assistive devices
CO4: Analyze bio signals and recorders
CO5: Evaluate the performances of specialized Bio-Medical Devices,
CO6: Design Bio-Medical instruments for various Applications

Text Books:

1. "M. Arumugam", "Biomedical Instrumentation", 2nd Edition, Anuradha Publications, Reprint 2011. ISBN 978-8187721123.
2. "Leslie Cromwell", Biomedical Instrumentation and Measurement, 2nd Ed. (Prentice Hall of India, New Delhi, 2007) ISBN 9788187721123.
3. "R. S. Khandpur", Handbook of Biomedical Instrumentation, 2nd Ed. (Tata McGraw-Hill, New Delhi, 2011) **ISBN-13:** 9780070473553.
4. "M. Kutz", Standard Handbook of Biomedical Engineering and Design, 1st Ed. (McGraw Hill Publisher, 2003). **ISBN** 9780071356374.
5. "J. J. Carrand J. M. Brown", Introduction to Biomedical Equipment Technology, 4th Ed. (Pearson Education, 2004) **ISBN**, 8177588834, 9788177588835.
6. "G. S. Sawhne", Biomedical Electronics and Instrumentation made easy (2011) SBN-13: 978-9381141472 ISBN-10: 9789381141472.

Reference Books:

1. "Gowri Nambi", Biomedical Engineering: A Quick Reference Guide (Notion Press, 2019). **ISBN**-10. 164760804X.
2. "John G. Webster", Amit J. Nimunkar, Medical Instrumentation, Application and Design (2021) ISBN: 9789354249150.

e-book Links:

1. <https://nptel.ac.in/courses/108108180>
2. <https://www.edx.org/course/biomedical-equipment-technician-training-maintenance-repair>

Semester	Course Code			Title of the Paper						
VI				BIOMEDICAL ELECTRONICS						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	2	2	2	1	2	3	3
CO-2	3	3	3	2	2	2	1	2	3	3
CO-3	3	3	3	2	2	2	1	2	3	3
CO-4	3	3	3	2	3	2	1	3	3	3
CO-5	3	3	3	2	3	2	1	3	3	3

*3-Strong; 2-Medium; 1-Low

Code:**Credits: 4**

The candidate shall be required to take up a Project Work by group or individual and submit it at the end of the final year. The Head of the Department shall assign the Guide who, in turn, will suggest the Project Work to the students in the beginning of the final year. A copy of the Project Report will be submitted to the University through the Head of the Department on or before the date fixed by the University.

The Project will be evaluated by an internal and an external examiner nominated by the University. The candidate concerned will have to defend his/her Project through a Viva-voce.

ASSESSMENT/EVALUATION/VIVA VOCE:**1. PROJECT REPORT EVALUATION (Both Internal & External)**

- Plan of the Project - 20 marks

- II. Execution of the Plan/collection of Data / Organisation of Materials / Hypothesis, Testing etc. and presentation of the report. - 45 marks

- Individual initiative - 15 marks

2. Viva-Voce / Internal & External - 20 marks**TOTAL - 100 marks****PASSING MINIMUM:**

Project	Vivo-Voce 20 Marks 40% out of 20 Marks (i.e. 8 Marks)	Dissertation 80 Marks 40% out of 80 marks (i.e. 32 marks)
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A candidate who gets less than 40% in the Project must resubmit the Project Report. Such candidates need to defend the resubmitted Project at the Viva-voce within a month. A maximum of 2 chances will be given to the candidate.

Code: **RASPBERRY PI PROGRAMMING**
(Theory)

Credits: 2

Course Objectives:

1. To introduce the architecture and operating environment of Raspberry Pi systems.
2. To develop Python programming skills using Raspberry Pi.
3. To interface sensors, displays, and communication modules with Raspberry Pi.
4. To design IoT and embedded applications using Raspberry Pi.
5. To focus on the practical application of microcontrollers to monitor and interact with the physical environment.

UNIT I: OVERVIEW OF RASPBERRY PI: Introduction to Raspberry Pi, Comparison of various Rpi Models, Understanding SoC architecture and SoCs used in Raspberry Pi

UNIT II: BOOTING UP RPI: operating System and Linux Commands, Linux-Introduction, Architecture, File System, Raspbian Operating System

UNIT III: RPI USING PYTHON AND SENSING DATA USING PYTHON: Introduction, Python vs. Other Languages

UNIT IV: UNDERSTANDING PYTHON INTERPRETED LANGUAGES: Variables, Keywords, Operators and Operands, Data Types in Python

UNIT V: SENSORS INTERFACING: Temperature and Humidity Sensor (DHT11), Motion Sensor (PIR), Obstacle detection using Ultrasonic sensor, etc

UNIT VI: CONTEMPORARY ISSUES:
Expert lectures, online seminars – webinars

COURSE OUTCOMES:

On completion of this course, students will be able to:

CO1: Students will be able to install and configure Raspberry Pi OS and perform basic Linux operations on Raspberry Pi.

CO2: Students will be able to write Python programs and interface basic input/output devices using Raspberry Pi GPIO.

CO3: Students will be able to interface sensors, actuators, and display devices with Raspberry Pi for embedded applications.

CO4: Students will be able to develop Raspberry Pi-based IoT applications using communication protocols and cloud connectivity.

CO5: Students will be able to design and implement real-time Raspberry Pi applications for automation and intelligent systems.

CO6: Students will be able to configure, optimize, and manage Raspberry Pi systems for edge computing and deploy real-time embedded applications.

Text Books:

1. Programming the Raspberry Pi, Second Edition: Getting Started with Python 2nd Edition by “Simon Monk” McGraw Hill Professional, 04-Jun-2021 - Technology & Engineering
2. Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux 1st Edition by “Derek Molloy”, wiley publications 2016.

Reference Books:

1. The Computer Programming Bible: A Step by Step Guide On How To Master From The Basics to Advanced of Python, C, C++, C#, HTML Coding Raspberry Pi3 by C.P.A Inc 2020.
2. Raspberry Pi IoT Projects: Prototyping Experiments for Makers by “John C. Shovic”, APress 2016

Semester	Course Code			Title of the Paper						
VI				RASPBERRY PI PROGRAMMING						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	1	3	2	1	2	3	3
CO-2	3	3	3	1	3	2	1	2	3	3
CO-3	3	3	3	1	3	2	1	2	3	3
CO-4	3	3	3	1	3	2	1	2	3	3
CO-5	3	3	3	1	3	2	1	2	3	3

*3-Strong; 2-Medium; 1-Low

Code:**LCD TV SERVICING
(Theory)****Credits: 2****COURSE OBJECTIVES:**

1. To understand the structure of LCD panel and Ic's.
2. To analyze power line and its blocks.
3. To articulate the structure of LCD TV.
4. To understand the methodology of operating panels and remote systems.

UNIT I: Introduction of LCD Panel. Different Types of Ic's used in LCD & LED TV.**UNIT II:** Power supply IC, Main Logic Board IC. Inverter Section IC, LCD TV Sections IC. Block Diagram of Power Supply Section.**UNIT III:** Block Diagram of LCD TV Sections. Block Diagram of Main Logic Board. Block Diagram of Video Drive Section.**UNIT IV:** Circuit Diagram of LCD TV Sections. Inverter Board Circuit Diagram.**UNIT V:** Front Operating Panel, Remote Control, Service Mode.**UNIT VI:** Contemporary Issues: Expert lectures, online seminars – webinars**COURSE OUTCOMES:**

On completion of this course, students will be able to:

CO1: Configure all LDC panels with its structure.**CO2:** Analyze power line and its blocks in LCD TV.**CO3:** Gain knowledge of LCD architecture.**CO4:** Operate on all LCD panels and its remotecontrol systems.**Text Books:**

1. "Humphrey Kimathi", LCD/LED Television Repair Case History, Vol.01 Kindle Edition
2. "A. M. Dhake", Television and Video Engineering, 2nd Edition, 2014

Reference Books:

1. "R. S. Khandpur", 2nd Edition, 2006, Modern Electronic Equipment: Troubleshooting, Repair and Maintenance
2. "John Preher", Troubleshooting and Repairing LCD TVs, Published by Perpustakaan Kolej Vokasional Seri Iskandar, 2021.

Semester	Course Code			Title of the Paper						
VI				LCD TV SERVICING						
Course Outcomes↓	Programme Outcomes (PO)									
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10
CO-1	3	3	3	1	3	2	1	2	3	3
CO-2	3	3	3	1	3	2	1	2	3	3
CO-3	3	3	3	1	3	2	1	2	3	3
CO-4	3	3	3	1	3	2	1	2	3	3
CO-5	3	3	3	1	3	2	1	2	3	3

*3-Strong; 2-Medium; 1-Low
