



BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI -620 024.

M.Sc. ELECTRONICS

**CHOICE BASED CREDIT SYSTEM -
LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS - LOCF)**

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

Sem.	Course	Course Title	Ins. Hrs.	Credit	Exam Hrs.	Marks		Total
						Int.	Ext.	
I	Core Course - 1 (CC - 1)	Advanced Electronic Circuits Designing	6	4	3	30	70	100
	Core Course - 2 (CC - 2)	Digital communication	6	4	3	30	70	100
	Core Practical -1 (CP - 1)	Advanced Electronic Circuits Designing Lab	6	4	3	40	60	100
	Discipline Centric Elective Course - 1 (DCEC-1)	Any one from the list	5	4	3	30	70	100
	Generic Elective Course - 1 (GEC - 1)	Any one from the list	5	3	3	30	70	100
	Skill Enhancement Course - 1 (SEC - 1)	Mobile Phone Servicing	2	2	3	30	70	100
	Value Added Course - 1 (VAC-1)*	Industrial Safety and Disaster Management	-	2*		30	70	100*
	Total		30	21	-	-	-	600
II	Core Course - 3 (CC - 3)	Control System	6	4	3	30	70	100
	Core Course - 4 (CC - 4)	Advanced Microcontrollers	6	4	3	30	70	100
	Core Practical - 2 (CP - 2)	Advanced Microcontrollers Lab	6	4	3	40	60	100
	Discipline Centric Elective Course - 2 (DCEC - 2)	Any one from the list	4	4	3	30	70	100
	Generic Elective Course - 2 (GEC - 2)	Any one from the list	4	3	3	30	70	100
	Skill Enhancement Course - 2 (SEC - 2)	Laptop Servicing	2	2		30	70	100
	Non-Major Elective Course - 1 (NMEC - 1)	One Course from Outside Department	2	2	3	30	70	100
	Total		30	23	-	-	-	700
Summer Internship / Industrial Activity during the Summer Vacation after 1 st Year								

III	Core Course - 5 (CC - 5)	VLSI Technology	6	4	3	30	70	100
	Core Course - 6 (CC - 6)	Digital Signal Processing	6	4	3	30	70	100
	Core Practical -3 (CP - 3)	VLSI Lab	6	4	2	40	60	100
	Discipline Centric Elective Course - 3 (DCEC - 3)	Any one from the list	5	4	2	30	70	100
	Generic Elective Course - 3 (GEC - 3)	Any one from the list	5	3	3	30	70	100
	Non-Major Elective Course - 2 (NMEC - 2)	One Course from Outside Department	2	2	3	30	70	100
	Internship / Industrial Activity @			2		20	80	100
Total			30	23	-	-	-	700
IV	Core Course - 7 (CC - 7)	PLC and It's Applications	6	4	3	30	70	100
	Core Course - 8 (CC - 8)	Smart Sensors and their Applications	6	4	3	30	70	100
	Core Course - 9 (CC - 9)	MEMS	6	4	3	30	70	100
	Discipline Centric Elective Course - 4 (DCEC - 4)	Any one from the list	4	4	2	30	70	100
	Entrepreneurship / Industry Based Course @	Industry 4.0 Application	3	3	3	30	70	100
	Project Work @		5	5	-	20	80	100
	Value Added Course - 2 (VAC-2)*	Fundamentals of Robotics	-	2*		30	70	100*
Total			30	24	-	-	-	600
Grand Total				91				2800

LIST OF DISCIPLINE CENTRIC ELECTIVE COURSE

Discipline Centric Elective Course - 1 (DCEC - 1)	
1.	PCB Designing
2.	Opto Electronic Material and Devices
Discipline Centric Elective Course - 2 (DCEC - 2)	
1.	Artificial Intelligence and Machine Learning
2.	Automotive Electronics
Discipline Centric Elective Course - 3 (DCEC - 3)	
1.	Data Communication Networks
2.	Cloud Computing
Discipline Centric Elective Course - 4 (DCEC - 4)	
1.	Embedded System Design
2.	Mobile Communication

LIST OF NON-MAJOR ELECTIVE COURSE (for other Department Students only)

NON-MAJOR ELECTIVE COURSE - 1 (NME-1)	
1	Home Appliances
NON-MAJOR ELECTIVE COURSE - 2 (NME-2)	
2	Bio-Medical Instrumentation

LIST OF GENERIC ELECTIVE COURSE (GEC)

GENERIC ELECTIVE COURSE - 1 (GEC - 1)	
1.	Nano Electronics
2.	Solar Electrical System
3.	Electromagnetic Theory
GENERIC ELECTIVE COURSE - 2 (GEC - 2)	
1.	Python Programming
2.	Raspberry PI Programming
3.	Radar and Satellite Communication
GENERIC ELECTIVE COURSE - 3 (GEC - 3)	
1.	ASIC and FPGA Design
2.	Power Electronics
3.	Drone Technology

SUMMARY OF CURRICULUM STRUCTURE OF PG PROGRAMMES

Sl. No.	Types of the Course	No. of Courses	Credits for each Course	Total Credits	Marks
1.	Core Course	9	4	36	900
2.	Core Practical	3	4	12	300
3.	Discipline Centric Elective Course	4	4	16	400
4.	Generic Elective Course	3	3	9	300
5.	Skill Enhancement Course	2	2	4	200
6.	Non-Major Elective Courses	2	2	4	200
7.	Internship / Industrial Activity @	1	2	2	100
8.	Entrepreneurship/ Industry Based Course @	1	3	3	100
9.	Project @	1	5	5	100
Total		26	-	91	2600
Value Added Courses *		2*	2	4*	200

*	The value-added courses credit will not be included in the total CGPA. These courses are extra-credit courses. Instruction hours for the courses is 30 hours								
@	Summer Internship will be carried out during the summer vacation after the First 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 3rd semester Mark Statement. Summer Internship / Industrial Activity& Project Scheme of Evaluation: <table border="1" style="width: 100%;"> <thead> <tr> <th>Description</th><th>Marks</th></tr> </thead> <tbody> <tr> <td>Report</td><td>80</td></tr> <tr> <td>Viva</td><td>20</td></tr> <tr> <td>Total</td><td>100</td></tr> </tbody> </table>	Description	Marks	Report	80	Viva	20	Total	100
Description	Marks								
Report	80								
Viva	20								
Total	100								

PROGRAM OBJECTIVES AND PROGRAM OUTCOMES

PROGRAM OBJECTIVES:

The objectives of the M.Sc., Electronics course incorporates the following potential areas.

1. Advanced Design & Analysis: To equip students with the mathematical and analytical skills required to design and optimize complex analog and digital systems, CMOS circuits, and synchronous/asynchronous sequential circuits.

2. Practical Problem Solving: To train students to independently formulate solutions to practical, real-life design problems using modern simulation, measurement, and hardware tools.

3. Industry Focus: To bridge the gap between academic and modern industries by providing specialized, hands-on training in emerging fields such as IoT, VHDL/Verilog HDL, and embedded systems.

4. Research & Innovation: To cultivate an environment that empowers students to conduct independent research, write substantial technical documents, and pursue careers as scientists, technologists, or business leaders.

PROGRAM OUTCOMES:

Post graduates of this M.Sc., program are generally expected to develop specific proficiencies which includes,

1. The ability to critically evaluate and develop electronic systems using both software design frameworks (**like PLDs and FPGAs**) and physical hardware.
2. The capacity to work professionally, ethically, and efficiently to manage projects and communicate technical findings to society.
3. Apply the real-world knowledge in the field of Signal Processing, Communication/Networking, **VLSI Design and Embedded Systems** to solve complex problems in Information and Communication Technology.
4. Apply modern tools and advanced development boards in electronics systems to provide solutions to **real-world problems**.
5. Adapt to the rapidly changing environment of Electronics to meet the issues, challenges, expectations and requirements.

Year: I

CORE COURSE 1

Semester: I

Code:

**ADVANCED ELECTRONIC
CIRCUITS DESIGNING
(Theory)**

Credits: 4

COURSE OBJECTIVES:

1. To encourage the students to learn Analog and Digital circuits design methods.
2. To get the knowledge to develop designing skills in Analog and digital circuits.
3. To know the important circuit operations.
4. To enhance the knowledge to differentiate between combinational and sequential circuits
5. To design the required analog and digital circuits for the specific applications.

UNIT I: MOSFET DEVICES

Physical Structure of the MOSFET The Threshold Voltage V_t - The n-Channel Characteristic - The i-v Characteristics of MOSFETs - MOSFETs in Resistive Dc Circuits - The MOSFET as an Amplifier/Switch - Small-Signal Operation of the MOSFET - Basic MOSFET Voltage Amplifiers - MOSFET Voltage and Current Buffers - The CMOS Inverter/Amplifier- SPICE Models for MOSFETs .

UNIT II: ANALOG INTEGRATED CIRCUITS

The mA741 Operational Amplifier - The Two-Stage CMOS Operational Amplifier - The Folded - Cascode CMOS Operational Amplifier - Voltage Comparators - Current and Voltage References -Current-Mode Integrated Circuits - Fully Differential Operational Amplifiers – Switched - Capacitor Circuits - SPICE Macro-Models.

UNIT III: COMBINATIONAL CIRCUIT DESIGN

Combinational Logic - Design of Half adder and Half subtractor - Design of Full adder and Full subtractor - Design of look - ahead carry generator - Design of BCD adder - Design of Series and parallel adder - Design of Multiplexer and demultiplexer - Design of encoder and decoder - Design of arithmetic circuits and ALU.

UNIT IV: SEQUENTIAL CIRCUIT DESIGN

Sequential Logic - Design of Level and edge-triggered flip-flops -RS flip-flop-D flip-flop-JK flip-flop- T flip-flop-timing specifications of flip-flops- characteristic table and equation of flip-flops-excitation table.

UNIT V: REGISTERS AND COUNTERS DESIGN

Registers and Counters - Design of Registers - Shift Registers - Bi-directional shift registers - Design of Counters-Ripple and Synchronous Counters - Ring and Johnson counters.

UNIT VI: APPLICATIONS (FOR INTERNAL ASSESSMENT ONLY)

Multiplexing - Displays-frequency – Counters - Time measurement - Digital voltmeters - A simple Computer design - Building blocks - Register Transfer language - Execution of Instructions, Macro and Micro operations - Design of Control Unit - Programming Computer.

Text Books:

1. Sergio Franco, Analog Circuit Design : Discrete & Integrated, 1st Edition, 2014 ,McGraw Hill higher Education.
2. Morris Mano, Michael D ciletti, Digital Logic Design, Vth edition, 2013, Pearson Education.

Reference Books:

1. Boylestad ,Nashelsky, Electronic Devices and Circuit Theory, 11th Edition, 2017, Pearson Education.
2. Thomas L Floyd, Digital Fundamentals, 11th Edition, 2017, Pearson Education.

COURSE OUTCOME:

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

1. To design an analog and digital Circuits.
2. To apply the theory knowledge to construct their own circuits.
3. To differentiate the working methods of analog and digital circuits.
4. To design sequential and combinational circuits.
5. To design registers and counters.

Semester	Course Code			Title of the Paper						
I				ADVANCED ELECTRONIC CIRCUITS DESIGNING						
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	2	2	3	3	3
CO-3	3	3	3	2	1	2	2	2	2	3
CO-4	3	3	3	3	2	2	3	2	2	3
CO-5	3	3	3	3	1	2	3	2	3	3

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

Year: I

CORE COURSE 2

Semester: I

Code:

**DIGITAL COMMUNICATION
(Theory)**

Credits: 4

COURSE OBJECTIVES:

1. To know the principles of sampling and quantization
2. To study the various waveform coding schemes
3. To analyze baseband transmission schemes
4. To understand the various band pass signaling schemes and to know its principles.
5. To find error and control using coding

UNIT I: INFORMATION THEORY

Discrete Memory less source, Information, Entropy, Mutual Information - Discrete Memory less channels - Binary Symmetric Channel, Channel Capacity - Hartley - Shannon law - Source coding theorem - Shannon - Fano & Huffman codes.

UNIT II: WAVEFORM CODING AND REPRESENTATION

Prediction filtering and DPCM - Delta Modulation - ADPCM & ADM principles - Linear Predictive Coding - Properties of Line codes - Power Spectral Density of Unipolar / Polar RZ & NRZ -Bipolar NRZ - Manchester

UNIT III: BASEBAND TRANSMISSION AND RECEPTION

Nyquist criterion for distortion less transmission - Pulse shaping - Correlative coding - Eye pattern - Receiving Filters - Matched Filter, Correlation receiver, Adaptive Equalization

UNIT IV: DIGITAL MODULATION SCHEME

Geometric Representation of signals - Generation, detection, PSD & BER of Coherent BPSK,BFSK & QPSK - QAM - Carrier Synchronization - Structure of Non - coherent Receivers - Principle of DPSK.

UNIT V: ERROR CONTROL CODING

Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes - Viterbi Decoder.

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

Image and video processing - Data compression - Channel coding - Equalization - Digital Signal Processing - Speech processing - Satellites - Digital audio transmission.

Text Books:

1. S. Haykin, Digital Communications (John Wiley, 2005).15
2. B. Sklar, Digital Communication Fundamentals and Applications, 2nd Ed. (Pearson Education, 2009)
3. B. P. Lathi, Modern Digital and Analog Communication Systems, 3rd Ed.(Oxford University Press, 2007).

4. H. P. Hsu, Schaum Outline Series - Analog and Digital Communications (Tata McGraw - Hill, 2006)
5. J. G. Proakis, Digital Communication, 4th Ed. (Tata McGraw Hill, 2001).

Reference Books:

1. Sanjay Sharma, Digital Communications, (S.K.Kataria and Sons, 2013)
2. Arthur A. Giardano Allen A. Levesque, Modeling of Digital communication Systems using Simulink, (Wiley Publications, 2015)
3. Apurba Das, Digital Communication: Principles and System Modeling, (Springer Publications, 2012)

e-book Links:

1. [www.classcentral.com/swayam-principles of digital communications-12951](http://www.classcentral.com/swayam-principles-of-digital-communications-12951)
2. www.open.edu/openlearn

COURSE OUTCOME:

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

CO 1: Analyze various Digital Communication systems.

CO 2: Implement base band transmission schemes.

CO 3: Design band pass signaling schemes.

CO 4: Analyze the spectral characteristics of band pass signaling schemes and their noise performance.

CO 5: Evaluate error control coding schemes.

Semester	Course Code			Title of the Paper						
I				DIGITAL COMMUNICATION						
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	2	2	3	3	3
CO-3	3	3	3	2	1	2	2	2	2	3
CO-4	3	3	3	3	2	2	2	2	2	3
CO-5	3	3	3	3	1	2	2	2	3	3

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

Year: I

CORE PRACTICAL 1

Semester: I

Code:

**ADVANCED ELECTRONIC
CIRCUITS DESIGNING LAB
(Practical)**

Credits: 4

ANY TWELVE EXPERIMENTS

COURSE OBJECTIVES:

Design, construction and analysis of Analog and Digital circuits and verification of characteristics.

1. Construction of Regulated power supply for 5V, 12V and - 12V
2. Analysis of the input and output characteristics of CE amplifier
3. Finding the frequency response of CE Amplifier
4. Design of CB amplifier
5. Design of CC amplifier.
6. Analysis of FET characteristics.
7. Construction of FET amplifier.
8. Construction of the circuits for performing basic operations of Op-Amp.
9. Construction of summing amplifier.
10. Construction of Instrumentation amplifier.
11. Design of three variable Boolean expressions and construct the circuits.
12. Design of Multiplexer and de - multiplexer.
13. Design of controlled SR Flip - flop and D Flip – flop
14. Construction J - K Flip - Flop and Master - slave FF.
15. Design of 4 - bit Synchronous and Asynchronous counter.
16. Design of a Decade counter.
17. Design of PAL.
18. Design of PLA.

REFERENCES:

1. Brian Dean, Introduction to Analog and Digital Circuits, lab Manual, Kendall and Hunt Publishing, 2018
2. Gary E. Ford, Carl M Arri, , Analog Electronics Circuits & Systems, 3rd Ed., Kendall and Hunt Publishing, 2006
3. Paul Schertz and Simon Monk, Practical Electronics for Inventors, Fourth Ed.,Mc- Graw Hill, 2016

COURSE OUTCOMES:

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

1. Design Amplifier Circuits
2. Design of Instrumentation Amplifier using Op-Amp
3. Know about reduction techniques of Boolean Expressions
4. Design Counters and memory devices by using digital circuits

Year: I	DISCIPLINE CENTRIC ELECTIVE COURSE 1	Semester: I
Code:	1. PCB DESIGNING (Theory)	Credits: 4

COURSE OBJECTIVES:

1. To learn the basic components of Printed Circuit Boards design
2. To get the knowledge to use CAD tools to design PCB
3. To know the procedure to transfer the circuit Image on the PCB
4. To obtain a self PCB designing via printing, plating and etching processes
5. To encrypt the knowledge of CAD

UNIT I: DESIGN OF PRINTED CIRCUIT BOARDS

Layout Planning - General Considerations - PCB sizes - layout Approaches - Documentation - layout, General Rules and Parameters - Resistance - Capacitance - inductance of PCB conductors - Conductor Spacing - Realising supply and Ground Conductors - Component placing and Ground conductors - Cooling requirements and Package density - Layout check.

UNIT II: DESIGN RULES FOR ANALOG AND DIGITAL CIRCUIT PCBS

Component conductors - Signal conductors - High frequency amplifiers - Oscillators - multistage Amplifiers - Feedback amplifiers - High gain DC Amplifiers - Supply and Ground Conductors - Dividing circuit for high and Low - power part - Copper - Clad laminates - PCB terminal connections and assembly - Conductors - Reflections - Integrated Circuits - TTL - C -MOS - ECL - Elements or with Line - Driver/Receiver - Crosstalk - ground - and - Supply - Line noise

UNIT III: TECHNOLOGY OF PCBS

Film master Production - Film Emulsion - Dimensional stability - reprographic cameras - Darkroom - Film processing - Increasing and Decreasing line widths - Film Registration - manufacture of Copper - Clad Laminates - Properties of laminates - types of Laminates - Test methods - Board cleaning - manual cleaning processes - machine cleaning processes.

UNIT IV: PRINTING, PLATING AND ETCHING PROCESSES

Basic processes for Double sided PCBs - Photo film resists - wet - film resists - Coating Processes - Dry film resists - Screen Printing - Screen Fabrics - Screen and Frame Fabrics - Pattern Transfer on to the screen Plating - Immersion Plating - Electroless plating - Electroplating - Principle - Copper plating - Tin plating - Nickel plating - Gold plating - Etching machines - Etchant systems - Ferric Chloride - Cupric Chloride - Chromic acid.

UNIT V: AUTOMATION AND COMPUTERS IN PCB DESIGNS

Limitations of Manual Designing - Automated artwork designing – Computer aided design (CAD) - Engineering Design - Designer Vs. computer - Computer as design medium - Programming language for CAD - Computer Graphics - Graphics designs - Representation of Images in Computer - Transformations - Segmentation - Geometric modeling - Computer Aided Drafting

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

High - Density Interconnect and Miniaturisation - Greener Manufacturing - PCB automatic placement machine - IOT PCB - Bio - Gradable PCBS

Text Books:

1. W. C. Bosshart, Printed Circuit Boards, Design and Technology, (Tata McGraw Hill Ltd., 1983).
2. C.S. Krishnamoorthy, S. Rajeev and A. Rajaraman, Computer Aided Design, 2nd Ed. (Alpha Science International Ltd., 2005).
3. D. Boswell, Surface Mount and Mixed Technology: PCB design Guidelines”, Electro mechanical Publications.

Reference Books:

1. J. A. Scarlett, Printed circuit Boards for Micro Electronics, Van Nostr and Reinhold Company.
2. www.resources.altium.com/p/where-you-can-learn-pcb-design
3. www.udemy.com/circuits

COURSE OUTCOMES:

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

CO 1: Apply advance techniques in designing PCB.

CO 2: Understand the fabrication processes

CO 3: Familiarize with different types of fabric used for screen printing

CO 4: Design Printed Circuit Board with Computer Tools.

CO 5: Design using CAD

Semester	Course Code			Title of the Paper						
I				PCB DESIGNING						
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	3
CO-2	3	3	3	2	2	2	2	3	3	3
CO-3	3	3	3	2	2	2	2	2	3	3
CO-4	3	3	3	3	2	2	2	2	3	3
CO-5	3	3	3	3	2	2	2	2	3	3

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

Year: I	DISCIPLINE CENTRIC ELECTIVE COURSE 1	Semester: I
Code:	2. OPTO ELECTRONIC MATERIAL AND DEVICES (Theory)	Credits: 4

COURSE OBJECTIVES:

1. To learn about the fundamental theory of optical structure.
2. To know about the fabrication methods of Opto electronic material.
3. To learn about the spectroscopy techniques.
4. To understand the need of material science.
5. Identify about the Opto Electronic Devices.

UNIT I: INTRODUCTION

Introduction - Fundamental Structure - Property Relationships in Solid-State Materials - Bonding - crystal lattices and crystallographic notation - Surfaces and interfaces - Electronic structure

UNIT II: ELECTRO OPTICS AND NON -LINEAR OPTICS EFFECTS:

Electro optics and non- liner optics effects: acousto electro, Design of A.O modulators and deflectors- Electro- optic effects- pockels and kerr effects : change in refractive index in KDP crystal -Design of electro optical modulators - switching -multiplexers and other devices-Integrated optical circuits-materials and design of specific PO system -applications

UNIT III: OPTICAL SENSORS AND SYSTEMS:

An overview of various optoelectronic sensing techniques used in scientific - medical and industrial fields -Opto-electronic transducers-types and properties - design consideration of intensity and interferometric types of fiber optic sensors for pressure - strain, rotation, temperature , current and magnetic fields etc.- High speed communication (optical)& optical Networks

UNIT IV: OPTO ELECTRONIC DEVICES

Photonic devices - LEDs, lasers, photonic bandgap architectures, plasmons - Electronic devices – nanoscale FETs - nano/micro electromechanical systems, spin-based devices, memory elements integrated systems - Energy conversion – and storage - solar cells thermo electrics, piezo-electric devices.

UNIT IV: OPTOELECTRONIC ICs

Optoelectronic ICs-advantages-integrated transmitters and receivers -guided wave devices-Working of LDR-liquid crystal display-structure-TFT display-structure-organic LED.

UNIT VI: APPLICATIONS

Optical Electronics Supporting Application - LED based – Solar cell based-
Optical Fiber based– Laser Diode based Application.

Text Books:

1. C.K. Sarkar, Opto Electronics and Fiber optics communication, 2nd Edition, 2012, New Age International Pvt. Ltd.
2. Sheridan Libraries (JHU) – <http://www.library.jhu.edu>.

Reference Book:

1. Web of Science–<http://databases.library.jhu.edu/databases/proxy/JHU03259>.

e-book Links:

1. <https://www.elprocus.com/optoelectronics-devices-with-their-applications/>
2. <https://nptel.ac.in/courses/115/107/115107095/>

COURSE OUTCOME:

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

1. The fundamental theory of optical structure.
2. Fabrication methods of opto electronic material.
3. Different types of spectroscopy techniques.
4. Importance of material science.
5. Opto Electronic devices and its supporting applications.

Semester	Course Code			Title of the Paper						
I				OPTO ELECTRONIC MATERIAL AND 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	3
CO-2	3	3	3	2	2	2	2	3	3	3
CO-3	3	3	3	2	2	2	2	3	3	3
CO-4	3	3	3	3	2	2	2	3	3	3
CO-5	3	3	3	3	2	2	2	3	3	3

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

Year: I

GENERIC ELECTIVE COURSE 1

Semester: I

Code:

**1. NANO ELECTRONICS
(Theory)**

Credits: 3

COURSE OBJECTIVES:

1. To gain knowledge on comparing Electronics and Nano electronics.
2. To recall the basics Electronic Nanomaterial Properties.
3. To analyze the concepts of Nano - optics and Nano composite fibers.
4. To Evaluate the Operation of Nano sensors used in biomedical field.
5. To inculcate Nano machines and devices.

UNIT I: NANO ELECTRONICS

Fundamental Types of Electronic Materials and Nano materials – Fundamental Kinds of Electronic Devices - The Nano Perspective - Micro - electronics: Introduction to Band Structure - Basic Conductor and Semiconductor Physics - Transistors - Nano scale Electronics: Background - The Current State of Micro - Electronics and Extensions to the Nano scale - Nanotechnology - Based Strategies: Single - Electron Tunneling - Nanotechnology - Based Strategies: Molecular Wires

UNIT II: NANO STRUCTURES AND QUANTUM ELECTRONIC DEVICES

Low - dimensional structures: Quantum wells, Quantum wires and Quantum dots; Density of states in low - dimensional structures; Quantum Interference Devices: Split - Gate Transistor - Electron - Wave Transistor - Resonant tunneling phenomena and its applications in diodes and transistors.

UNIT II: MOSFETS AND NANO – OPTICS

Limitations of the conventional MOSFETs at Nanoscales, MOSFET Scaling & implications, Introductory concepts of Ballistic transport and Quantum confinement, Differences in Few Electron Devices (as analog version) and Single Electron Devices (as digital version) of Nano - Electronic devices - Nano - Optics - Interactions of Light with Matter - The Nano Perspective - The Surface - Plasmon - The Surface Plasmon Resonance - Scattering - Color Generation from Nanoparticles and Nanostructures - Applications of Nano plasmonics.

UNIT IV: NANO - COMPOSITES AND FIBERS

Physical and Chemical Properties of Materials - Mechanical Properties – Thermal Properties - Electronic Properties - Chemical Properties - Natural Nanocomposites - Skin of the Sea Cucumber - Hard Natural Nanocomposites - Carbon Fibers and Nanotubes - Types of Fibers, Whiskers, and Nanotubes - Synthesis of Fibers and Nanotubes - Chemical Modification of Carbon Nanotubes - Carbon Nanotube Applications

UNIT V: NANO MACHINES AND DEVICES

MEMSs – NEMSs – Fabrication – Resonant -tunneling diodes – Potential – effect Transistors – Quantum – Dot Cellular automata – Graphene batteries- Graphene wireless Sensor – Ultra

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

Current Nano - Electronic Devices: Quantum Effects in MOSFETs – Strained Silicon – Fully Depleted SOI - MOSFET - Double - Gate MOSFET - Multi – gate MOSFETs

Text Books:

1. G. L. Hornyak and J. J. Moore, Fundamentals of Nanotechnology (CRC Press, 2009).
2. S. Oda and D. Ferry, Nanaoscale Silicon Devices (CRC Press, 2015).
3. K. Gosser and P. Glosekotter, Nanoelectronics and Nanosystems (Springer, 2005).

Reference Books:

1. G. Cao. (Ed.), Nanostructures and Nanomaterials: Synthesis, Properties, and Applications, World Scientific Series in Nanoscience and Nanotechnology (World Scientific, 2011)
2. R. Leach, Fundamental Principles of Engineering Nanometrology (Elsevier, 2014)

e-book Links:

1. <https://ocw.mit.edu/courses/6-701-introduction-to-nano-electronics>
2. <https://nanohub.org/resources/series>

COURSE OUTCOMES:

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

CO 1: Gain the concepts of Nano electronics such as ballistic transport and quantum confinement.

CO 2: Understand various nanostructures and its applications towards quantum electronic devices.

CO 3: Design and simulate various advanced Nano - electronic devices.

CO 4: Design Nano – Sensor for Electronic Applications

CO 5: Use carbon nanotubes for various applications.

Semester	Course Code			Title of the Paper						
I				NANO 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	2	3	3	3
CO-2	3	3	3	2	2	2	2	3	3	3
CO-3	3	3	3	2	2	2	2	3	3	3
CO-4	3	3	3	3	2	2	3	3	3	3
CO-5	3	3	3	3	2	2	3	3	3	3

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

Year: I

GENERIC ELECTIVE COURSE 1

Semester: I

Code:

**2. SOLAR ELECTRICAL SYSTEM
(Theory)**

Credits: 3

COURSE OBJECTIVES:

1. To encourage the students to learn about solar electrical systems
2. To utilize this knowledge for using alternative sources instead non - renewable sources
3. To get the knowledge to construct the solar panels
4. To gain knowledge on solar batteries
5. To build solar panels.

UNIT I: SOLAR ENERGY AND PHOTOVOLTAICS

Introduction - The need to develop solar energy - A comparison of Solar energy with other renewable forms of energy - The future of Solar energy - Photo - Voltaic Manufacturing - Photovoltaic Technology - Light absorption in the materials and excess carrier generation - Photovoltaic effects and basic solar cell Parameters - Principles of Solar cell construction - Photovoltaic modules.

UNIT II: CONFIGURATIONS AND COMPONENTS OF SOLAR POWER

Four Configurations - Stand - Alone/off grid - Examples - Grid - tie - Examples - Grid fall back - Example - Grid fail over - Solar panels - Batteries - Controller - Inverter - Electrical devices - Low voltage and High voltage devices - A standalone system - A grid - tie system using single central inverter - using multiple micro - inverters - Design process - Short - cutting the design work.

UNIT III: INORGANIC AND ORGANIC PHOTO VOLTAICS

Semiconductor Silicon - Crystalline Silicon wafer fabrication - PV cell design and fabrication technology - Crystalline Si Module design - CdTe Solar cell - Layers, Processes - Voltage, doping and substrate cells - Thin film fabrication and formation - Perovskite Solar cell device structure - Device Optimization and stability issues - Organic photovoltaic - Operating Principles - Device structure - Up - Conversion - Down Conversion.

UNIT IV: SOLAR ELECTRICITY AND BATTERIES

Introduction - Common uses of Solar electricity - The Solar Resource - Converting solar energy - Solar radiation principles - Direct and Diffusion Radiation - Understanding and using Meteorological records - Angles, solar orientation and tracking the sun - - Concentrating solar energy - Trapping solar energy - I - V curve - Output solar cell module. Energy storage - Batteries - Principles and operations - Charge and discharge - State of Charge - Types of Lead - acid batteries - Improved automotive batteries - Stand - by batteries - Lead - Calcium maintenance free batteries - VRLA or Sealed Batteries.

UNIT V: SOLAR PANEL DESIGN

Calculating solar energy - calculating solar irradiance - Capturing more of the sun's energy - The impact of tilting solar panel on solar irradiance – calculating the optimum solar tilt - positioning the solar panels - panels and shade – The effect of temperature on solar panels - surveying the site - Ground mounting - Pole mounting - positioning batteries, controllers and inverters - cabling.

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

Water - Lithium Bromide Absorption chillers for Solar Cooling - Solar assisted Air - Conditioning systems - Solar food processing and cooking methodologies - Visual comfort Based Algorithmic Control for Roller shade - Solar updraft Tower - A potential for Future Renewable Power Generation.

Text Books:

1. T. M. Letcher and V. M. Fthnakis, A Comprehensive guide to Solar Energy Systems (Academic Press, 2018)
2. M. Boxwell, Solar Electricity Handbook (Green Stream Publishing, 2012)
3. H. Tyagi, A. K. Agarwal, P. R.Chakraborty and S. Powar, Applications of Solar Energy, 1st Ed. (Springer Publications, 2018)

Reference Books:

1. Varun Sivaram , Taming the Sun: Innovations to Harness Solar Energy and power the Planet, (MIT Press, 2018)
2. Mukund R. Patel, Omid Beik, Wind and Solar Power Systems: Design, Analysis and Operation, (2nd Ed. CRC Press, 2021)

e-book Links:

1. www.edx.org/learn/solar-energy
2. [www.nielit.gov.in/solar power -installation](http://www.nielit.gov.in/solar%20power%20installation)

COURSE OUTCOMES:

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

CO 1: Understand solar energy and its applications in various fields

CO 2: Initiate solar power related start - ups in future.

CO 3: Design Solar panels for electrical use

CO 4: Construct mini solar station for E – Vehicle charging

CO 5: Design solar roof for high level electricity generation.

Semester	Course Code			Title of the Paper						
I				SOLAR ELECTRICAL 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	2	2	2	2	3	3	3
CO-2	3	3	3	2	2	2	2	3	3	3
CO-3	3	3	3	2	2	2	2	3	3	3
CO-4	3	3	3	3	2	2	3	3	3	3
CO-5	3	3	3	3	2	2	3	3	3	3

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

Year: I	GENERIC ELECTIVE COURSE 1	Semester: I
Code:	3. ELECTROMAGNETIC THEORY (Theory)	Credits: 3

COURSE OBJECTIVES:

1. To learn the concepts of Electromagnetic fields and its importance.
2. To serve as the Prerequisite for understanding Transmission techniques
3. To know the principle of using Waveguides
4. To gain knowledge on highspeed electrical systems
5. To learn about bio electromagnetics

UNIT I: ELECTRO STATISTICS

Fundamental relations of the Electrostatic field - Gauss's law - The potential function - Field due to a continuous - Distribution of Charge - Equipotential Surfaces - Divergence Theorem - Poisson's Equation and Laplace Equation - Capacitance - Electrostatic Energy - Conditions at boundary between Dielectrics - The Electrostatic Uniqueness Theorem.

UNIT II: MAGNETIC FIELD AND MAXWELL EQUATIONS

Magnetic induction and Faraday's law - Magnetic flux density - Ampere's Law for a current Element - Volume distributions of Current and the Dirac delta - Ampere's force law - Analogies between Electric and Magnetic field - The equation of Continuity for Time - Varying fields - Maxwell's equations - Conditions at a Boundary Surface.

UNIT III: EM WAVES AND GUIDED WAVES

Solution for free - space conditions - Uniform plane - wave propagation - The wave Equations for a conducting medium - Poynting theorem - Waves between parallel planes - TE waves - TM waves - TEM waves - Impossibility of TEM waves in Rectangular guides - Velocities of propagation - Attenuation in parallel plane guides - Transmission lines.

UNIT IV: ELECTROMAGNETIC EFFECTS AND HIGH - SPEED ELECTRICAL SYSTEMS

Distributed systems - Speed and distance - Rise time and length: Lumped Vs. Distributed circuits - Knee frequency - Reflections in the presence of capacitance terminations - Inductance and capacitance - Electromagnetic interference - Desktop PC - CD player on jet aircraft.

UNIT V: BIO - ELECTROMAGNETICS

Introduction - The Axon: An active, lossless, shielded, noiseless transmission line - Retinal Optic Fibers - Heart dipole field - Defibrillators and pacemakers - Biological fields - Electric eel - Electric field of eel - Electromagnetic hazards and the environment.

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

EM survey unit - Storm fields and thunder cloud potentials - Solar power to food
- Solar power problems

Text Books:

1. E. C. Jordan, K. G. Balmain, Electromagnetic Waves and Radiating Systems, 2nd Ed. (PHI, 2015)
2. Kraus/Fleisch, Electromagnetics with Applications, 5th Edition (McGraw – Hill Publications, 2017)

Reference Books:

1. A.K. Saxena, Electromagnetic Theory and Applications, 2nd Ed. (Narosa Publishing House, 2009).
2. D. J. Griffiths, Introduction to Electrodynamics, 4th Ed. (Pearson Education, 1999)

e-book Links:

1. <https://ocw.mit.edu/courses/8-311-electromagnetic-theory-spring-2004/>
2. www.classcentral.com/swayam-electro-magnetic-theory-5223

COURSE OUTCOMES:

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

CO 1: Acquire in - depth knowledge of Electro statistics and Electro magnetic

CO 2: Apply Electromagnetic theory in communication systems

CO 3: Familiarize with applications in various fields

CO 4: Solve waveguide problems for the transmission of signals

CO 5: Utilize EM waves in safer way.

Semester	Course Code			Title of the Paper						
I				ELECTROMAGNETIC THEORY						
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	2	2	3	3
CO-2	3	3	3	2	2	2	2	2	3	3
CO-3	3	3	3	2	2	2	2	2	3	3
CO-4	3	3	3	3	2	2	3	2	3	3
CO-5	3	3	3	3	2	2	3	2	3	3

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

Year: I

SKILL ENHANCEMENT COURSE 1

Semester: I

Code:

**MOBILE PHONE SERVICING
(Theory)**

Credits: 2

COURSE OBJECTIVES:

1. To introduce the fundamentals of mobile phone hardware and software.
2. To familiarize students with mobile servicing tools and techniques.
3. To understand fault diagnosis and troubleshooting procedures.
4. To provide basic skills in smartphone maintenance and repair.
5. To learn knowledge on 4G and 5G network technologies.

UNIT I: INTRODUCTION TO MOBILE PHONES AND COMPONENTS

Evolution of mobile communication- Types of mobile phones and smart phones- Block diagram of a smartphone- Identification of mobile hardware components- PCB layout and SMD components Battery technologies and charging circuits- SIM, memory card, and connector interfaces.

UNIT II: MOBILE HARDWARE SERVICING TECHNIQUES

Mobile servicing tools and instruments- Soldering and desoldering techniques- Use of multimeter and DC power supply- PCB handling and ESD precautions- Connector replacement and jumper techniques- Display, microphone, speaker, and charging port servicing.

UNIT III: MOBILE SOFTWARE AND FLASHING

Mobile operating systems: Android and iOS overview- Firmware and boot process- Mobile flashing concepts- Factory reset and recovery modes- IMEI concepts and software issues- Backup and restoration techniques- Virus and malware protection.

UNIT IV: FAULT DIAGNOSIS AND TROUBLESHOOTING

Common mobile faults and symptoms- No power problem diagnosis- Charging problems and battery issues- Network and SIM-related faults- Audio and display troubleshooting- Water damage handling techniques- Heating and automatic restart problems.

UNIT V: ADVANCED MOBILE TECHNOLOGIES AND SERVICE PRACTICES

4G and 5G mobile technologies overview- Sensors used in smart phones- Fingerprint and face recognition systems- Mobile security and data privacy- Service centre procedures and customer handling- E-waste management and safe disposal practices.

UNIT VI: EMERGING TRENDS IN MOBILE TECHNOLOGY AND IOT APPLICATIONS

Introduction to Internet of Things (IoT) enabled mobile devices – Smart wearable devices and mobile integration – Mobile app-based device control systems – Basics of mobile communication protocols: Bluetooth, Wi-Fi, NFC, and GPS – Cloud storage and mobile synchronization – Introduction to mobile diagnostics applications and AI-assisted servicing tools – Future trends in foldable phones, AI smartphones, and sustainable mobile technologies.

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.

Reference Books:

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

COURSE OUTCOMES:

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

CO1: Students will be able to identify mobile phone components and explain the basic architecture of smart phones.

CO2: Students will be able to use servicing tools safely and perform basic hardware repair operations.

CO3: Students will be able to understand mobile software architecture and perform basic Software maintenance procedures.

CO4: Students will be able to diagnose common mobile phone faults and apply systematic troubleshooting procedures.

CO5: Students will be able to describe modern Smartphone technologies and follow professional service practices.

CO6: Students will be able to explain emerging mobile technologies, IoT integration concepts, and future trends in smartphone servicing and diagnostics.

Semester	Course Code			Title of the Paper						
I				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

Year: I	VALUE ADDED COURSE 1	Semester: I
Code:	INDUSTRIAL SAFETY AND DISASTER MANAGEMENT (Theory)	Credits: 2*

COURSE OBJECTIVES:

1. To encourage the students to learn safety measures while handling the instruments in industry.
2. To encourage the students to get the knowledge of handling unexpected situations.
3. To know to handle the protective equipment in proper way.
4. To get the awareness about the preparedness during disasters.
5. To involve in rehabilitation work as a volunteer.

UNIT I: ELECTRICAL SAFETY

Fuse-Circuit breakers and overload relays-Protection against over voltage and under voltage-Safe limits of Amperage-Overload and short circuit protection-No load protection-Earth fault protection-Electrical guards -Personal protective equipment.

UNIT II: FIRE PROTECTION SYSTEMS

Sprinkler hydrants and stand pipes-Deluge and Emulsifier-Alarm and detection Systems-CO₂ and foam systems-Smoke venting-Portable extinguishers-Tank Farms-Fire fighting systems.

UNIT III: SAFETY STRANGERS AND WELFARE MEASURES

Storage tanks and vessel-Venting and relief-LPG storages-Toxic storages-Underground storages-Wave house-Health hazards-Control measures-Personal protective equipment – Health and welfare measures-Special precautions for specific hazardous work places.

UNIT IV: DISASTER PREPAREDNESS

Disaster preparedness-ways and means-skills and strategies-rescue, relief and reconstruction- Rehabilitation-Preparedness and planning for an urban earthquake disaster.

UNIT V: DISASTER PREVENTION PROCEDURES

Role of remote sensing-Information systems and decision making tools-Voluntary Agencies-Community participation at various stages of disaster Management-School Awareness and safety programme.

UNIT VI: TRAINING AND MAINTENANCE OF AWARENESS

The need for Training-Training Policy-Types of training and Trainee categories - Implementation of Training-Public Education-The importance of Public awareness-Maintenance of awareness level.

Text Books:

1. Akhilkumar das, Principles of Industrial Safety Management: Understanding the Ws of Safety at Work ,2021, Prentice Hall of India
2. R.K. Jain Sunil S.Rao, Industrial Safety, Health And Environment, Management Systems, 2000, Khanna Publishers.
3. Mirunalini Pandey, Disaster Management, IInd Ed., 2023, Wiley Publication

Reference Books:

1. Carsten Busch, Preventing Industrial Accidents, 2021, Taylor & Francis Publications
2. Ali Farazmand, Crisis and Management :Theory and Practice, IInd Edition, 2017, Taylor & Francis Publications.

e-book link:

nptel.ac.in/courses/110105094

COURSE OUTCOMES:

On the completion this course, Students will be able:

CO1: To get the awareness of an industrial safety in work place.

CO2: To know to handle the instruments in safe way.

CO3: To involve themselves in rehabilitation work during emergency.

CO4: To create awareness among the public about safety measures.

CO5: To maintain high awareness level during disaster.

Semester	Course Code			Title of the Paper						
I				INDUSTRIAL SAFETY AND DISASTER MANAGEMENT						
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

Year: I

CORE COURSE 3

Semester: II

Code:

**CONTROL SYSTEM
(Theory)**

Credits: 4

COURSE OBJECTIVES:

1. Convert physical and mechanical processes into simplified mathematical representations, specifically differential equations and transfer functions.
2. Simplify complex feedback structures using block diagram algebra and signal flow graphs.
3. Determine the transient and steady-state behaviour of a system.
4. Stability Evaluation: Assess the stability of a system using analytical tools.
5. Design and tune basic controllers to meet specific performance criteria.

UNIT I: INTRODUCTION TO CONTROL SYSTEM MODELLING

Introduction: Open-loop vs. Closed-loop systems, advantages of feedback. Physical Modeling: Deriving transfer functions for electrical, mechanical (translational and rotational), thermal, and fluid systems. System Reduction: Block diagram reduction rules and signal flow graphs (SFG). Mason's Gain Formula

UNIT II: TIME DOMAIN & ERROR ANALYSIS

Standard Test Signals: Step, ramp, impulse, and parabolic inputs. System Orders: Response of first-order and second-order systems. Transient Response Specifications: Damping ratio, natural frequency, rise time, peak time, and settling time. Steady-State Error: Error coefficients and generalized error series.

UNIT III: STABILITY ANALYSIS

Concept of Stability: Bounded-Input, Bounded-Output (BIBO) stability. Routh-Hurwitz Criterion: Criteria for stability and special cases. Root Locus Concept: Rules for constructing root loci. Effects of adding open-loop poles and zeros to the system.

UNIT IV: FREQUENCY DOMAIN ANALYSIS

Frequency Response: Frequency domain specifications (resonant peak, resonant frequency, bandwidth). Graphical Techniques: Bode plots, Polar plots. Nyquist Criterion: Mapping and stability analysis. Stability Margins: Calculation of Gain Margin (GM) and Phase Margin (PM).

UNIT V: CONTROLLERS AND THEIR APPLICATIONS

Classical Control Design: Introduction to Lead, Lag, and Lag-Lead compensators. PID Controllers: Tuning of Proportional, Integral, and Derivative controllers.

Text Books:

1. "Modern Control Engineering" by Katsuhiko Ogata, Prentice Hall India limited, 5th Edition, 2010, ISBN-10: 013615 6738.
2. "Control Systems – Principles and Design", by M.Gopal, McGrawhil, Indian Edition, 4th Edition-2012, ISBN-10: 007133 266.

Reference Book:

1. "Advanced control Theory," by A.NagoorKani, CBS Publications, 3rd Edition, 2020, ISBN – 13: 9789389688177.

COURSE OUTCOMES:

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

1. Troubleshoot and optimize industrial processes.
2. Create new ideas in common applications which include Robotics and automation.
3. Design motion control systems to achieve accurate positioning.
4. Using feedback loops and controllers to maintain constant industrial parameters.
5. Calibrating speed controllers, braking systems, and autonomous navigation inputs.

Semester	Course Code			Title of the Paper						
II				CONTROL 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	3	2	2	3
CO-2	3	3	3	1	2	2	3	2	2	3
CO-3	3	3	3	1	2	2	3	3	3	3
CO-4	3	3	3	3	2	2	3	2	3	3
CO-5	3	3	3	3	2	2	3	3	3	3

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

Year: I

CORE COURSE 4

Semester: II

Code:

**ADVANCED MICROCONTROLLERS
(Theory)**

Credits: 4

COURSE OBJECTIVES:

1. To learn about Hardware parts and architecture of PIC microcontroller
2. To learn PIC assembly language programming, C programming, and the use of development tools for program development, simulation, debugging, and testing.
3. To design and implement embedded systems using PIC microcontrollers with appropriate hardware and software integration.
4. To develop interfacing techniques between PIC microcontrollers and external peripherals such as switches, displays, LCDs, sensors, communication modules, and wireless devices.
5. Students will learn to connect microcontrollers to external physical devices and master both assembly and C programming architectures.

UNIT - I: PIC MICROCONTROLLERS-ARCHITECTURE:

PIC Microcontrollers - PIC hardware - Processor - Memory - Input and Output - PIC 16F877A pin out - Architecture - PIC Instruction - SFR - Program Counter - Status Register - Ports - Timers - Indirect Addressing - Interrupt Control - Peripheral Control.

UNIT - II: PROGRAM WRITING, DOWNLOADING, TESTING AND TOOLS:

Simple PIC program - Writing the program - Simulation of LED - Downloading and Testing - In - circuit programming and Debugging-ICPD hardware-LED1 Program Testing - Development steps - Assembling Language - Assembler Code - Syntax - MCU Configuration - PIC Instruction set - Processor Directive-CONFIG Directive- Typical Configurations- PIC instruction set -Instruction Type - Program Execution - Program structure - Software Design - C Programming

UNIT - III: PIC MICROCONTROLLER DESIGN:

Application Design and test-Schematic Capture - Circuit simulation-Software Debugging-Source Debug window - other debug window - Hardware design - NET list - PCB layout - Hardware requirements - ICPD requirements - ICPD testing PIC 16F877a Electrical Characteristics

UNIT - IV: PIC INTERFACING:

Switch inputs-Display outputs-Keypad system-LCD-Analogue Interfacing -Analog input -Op-Amp Interfacing-Relay Interfaces-Serial Communications-USART-I2C-Network links-USB-CAN bus Ethernet-Wireless links-Wi-Fi-Zigbee

UNIT - V: AVR MICROCONTROLLER:

AVR Microcontroller Architecture-Register-ROM space and other Hardware modules-Addressing modes-Assembly Language Programming-Instruction set-

Data types-Simple programs- I/O port Programming - Time delay loop - Look - Up table - Programming in C language.

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

AVR Interfacing Programs: Moving On programs - Servo motor – Sensor switches - Intelligent devices - Digitally speaking - Error checking – talking Tokens - Object models - Implementing a tokenized object model in AVR - Tokenization

Text Books:

1. Martin Bates, “Interfacing PIC Microcontrollers, Embedded Design by Interactive Simulation”, Newnes Publications , 2nd Edition, 2016
2. Muhammad Ali Mazidi, Sermad Naimi, Sepehr Naimi, “The AVR Microcontroller and Embedded Systems using Assembly and C” Pearson Publications, Second Ed.2017
3. Alan Trevennor, “Practical AVR Microcontrollers” Springer Publications. A press, I st Edition, 2012

Reference Books:

1. John B. Peatman, “Design with PIC Microcontroller “Pearson Publications, India, 2002
2. Julio Sanchez and Maria P. Canton, “Microcontroller Programming, The Microchip PIC”, CRC Press, 2018

E-book Links:

1. <http://www.microchip.com>
2. www.circuitstoday.com/avr-microcontroller-tutorial

COURSE OUTCOMES:

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

CO1: Explain the architecture, memory organization, instruction set, and peripheral modules of PIC microcontrollers.

CO2: Develop, simulate, debug, and test PIC programs using Assembly and C language with appropriate development tools.

CO3: Design PIC-based embedded hardware systems and perform circuit simulation, PCB design, and in-circuit programming/debugging.

CO4: Interface PIC microcontrollers with input/output devices, communication protocols, and wireless technologies to develop embedded applications.

CO5: Demonstrate knowledge of AVR microcontroller architecture, addressing modes, instruction set, and programming in Assembly and C.

Semester	Course Code			Title of the Paper						
II				ADVANCED 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	2	2	2	2	3	3	3
CO-2	3	3	3	2	2	2	2	3	3	3
CO-3	3	3	3	2	2	2	2	3	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

Year: I

CORE PRACTICAL 2

Semester: II

Code:

**ADVANCED MICROCONTROLLERS LAB
(Practical)**

Credits: 4

Any Twelve Experiments

COURSE OBJECTIVES:

To expertise in microcontrollers and Interfacing various I/O devices.

LIST OF EXPERIMENTS

1. Arithmetic and Logical operations using ALP
2. Square wave generation
3. Interfacing LCD
4. Interfacing Stepper motor
5. Interfacing Key Board
6. Interfacing Relay
7. Angle control of Stepper motor
8. Speed control of DC motor
9. Serial Communication using RS232
10. RTC interfacing using I2C protocol
11. USB Communication
12. Study of ports in AVR microcontroller with DIP switch
13. Study of LED pattern generation using AVR microcontroller
14. Study of Matrix display using AVR microcontroller
15. Interfacing PWM in AVR microcontroller to control the speed of a DC motor.
16. Study of in-built ADC in AVR microcontroller.
17. Sampling and aliasing in PDSP kit
18. Implementation of FIR filter in PDSP kit.
19. Decoder circuit implementation in FPGA
20. Fourbit counter implementation in FPGA
21. PLC based Light control circuit
22. PLC based Motor control circuit

Year: I DISCIPLINE CENTRIC ELECTIVE COURSE 2 Semester: II

Code: 1. ARTIFICIAL INTELLIGENCE AND MACHINE Credits: 4
LEARNING
(Theory)

COURSE OBJECTIVES:

1. Understand fundamentals of AI and ML.
2. Apply machine learning algorithms to electronics applications.
3. Develop intelligent systems using AI techniques.
4. Introduce deep learning and embedded AI concepts.
5. Enable students to work on AI-based electronics projects.

UNIT I: INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Introduction to Artificial Intelligence- History and evolution of AI- AI vs ML vs Deep Learning- Applications of AI in Electronics- Intelligent agents and environments- Problem solving and search techniques- Knowledge representation- Introduction to Machine Learning- Types of Machine Learning: Supervised Learning, Unsupervised Learning, Reinforcement Learning.

UNIT II: DATA PROCESSING AND FEATURE ENGINEERING

Data collection and preprocessing- Data cleaning and normalization- Feature extraction techniques-Dimensionality reduction- Principal Component Analysis (PCA) - Feature selection methods- Training, validation and testing datasets- Performance metrics: Accuracy, Precision, Recall, F1-score.

UNIT III: MACHINE LEARNING ALGORITHMS

Supervised Learning: Linear Regression, Logistic Regression, Decision Trees, Random Forest, Support Vector Machine (SVM), K-Nearest Neighbour (KNN), Naive Bayes Classifier-Unsupervised Learning: K-Means Clustering, Hierarchical Clustering-Model Evaluation: Confusion Matrix, Cross Validation, Bias and Variance.

UNIT IV: NEURAL NETWORKS AND DEEP LEARNING

Biological neuron model - Artificial Neural Networks (ANN)- Perceptron model - Multilayer neural networks- Backpropagation algorithm- Activation functions- Introduction to Deep Learning- Convolutional Neural Networks (CNN)- Recurrent Neural Networks (RNN)- Introduction to TensorFlow/Keras.

UNIT V: AI APPLICATIONS IN ELECTRONICS

AI in Embedded Systems- Edge AI and TinyML- AI for IoT systems- Smart surveillance systems- AI in communication systems- AI-based signal and image processing- Intelligent control systems- Robotics and autonomous systems- Case studies in Electronics AI applications

UNIT VI: NATURAL LANGUAGE PROCESSING

Text pre-processing- Tokenization- Sentiment analysis- Chat bots- Speech recognition basics

Text Books:

1. Stuart J. Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, **Pearson education (2022) fourth edition.**
2. Tom M. Mitchell, Machine Learning, McGraw Hill, (1997)

COURSE OUTCOMES:

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

CO1: Understand the fundamental concepts of Artificial Intelligence and Machine Learning and their applications in electronics systems.

CO2: Apply data preprocessing, feature engineering, and performance evaluation techniques for machine learning models.

CO3: Implement supervised and unsupervised machine learning algorithms for solving electronics-related problems.

CO4: Develop basic neural network and deep learning models using modern AI frameworks.

CO5: Analyze and apply AI techniques in embedded systems, IoT, robotics, and intelligent electronic applications.

CO6: Demonstrate knowledge in advanced AI domains such as NLP.

Semester	Course Code			Title of the Paper						
II				ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING						
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	2	3	3
CO-2	3	3	3	1	2	2	2	2	3	3
CO-3	3	3	3	1	2	2	2	2	3	3
CO-4	3	3	3	1	2	2	2	2	3	3
CO-5	3	3	3	1	2	3	3	3	3	3

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

Year: I	DISCIPLINE CENTRIC ELECTIVE COURSE 2	Semester: II
Code:	2. AUTOMOTIVE ELECTRONICS (Theory)	Credits: 4

COURSE OBJECTIVES:

1. To analyze and understand the electronics systems in modern automobile
2. To understand the operation and function of automotive communication protocols
3. To familiarize the hybrid and electric vehicles.
4. To learn about various types of sensors used in vehicles.
5. To familiarize with Electric and hybrid vehicles.

UNIT I: AUTOMOTIVE INDUSTRY

Introduction to Automotive Industry and Modern Automotive Systems - Vehicle classifications and specifications - need for electronics in automobiles - Application of electronics in automobiles - Current trends in modern automobiles - Component electronic engine management - Electronic management of chassis system- Vehicle motion control- Free scale controller's families .

UNIT II: AUTOMOTIVE SENSORS

Airflow rate sensor-Strain Gauge MAP sensor-Engine Crankshaft Angular Position Sensor-Magnetic Reluctance Position Sensor-Hall effect Position Sensor-shielded Field Sensor, Optical Crankshaft Position Sensor, Throttle Angle Sensor (TAS), Engine Coolant Temperature (ECT) Sensor, Exhaust Gas Oxygen (O₂/EGO) Lambda Sensors-Piezoelectric Knock Sensor.

UNIT III: CAN PROTOCOL

Controller Area Network (CAN) Protocol: History and foundation of CAN- CAN Applications -Main characteristics of CAN- CAN in OSI Reference Model- CAN Data Link Layer- Principles of data exchange in CAN- Arbitration - Data Frame - Remote Frame- Error detection and management in CAN - CAN physical Layer- bus length -Single wire - twin wire media- CAN repeaters - Protocol handlers- Micro-controllers and line drivers .

UNIT IV: LOCAL INTERCONNECT NETWORK (LIN) AND FLEXRAY PROTOCOL

Introduction to LIN - LIN specification - LIN features - Technical overview, Work flow concept- LIN operation - LIN frame format - Scheduling table- Network management of LIN cluster-LIN Transport Layer- LIN node configuration and identification- LIN physical layer-Flex-Ray Protocol- Need for Flex-Ray- Flex-Ray Objectives- Flex-Ray Features- Application requirements -Working of Flex-Ray Network topologies.

UNIT V: HYBRID AND ELECTRIC VEHICLES

Battery Technology: Energy density of various energy sources - storage devices- basics of battery- working principle- construction - good practices of battery maintenance - Other Energy Storage Devices for Hybrid Vehicles: Super capacitor - Ultra capacitor - fly wheel technology Electric Vehicle (EV): Requirement of drive train of EV - various configurations of drive train in EV .

UNIT VI: APPLICATIONS

AUTOSAR - transmissions systems - motor sizing for EV -transmission requirement - general EV configuration - Energy consumption pattern in EV- driving pattern in EV - control of EV. Applications: Collision Avoidance Radar warning Systems, Low tire pressure warning system, Heads Up display, Speech Synthesis, Navigation –Navigation Sensors - Radio Navigation

Text Books:

1. William B. Ribbens, —Understanding Automotive Electronics, 6th Edition, 2017,Elsevier Publishing.
2. Thandavarayan Maiyalagan, Perumal Elumalai, Rechargeable Lithium-Ion batteries: Trends and progress in Electric vehicles, 1st Ed. 2022, CRC Press.

References:

1. Robert Bosch Gmbh (Ed.) Bosch Automotive Electrics and Automotive Electronics,5th edition, 2014, Springer Nature.
2. JorgSchauffele and Thomas Zurawka, Automotive Software Engineering Principles, Processes Methods and Tools, SAE International Publishers.
3. A.K. Babu, Automotive Electrical and Electronics, 1st Ed., 2018,Khanna Publishing.

Online link:

Automotive Electrical Systems And Components Technology | Coursesity

COURSE OUTCOMES:

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

1. To understand the various electronic circuits involved in automobile industry.
2. To get the thorough knowledge of automotive sensors.
3. To familiarize the software used in vehicles.
4. To know the use of batteries in vehicles.
5. To utilize the electronic components in Electric vehicles.

Semester	Course Code			Title of the Paper						
II				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

Year: I

GENERIC ELECTIVE COURSE 2

Semester: II

Code:

**1. PYTHON PROGRAMMING
(Theory)**

Credits: 3

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
5. To update knowledge on systems and networks

UNIT 1: INTRODUCTION

Python: Introduction – Numbers – Strings – Variables – Lists – Tuples – Dictionaries – Sets– Comparison.

UNIT II: CODE STRUCTURES

Code Structures: if, elif, and else – Repeat with while – Iterate with for – Comprehensions – Functions – Generators – Decorators – Namespaces and Scope – Handle Errors with try and except – User Exceptions.

UNIT III: MODULES, PACKAGES AND CLASSES

Modules, Packages, and Programs: Standalone Programs – Command-Line Arguments – Modules and the import Statement – The Python Standard Library. Objects and Classes: Define a Class with class – Inheritance – Override a Method – Add a Method – Get Help from Parent with super – In self Defense – Get and Set Attribute Values with Properties – Name Mangling for Privacy – Method Types – Duck Typing – Special Methods –Composition.

UNIT IV: DATA TYPES AND WEB

Data Types: Text Strings – Binary Data. Storing and Retrieving Data: File Input/Output – Structured Text Files – Structured Binary Files – Relational Databases – NoSQL Data Stores. Web: Web Clients – Web Servers – Web Services and Automation

UNIT V: SYSTEMS AND NETWORKS

Systems: Files –Directories – Programs and Processes – Calendars and Clocks. Concurrency: Queues – Processes – Threads – Green Threads and gevent – twisted – Redis. Networks: Patterns – The Publish-Subscribe Model – TCP/IP – Sockets – ZeroMQ –Internet Services – Web Services and APIs – Remote Processing – Big Fat Data and MapReduce – Working in the Clouds.

UNIT VI: CONTEMPORARY ISSUES

Expert lectures, online seminars – webinars

Text Books:

1. Bill Lubanovic, "Introducing Python", O'Reilly, First Edition-Second Release, 2014.
2. Mark Lutz, "Learning Python", O'Reilly, Fifth Edition, 201

Reference Books:

1. David M. Beazley, "Python Essential Reference", Developer's Library, Fourth Edition, 2009.
2. Sheetal Taneja, Naveen Kumar, "Python Programming-A Modular Approach", Pearson Publications.

e-book Links:

1. <https://www.programiz.com/python-programming/>
2. <https://www.tutorialspoint.com/python/index.htm>
3. https://onlinecourses.swayam2.ac.in/aic20_sp33/preview

COURSE OUTCOMES:

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

1. Understand the basic concepts of Python Programming
2. Understand File operations, Classes and Objects
3. Acquire Object Oriented Skills in Python
4. Develop web applications using Python
5. Develop Client Server Networking applications

Semester	Course Code			Title of the Paper						
II	GEC2(1)			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

Year: I

GENERIC ELECTIVE COURSE 2

Semester: II

Code:

**2. RASPBERRY PI PROGRAMMING
(Theory)**

Credits: 3

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 analyze and design projects and applications.

UNIT I: INTRODUCTION TO RASPBERRY PI AND LINUX BASICS

Introduction to embedded systems and single-board computers- Overview of Raspberry Pi Foundation and Raspberry Pi boards- Features and specifications of Raspberry Pi 4 Model B- Raspberry Pi architecture and GPIO overview- SD card preparation and OS installation- Introduction to Raspberry Pi OS- Linux commands and terminal usage - File management and shell scripting basics- Network configuration and remote access using SSH and VNC.

UNIT II: PYTHON PROGRAMMING FOR RASPBERRY PI

Introduction to Python programming- Variables, data types, operators, and expressions- Conditional statements and loops- Functions and modules- File handling in Python- Exception handling- Introduction to GPIO programming using Python- Controlling LEDs and relays using GPIO- Push button interfacing and event handling.

UNIT III: SENSOR AND DISPLAY INTERFACING

Digital and analog interfacing concepts- Temperature and humidity sensor interfacing- Ultrasonic sensor interfacing- PIR sensor and motion detection- Interfacing ADC modules- LCD and OLED display interfacing- Servo motor and buzzer interfacing- Camera interfacing using Raspberry Pi Camera Module Image capture and video streaming basics.

UNIT IV: COMMUNICATION AND IOT APPLICATIONS

Serial communication concepts-UART, I2C, and SPI protocols-Wi-Fi and Bluetooth communication-Introduction to IoT systems-Sending sensor data to cloud platforms-MQTT protocol basics-Web server creation using Python Flask-Mobile notification and remote monitoring applications-Smart home automation concepts.

UNIT V: ADVANCED RASPBERRY PI APPLICATIONS AND PROJECTS

Open CV basics with Raspberry Pi- Face detection and object recognition overview- Voice assistant concepts- Data logging applications- Raspberry Pi in robotics and automation- Industrial and consumer applications- Cyber security basics for IoT devices- Mini project development using Raspberry Pi- Documentation and project presentation.

UNIT VI (OPTIONAL): RASPBERRY PI SYSTEM ADMINISTRATION AND EDGE COMPUTING

System performance optimization – Process management and resource monitoring – Shell scripting for automation – Package installation and software management – Introduction to edge computing concepts – Raspberry Pi as an edge device – Containerization basics using Docker on Raspberry Pi – Deployment of edge-based IoT applications

Text Books:

1. Simon Monk, *Programming the Raspberry Pi: Getting Started with Python*. (2013) Mc Graw Hill Education.
2. Simon Monk, *Raspberry Pi Cookbook*, (2016) O'Reilly Media.
3. Derek Molloy, *Exploring Raspberry Pi*, (2016) Wiley Publishers.

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

COURSE OUTCOMES:

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.

Semester	Course Code			Title of the Paper						
II				RASPERRY 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

Year: I

GENERIC ELECTIVE COURSE 2

Semester: II

Code:

**3. RADAR AND SATELLITE COMMUNICATION
(Theory)**

Credits: 3

COURSE OBJECTIVES:

1. To familiarize the basic principles of radar
2. To acquire the knowledge about Satellites.
3. To learn the importance of Radar and Satellite in modern Communication era
4. To gain knowledge on satellite system
5. To design using satellite link

UNIT I: INTRODUCTION TO RADAR

Introduction to radar - Radar block diagram and operation - Radar frequencies - Applications of radar - Prediction of range performance - Minimum detectable signal - Receiver noise - Probability density function - SNR - Integration of radar pulses - Radar cross - section of targets - PRF and range ambiguities - Transmitter power - System losses.

UNIT II: RADAR TECHNOLOGY

Doppler Effect - CW radar, FM CW radar, Multiple frequency CW radar, MTI radar - Delay line canceller - Range gated MTI radar - Blind speeds - Staggered PRF - Limitations to the performance of MTI radar - Non - coherent MTI radar; Tracking radar: Sequential lobing - conical scan; Monopulse: Amplitude comparison and phase comparison methods - Radar antennas - Radar displays.

UNIT III: INTRODUCTION TO SATELLITE COMMUNICATION

Orbital aspects of Satellite Communication: Introduction to geo - synchronous and geo - stationary satellites - Kepler's laws - Locating the satellite with respect to the earth - Sub - satellite point - Look angles - Mechanics of launching a synchronous satellite - Orbital effects - Indian scenario in communication satellites.

UNIT IV: SPACECRAFT AND EARTH STATION

Satellite sub - systems: Attitude and orbit control systems - Telemetry - Tracking and command control system - Power supply system - Space craft antennas - Multiple access techniques - comparison of FDMA, TDMA, and CDMA - Earth station equipment - tracking systems.

UNIT V: SATELLITE LINK DESIGN

Introduction to satellite link design, basic transmission theory, system noise temperature and G/T ratio, design of down link and uplink, design of satellite links for specified C/N, satellite data communication protocols.

UNIT VI: CURRENT CONTOURS (FOR CONTINUOUS INTERNAL ASSESSMENT ONLY)

Air borne systems – Space radar systems – Ground to Air systems – Remote sensing applications – Small satellites – Satellite IoT – Nano Sat bases IoT systems -Orbital Transfer Vehicles (OTV)

Text Books:

1. M. I. Skolnik, Introduction to Radar Systems, 2nd Ed. (McGraw - Hill, 1981).
2. M. A. Richards, J. A. Scheer and W. A. Holm, Principles of Modern Radar: Basic Principles (YesDee Publishing Pvt. Ltd., 2012).
3. B. Edde, Radar: Principles, Technology, Applications (Pearson, 2008).
4. T. Pratt and C. Bostian, Satellite Communications (John Wiley, 1986).

Reference Books:

1. D. Roddy, Satellite Communications (McGraw Hill, 2009).
2. N. Kingsley and J R Guerch, Radar RF Circuit Design (Artech House, 2016)
3. M. Richaria, Satellite Communication Systems (Macmillan Publishers Ltd., 1998)

e-book Links:

1. www.ll.mit.edu/outreach/radar-introduction-radar-systems
2. www.jpl.nasa.gov/edu/teach/activity/build-a-satellite

COURSE OUTCOMES:

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

CO 1: Know the fundamentals of Radar system

CO 2: Use doppler effect in Radar communication

CO 3: Familiarize with different types of Radar

CO 4: Know the working principles of satellite

CO 5: Utilize this knowledge in designing small satellites

Semester	Course Code			Title of the Paper						
II				RADAR AND SATELLITE COMMUNICATION						
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

Year: I

SKILL ENHANCEMENT COURSE 2

Semester: II

Code:

**LAPTOP SERVICING
(Theory)**

Credits: 2

COURSE OBJECTIVES:

1. To understand laptop architecture and operating systems.
2. To develop skills in laptop troubleshooting and maintenance.
3. To perform hardware and software repair operations.
4. To diagnose and resolve common laptop performance and connectivity issues.
5. To gain knowledge displays and graphics.

UNIT I: INTRODUCTION TO LAPTOP REPAIR AND MAINTENANCE

Getting to know laptop- Basic repair tools- laptop anatomy-understanding operating system- system setting and updates-Common issues and fixes- Diagnosing hardware issues

UNIT II: BATTERY AND HARDWARE MAINTENANCE

Maximizing battery power- Replacing batteries-optimizing charging cycles- Enhancing charging efficiency-cleaning and upgrading the keyboard and mouse- upgrading memory and storage- common component issues and replacements – Assessing heat and power issues.

UNIT III: SOFTWARE AND CONNECTIVITY

Installing and configuring operating system – customizing software-virus and malware detection and protection-troubleshooting driver and compatibility issues- wifi and charging- setting up Bluetooth and networking- troubleshooting common connectivity issues- cloud services.

UNIT IV: REPAIRS AND UPGRADES

Part selection and replacement tips- Maintenance tips-professional repair- external repairs and enhancements-identifying system error- solving common system problem- improving system performance.

UNIT V: DISPLAY AND GRAPHICS

Assessment and repair tips-optimizing display settings and resolution- upgrading video and audio components-troubleshooting distorted graphics.

UNIT VI: EMERGING TRENDS IN LAPTOP TECHNOLOGY AND IOT APPLICATIONS

Modern laptops and IoT systems - Edge AI, 5G/Wi-Fi 7 connectivity, and Digital Twins. (NPU) -local machine learning IoT- decentralized intelligence and real-time, low-latency automation in healthcare and smart cities.

Text Books:

1. PS publishing, Laptop Repair & Maintenance, (2023)
2. Charles flores, The Repair Handbook: A Comprehensive Guide to Laptop and PC Troubleshooting and Hard Drive Repair, (2024)

COURSE OUTCOMES:

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

CO1: Students will be able to identify laptop components, use servicing tools, and diagnose common hardware issues safely.

CO2: Students will be able to maintain laptop hardware, replace components, and troubleshoot battery, heat, and power-related issues.

CO3: Students will be able to configure operating systems, manage software, and troubleshoot laptop connectivity and security issues.

CO4: Students will be able to perform laptop repairs, upgrades, and preventive maintenance to improve system performance.

CO5: Students will be able to diagnose and repair display and graphics-related problems in laptops.

Semester	Course Code			Title of the Paper						
II				LAPTOP 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

Year: I

NON-MAJOR ELECTIVE COURSE 1

Semester: II

Code:

**HOME APPLIANCES
(Theory)**

Credits: 2

COURSE OBJECTIVES:

1. To provide an in-depth understanding of the principles of household appliances
2. To learn internal architecture, and diagnostic procedures of household appliances
3. To analyze mobile devices, digital office equipment, and digital access networks.
4. Students will learn to troubleshoot hardware faults
5. To understand control mechanisms (like fuzzy logic and microprocessors), and grasp the functionalities of modern networked systems

UNIT I: MICROWAVE OVENS Microwaves - Properties and generation - Microwave oven block diagram - LCD timer with alarm - Controllers - Wiring and Safety instructions - Care and Cleaning

UNIT II: WASHING MACHINES Electronic controller for washing machines - Washing machine hardware and software - Types of washing machines - Fuzzy logic washing machines - Features of washing machines.

UNIT III: MOBILE PHONES Power section - Charging Section - Audio Section - Network Section - Display Section - Light Section - Keyboard Section - Replacing of Faulty Chips using Rework Station

UNIT IV: HOME / OFFICE DIGITAL DEVICES Facsimile machine - Xerographic copier - Calculators - Structure of a calculator - Internal Organization of a calculators - Servicing electronic calculators - Digital clocks - Block diagram of a digital clock

UNIT V: DIGITAL ACCESS DEVICES **Digital computer** - Internet access - Online ticket reservation - Functions and networks - Barcode Scanner and decoder - Electronic Fund Transfer - Automated Teller Machines (ATMs) - Set-Top boxes - Digital cable TV - Video on demand

UNIT VI: SMART HOME INTEGRATION & ENERGY EFFICIENCY

Smart Appliances: IoT connectivity, Wi-Fi modules, sensors, and remote app troubleshooting. Bureau of Energy Efficiency (BEE) star ratings and calculation of EER/ISEER.

Inverter Technology: Variable speed compressors and motors for power saving. Maintenance & E-Waste: Preventive maintenance schedules and safe electronic waste disposal.

Text Books:

1. S.P. Bali, Consumer Electronics, Pearson Education, New Delhi, 2005.
2. Manahar Lotia, Pradeep Nair & Shailesh Tank, Modern Mobile Phone Repairing Using Computer S/W & Service Devices, BPB Publications, 2006.

Reference Books:

1. Sanjib Pandit, Advance Mobile Repairing: Multicolour Circuits, Service Diagrams & Repairing, BPB Publications, 2010.

COURSE OUTCOMES:

CO1: Explain Appliance Architecture: Describe the working principles, block diagrams, and operational features of microwave ovens, washing machines, and digital home devices.

CO2: Understand Control Mechanisms: Identify the role of controllers, microprocessors, and fuzzy logic systems in automating modern electronic appliances.

CO3: Troubleshoot & Repair: Diagnose faults in mobile phone sections, calculators, and other digital devices, and perform chip-level replacements using rework stations.

CO4: Appreciate Digital Networking: Understand the fundamental structures of data access technologies, including ATMs, electronic fund transfers (EFT), set-top boxes, and online reservation networks.

CO5: Ensure Safety & Maintenance: Implement safety protocols, wiring standards, and routine care/cleaning practices for electronic equipment.

Semester	Course Code			Title of the Paper						
II				HOME APPLIANCES						
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

Year: II

CORE COURSE 5

Semester: III

Code:

**VLSI TECHNOLOGY
(Theory)**

Credits: 4

COURSE OBJECTIVES:

1. To encourage the students to learn Analog and Digital circuits design methods.
2. To get the knowledge to develop designing skills in Analog and digital circuits.
3. To know the important circuit operations.
4. To enhance the knowledge to differentiate between combinational and sequential circuits
5. To design the required analog and digital circuits for the specific applications.

UNIT I: MOSFET DEVICES

Physical Structure of the MOSFET The Threshold Voltage V_t - The n-Channel Characteristic -The i-v Characteristics of MOSFETs - MOSFETs in Resistive Dc Circuits - The MOSFET as an Amplifier/Switch - Small-Signal Operation of the MOSFET- Basic MOSFET Voltage Amplifiers - MOSFET Voltage and Current Buffers - The CMOS Inverter/Amplifier- SPICE Models for MOSFET's .

UNIT II: ANALOG INTEGRATED CIRCUITS

The mA741 Operational Amplifier -The Two-Stage CMOS Operational Amplifier - The Folded-Cascade CMOS Operational Amplifier -Voltage Comparators -Current and Voltage References -Current-Mode Integrated Circuits -Fully Differential Operational Amplifiers -Switched-Capacitor Circuits - SPICE Macro-Models.

UNIT III: COMBINATIONAL CIRCUIT DESIGN

Combinational Logic- Design of Half adder and Half subtractor- Design of Full adder and Full subtractor-Design of look- ahead carry generator-Design of BCD adder- Design of Series and parallel adder- Design of Multiplexer and demultiplexer- Design of encoder and decoder- Design of arithmetic circuits and ALU.

UNIT IV: SEQUENTIAL CIRCUIT DESIGN

Sequential Logic-Design of Level and edge-triggered flip-flops -RS flip-flop-D flip-flop-JK flip-flop- T flip-flop-timing specifications of flip-flops- characteristic table and equation of flip-flops-excitation table.

UNIT V: REGISTERS AND COUNTERS DESIGN

Registers and Counters- Design of Registers-Shift Registers- Bi-directional shift registers- Design of Counters-Ripple and Synchronous Counters-Ring and Johnson counters.

UNIT VI: APPLICATIONS (FOR INTERNAL ASSESSMENT ONLY)

Multiplexing - Displays - frequency - Counters - Time measurement - Digital voltmeters- A simple Computer design - Building blocks - Register Transfer language - Execution of Instructions, Macro and Micro operations - Design of Control Unit-Programming Computer.

Text Books:

1. Sergio Franco, Analog Circuit Design: Discrete & Integrated, 1st Edition, 2014, McGraw Hill higher Education.
2. Morris Mano, Michael D ciletti, Digital Logic Design, Vth edition, 2013, Pearson Education.

Reference Books:

1. Boylestad, Nashelsky, Electronic Devices and Circuit Theory, 11th Edition, 2017, Pearson Education.
2. Thomas L Floyd, Digital Fundamentals, 11th Edition, 2017, Pearson Education.

COURSE OUTCOMES:

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

CO1: To design an analog and digital Circuits.

CO2: To apply the theory knowledge to construct their own circuits.

CO3: To differentiate the working methods of analog and digital circuits.

CO4: To design sequential and combinational circuits.

CO5: To design registers and counters.

Semester	Course Code			Title of the Paper						
III				VLSI TECHNOLOGY						
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

Year: II

CORE COURSE 6

Semester: III

Code:

**DIGITAL SIGNAL PROCESSING
(Theory)**

Credits: 4

COURSE OBJECTIVES:

1. To encourage the students to learn the digital techniques in signal processing.
2. To introduces the mathematical and conceptual building blocks of signal processing
3. To analyze DFT and FFT transform
4. To Design the Digital filters to reduce noise in the processing.
5. Understand Mathematical Operations on signal Processing

UNIT I: SIGNALS

Definition of Signal - Classification of Signals - Linear shift Invariant systems - Stability and causality - Linear constant - Co - Efficient Difference Equations - frequency - domain representation of Discrete - Time systems and signals - Symmetry properties of the Fourier transform - Sampling of continuous Time signals.

UNIT II: THE LAPLACE AND Z – TRANSFORM

Laplace Transform - Inverse Laplace Transform - Properties of Laplace transform - initial and Final value Theorem - Solution of Differential Equations - Z - transform - inverse Z - Transform - System function – Two dimensional Z - transform - Partial fraction Expansion - Z - Transform theorem and Properties - Simple problems.

UNIT III: DISCRETE FOURIER TRANSFORM (DFT) AND FAST FOURIER TRANSFORM (FFT)

Discrete Fourier Series - Properties of DFT - Circular Convolution – Computation of DFT - Decimation In Time FFT - Bit Reversal - Butterfly Computation - Decimation In Frequency FFT - Example problems - Hilbert Transform - design of Hilbert transformers.

UNIT IV: DIGITAL FILTERS

IIR filters - Basic network structure of IIR filter - Transposed form - Basic network structure of FIR filter - Design of IIR digital filters from analog filter – Impulse Invariance - Bilinear Transformation - Frequency transformation - FIR filter - Properties of FIR - Window techniques - Comparison of IIR and FIR filters.

UNIT V: DSP PROCESSORS

Digital signal processing and DSP systems - DSP processors - Data path - Memory Architecture - Addressing modes - Instruction set - Pipelining -

Peripherals - Serial ports - Timers - Parallel Ports - Bit I/O ports - Host ports - Communication ports - External interrupts.

UNIT VI: CURRENT CONTOURS (FOR CONTINUOUS INTERNAL ASSESSMENT ONLY)

Audio and Speech Processing - Radar, Sonar and other sensor Processing - Statistical sensor Processing - Data compression - Digital Image Processing - Image compression - Signal processing for control systems – Telecommunications - Bio - Medical Engineering.

Text Books:

1. V. Oppenheim and R. W. Schaffer, Digital Signal Processing (PHI Learning Private Ltd.,)
2. P. Lapsley, J. Bier, A. Shoham and E. A. Lee, DSP Processor Fundamentals (Wiley Edition,)
3. S. Salivahanan, A Vallavaraj and C Gnanapriya, Digital Signal Processing, 2nd Ed. (Tata McGraw Hill, 2010).

Reference Books:

1. Stephan W. Smith, A Practical Guide for Engineers and Scientists Digital Signal Processing (IDC Technology, 2002).

e-book Links:

1. <https://ocw.mit.edu/courses/res-6-008-digital-signal-processing>
2. www.github.com/openlists/dspsources.

COURSE OUTCOMES:

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

CO1: Analyze the different form of signals

CO2: Differentiate DFT and FFT transform methods for DSP applications

CO3: Develop Speech Processing System

CO4: Use it in a Control System

CO5: Apply in Image Compression

Semester	Course Code			Title of the Paper						
III				DIGITAL SIGNAL PROCESSING						
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

ANY TWELVE EXPERIMENTS**COURSE OBJECTIVES:**

To familiarize with VHDL synthesis and Arduino interfacing by performing practical.

1. Writing a VHDL program for Logic gates
2. Writing a VHDL program for Half - adder and full - adder
3. Writing a VHDL program for Combinational circuits
4. Writing a VHDL program for sequential circuits
5. Writing a VHDL program for ALU
6. Writing a VHDL program for Up - Down counter.
7. Interfacing DC motor using VHDL
8. Design of PLA
9. Design of PAL
10. Interfacing Relay using VHDL
11. Interfacing Seven - Segment display
12. Writing a VHDL program for hardware fusing and Testing
13. Study the Characteristics of PN junction diode using Arduino
14. Study the Characteristics of LED using Arduino
15. Construct Half Wave Rectifier using Arduino
16. Control Traffic light using Arduino
17. Measure the distance between objects with ultrasonic sensor using Arduino
18. Construct IR obstacle sensor using Arduino

REFERENCE:

1. J. Ashenden, VHDL Tutorial, Elsevier Science, USA, 2004.
2. VHDL Hand Book Hardi Electronics AB Publications, 2000.
3. Warwick A. Smith, Arduino Uno hardware Manual, A reference and user Guide for the hardware and firmware, WS Publishing.net.

COURSE OUTCOMES:

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

- Use the practical as a prerequisite for designing ASIC and FPGA boards.
- Design hardware circuits based on VHDL.
- Use Arduino for different applications.
- Perform Arduino interfacing with other devices.

Year: II DISCIPLINE CENTRIC ELECTIVE COURSE 3 Semester: III

Code: 1. DATA COMMUNICATION NETWORKS Credits: 4
(Theory)

COURSE OBJECTIVES:

1. To introduce the Fundamentals of data communication networks
2. To demonstrate the Functions of various protocols of Data link layer.
3. To demonstrate Functioning of various Routing protocols.
4. To introduce the Functions of various Transport layer protocols.
5. To understand the significance of application layer protocols

UNIT I: INTRODUCTION TO DATA COMMUNICATIONS

Components, Data Representation, Data Flow, Network, Uses of Networks, Network Topologies, Categories of Networks, Multiplexing: FDM, TDM. Reference Models: TCP/IP Model, The OSI Model, Comparison of the OSI and TCP/IP reference model. Physical Layer: Guided Media, Unguided Media (wireless).

UNIT II: DATA LINK LAYER

Design issues, Error Detection & Correction, Elementary Data Link Layer Protocols, Sliding window protocols Multiple Access Protocols - ALOHA, CSMA, CSMA/CD, CSMA/CA, Collision free protocols, Ethernet Physical Layer, Ethernet Mac Sub layer.

UNIT III: THE NETWORK LAYER

Network Layer Design issues, Routing algorithms: optimality principle, shortest path, flooding, Distance Vector Routing, Count to Infinity Problem, Link State Routing, Hierarchical Routing; Congestion control algorithms, IP addresses, CIDR, Sub netting, Super Netting, IPv4, Packet Fragmentation, IPv6 Protocol, Transition from IPv4 to IPv6.

UNIT IV: TRANSPORT LAYER

Services provided to the upper layer's elements of transport protocol, addressing, connection establishment, Connection release, Error Control & Flow Control. UDP, Introduction to TCP, The TCP Service Model, The TCP Segment Header, The Connection Establishment, The TCP Connection Release, The TCP Sliding Window, The TCP Congestion Control Algorithm.

UNIT V: APPLICATION LAYER

Introduction, services, Applications layer paradigms: Client-server model, HTTP, E-mail, WWW, TELNET, DNS.

UNIT VI: WIRELESS SENSOR NETWORKS (For Continuous Assessment Only)

Characteristic requirement of WSN – Challenges for WSNs – WSN Vs. adhoc networks -Sensor node Architecture – Commercially available sensor nodes - Imote, IRIS, Mica Mote, EYES nodes - BT nodes, TelosB, Sunspot – Physical layer and transceiver design Considerations – in WSNs, Energy user Profile – Choice of Modulation Scheme -Dynamic Modulation – Scaling – Antenna Considerations.

Text Books:

1. Kurose James F, Keith W- Computer Networking A Top-Down Approach, 6th Edition, Pearson.
2. Behrouz A. Forouzan - Data Communications and Networking, 5th Edition, McGraw-Hill)
3. Kazem Sohraby, Daniel Minoli and Taieb Znati, Wireless Sensor Networks Technology, Protocols, and Applications, John Wiley & Sons, 2007

Reference Books:

1. Bhusan Trivedi - Data communication and Networks, Oxford university press, 2016 2.
2. Andrew S Tanenbaum - Computer Networks, 4th Edition, Pearson Education
3. W. A. Shay - Understanding Communications and Networks, 3rd Edition, Cengage Learning.

COURSE OUTCOMES:

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

CO1: Know the Categories and functions of various Data communication Networks

CO2: Design and analyze various error detection techniques.

CO3: Demonstrate the mechanism of routing the data in network layer

CO4: Know the significance of various Flow control and Congestion control Mechanisms

CO5: Know the Functioning of various Application layer Protocols.

Semester	Course Code			Title of the Paper						
III				DATA COMMUNICATION NETWORKS						
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	1	2	3	3
CO-5	3	3	3	3	3	2	1	2	3	3

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

Year: II DISCIPLINE CENTRIC ELECTIVE COURSE 3 Semester: III

Code: 2. CLOUD COMPUTING Credits: 4
(Theory)

COURSE OBJECTIVES:

1. To gain knowledge on cloud computing, cloud services, architectures and applications.
2. To enable the students to learn the basics of cloud computing with real time usage
3. To learn management in cloud services
4. To evaluate web mail services and its tools
5. To learn to store and share, in and from cloud

UNIT I: INTRODUCTION

Cloud Computing Introduction, From, Collaboration to cloud, Working of cloud computing, pros and cons, benefits, developing cloud computing services, Cloud service development, discovering cloud services.

UNIT II: CLOUD COMPUTING

Centralizing email communications, cloud computing for community, collaborating on schedules, collaborating on group projects and events, cloud computing for corporation, mapping, schedules, managing projects, presenting on road.

UNIT III: CLOUD SERVICES

Collaborating on calendars, Schedules and task management, exploring on line scheduling and planning, collaborating on event management, collaborating on contact management, collaborating on project management, collaborating on word processing, spreadsheets, and databases.

UNIT IV: OUTSIDE THE CLOUD

Evaluating web mail services, Evaluating instant messaging, Evaluating web conference tools, creating groups on social networks, Evaluating on line

UNIT V: STORING AND SHARING

Understanding cloud storage, evaluating on line file storage, exploring on line book marking services, exploring on line photo editing applications, exploring photo sharing communities, controlling it with web based desktops.

UNIT VI: CONTEMPORARY ISSUES

Expert lectures, online seminars – webinars

Text Books:

1. Michael Miller, "Cloud Computing", Pearson Education, New Delhi, 2009.

Reference Books:

1. Anthony T. Velte, "Cloud Computing: A Practical Approach", 1st Edition, Tata McGraw Hill Education Private Limited, 2009.

e-book Links:

1. <https://nptel.ac.in/courses/106/105/106105167/>
2. https://www.tutorialspoint.com/cloud_computing/index.htm
3. <https://www.javatpoint.com/cloud-computing-tutorial>

COURSE OUTCOMES:

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

CO1: Understand the concepts of Cloud and its services

CO2: Collaborate Cloud for Event & Project Management ‘

CO3: Analyze on cloud in – Word Processing, Spread Sheets, Mail, Calendar, Database

CO4: Analyze cloud in social networks

CO5: Explore cloud storage and sharing

Semester	Course Code			Title of the Paper						
III				CLOUD COMPUTING						
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	2	2
CO-2	3	3	3	1	2	2	1	2	2	2
CO-3	3	3	3	1	2	2	1	2	2	2
CO-4	3	3	3	3	3	2	1	2	2	2
CO-5	3	3	3	3	3	2	1	2	2	2

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

Year: II

GENERIC ELECTIVE COURSE 3

Semester: III

Code:

**1. ASIC AND FPGA DESIGN
(Theory)**

Credits: 3

COURSE OBJECTIVES:

1. To encourage the students to learn design techniques of ASIC and FPGA
2. To learn FPGA and differentiate with ASIC
3. To get the knowledge to design FPGA boards and using Vivado design suite.
4. To articulate architectural techniques of FPGA.
5. To familiarize with simulation techniques

UNIT I: ASICS INTRODUCTION

ASIC - Types of ASICs - Full custom ASICs - Standard cell based ASICs - Gate - Array based ASICs - Channelled Gate Array - Channel - less Gate array - Structured Gate array - Field Programmable Gate Array - Design flow - Programmable ASICs - Anti - Fuse - Static RAM - EPROM and EEPROM Technology - PLDs - PLA - PAL - CPLD.

UNIT II: INTRODUCING FPGAS

Basic knowledge to Understand FPGAs - Components of FPGA – Programmable switch using flash memory - Architectures of FPGA - Relation between VHDL and FPGA - Relation between ASIC and FPGA - ASIC Vs. FPGA - Anti – Fuse technology - SRAM based - E 2 ROM or Flash based - Trade - Offs - Fine Grain fabric - Middle grain - Coarse grain

UNIT III: MATH, PARALLELISM AND PIPELINED DESIGN

Introduction to fixed point numbers - Using fixed - Point arithmetic in Temperature sensor - Temperature conversion using fixed - point arithmetic - Floating point numbers - Fixed point to floating point conversion - Floating point Math Operations - Float to fixed point conversion - Simulation

UNIT IV: ADVANCED ARCHITECTURAL TECHNIQUES

Tree based FPGA architectures - Interconnect description - Downward network - Upward network - Interconnect Depopulation - Connection with outside - Rent's Rule based model - Switches requirement - Wiring requirements – Configuration flow - Multilevel Partitioning and Routing - Experimental Evaluation - Tree based Architecture optimization - Switch utilization Efficiency - 2D physical design of tree based FPGA

UNIT V: CIRCUITS AND ARCHITECTURES FOR LOW - POWER FPGAS

Introduction - Power consumption in FPGA - Dynamic Power and Static power - Power and Clock gating for FPGAs - Multi VDD Architectures - Power reduction in

FPGA routing structures - Leakage power reduction - Routing buffer power optimization - Glitch Reduction - Ultra low - Power FPGAs

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

Reconfigurable Hardware Architectures - MPSoCs - NOCs - Processing elements - Reconfigurable Instruction set - Reconfigurable computing structures - Reconfigurable cache - Architecture Management - Virtualisation Technologies - Scheduling - Application of FPGA - Design of High performance Error correcting codes using FPGA - Low power FPGAs based on Resistive memories.

Text Books:

1. Gaillardon, "Reconfigurable Logic, Architecture, Tools and Applications", CRC Press
2. Hideharu amano," Principles and Structures of FPGAs" Springer Publications
3. Neeraj Goel, "FPGA Architecture, Technologies, and Tools",

Reference Books:

1. Hugh Jack, "Automatic Manufacturing Systems", 2010, Lulu , Ebook
2. Wayne Wolf, FPGA based system Design, I st Ed., (Prentice Hall,2009)

e-book Links:

1. www.oreilley.com/library/view/learning-fpgas

COURSE OUTCOMES:

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

CO1: Learn the differences between ASIC and FPGA Devices.

CO2: Understand the components of FPGA and Its memory

CO3: Know about power FPGAs

CO4: Employ FPGAs in interfacing applications

CO5: Design FPGA based resistive

Semester	Course Code			Title of the Paper						
III				ASIC AND FPGA 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	2	2	2	1	2	2	3
CO-2	3	3	3	2	2	2	1	2	2	3
CO-3	3	3	3	2	2	2	1	2	2	3
CO-4	3	3	3	3	3	2	1	2	2	3
CO-5	3	3	3	3	3	2	1	2	2	3

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

COURSE OBJECTIVES:

1. To describe the functions of power electronic devices and systems
2. To understand the large current handling devices and observe its working
3. To provide solutions for the electrical needs using power electronic devices
4. To analyze the working of electronic switches, drivers, converters and inverters
5. To evaluate the performance of power electronic systems

UNIT I: Power Electronic Switches and Systems Power Electronic Systems - Switching Characteristics - Ideal Switch - Practical Switch - Switching Functions and Matrix Representation - Types of Switches - Bipolar and Unipolar Devices - Thyristor-based Devices - Snubber Circuits - Switching Diode Circuits - Controlled Switching Circuits

UNIT II: Power Converters Converters - Non-Isolated Switch Mode DC-DC Converters - Isolated Switch-Mode DC-DC Converters - Weinberg Converter - Multi-output Converter - Problems - Soft-Switching DCDC Converters - Classification of Soft - Switching Resonant Converters - Advantages and Disadvantages of ZCS and ZVS - Problems

UNIT III: Controlled Rectifiers Rectifiers - Uncontrolled Diode Rectifier Circuits - Single-Phase Rectifier Circuits - Three Phase Rectifier Circuits - Half-Wave Rectifiers - Full-Wave Bridge Rectifiers - Phase controlled Converters - Full-Wave Phase-controlled Rectifiers - Three-Phase Phase Controlled Converters - Half-Wave Converters - Full-Wave Converters

UNIT IV: Inverters Inverters - Full-Bridge Inverters - Harmonic Reduction - Pulse Width Modulation - Equal Pulse (Uniform) PWM -Sinusoidal PWM -Three-phase Inverters - Current-Source Inverters - Problems

UNIT V: Power Drivers Motor Drive Applications Introduction - Dc Motor Drives - Induction Motor Drives - Synchronous Motor Drives - Other Applications - Residential and Industrial Applications - Design and Construction of Dual Converter Using Thyristor - PWM Converter with High Efficiency

Text Books:

1. Issa Batarseh and Ahmad Harb (2018), Power Electronics Circuit Analysis and Design (2nd Edition), Springer.
2. Bimbhra Dr. P. S. (2002), Power Electronics (3rd Edition), Khanna Publishers.
3. Ned Mohan Tore. M Undeland and William P Robbins (2007), Power Electronics Converters, Applications, and Design (3rd Edition), John Wiley and Sons' Inc.

Reference Books:

1. Branko L. Dokić and Branko Blanuša (2015), Power Electronics Converters and Regulators (3rd Edition), Springer.
2. Keith H. Sueker (2005), Power Electronics Design A Practitioners Guide (1st Edition), Newnes. B. Sc. ELECTRONICS - 138
3. Muhammad H. Rashid (2017), Power Electronics (4th Edition), Pearson.

e-book Links:

1. <http://ieeexplore.ieee.org/document/515001>
2. <https://www.powerelectronics.com/>
3. https://www.tutorialspoint.com/power_electronics/index.htm

Semester	Course Code			Title of the Paper						
III				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	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	2	2	1	2	3	3
CO-5	3	3	3	2	2	2	1	2	3	3

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

Year: II

GENERIC ELECTIVE COURSE 3

Semester: III

Code:

**3. DRONE TECHNOLOGY
(Theory)**

Credits: 3

COURSE OBJECTIVES:

1. Understand the fundamentals, history, and evolution of drone technology and UAV systems.
2. Gain knowledge of drone design, classification, propulsion systems, and structural configurations.
3. Learn the principles of drone navigation, communication, control systems, and autonomous operation.
4. Explore the diverse applications of drones in engineering, healthcare, agriculture, surveillance, and logistics.
5. Understand the integration of Artificial Intelligence, IoT, and machine learning in modern drone systems.
6. Examine emerging trends, regulatory challenges, and future advancements in drone technology.

UNIT I: INTRODUCTION TO DRONE TECHNOLOGY

Introduction to Unmanned Aerial Vehicles (UAVs) and Unmanned Aircraft Systems (UAS)- History and evolution of drone technology- Basic principles of flight- Forces acting on drones: Lift, Drag, Thrust, Gravity- Principal axes of motion: Roll, Pitch, Yaw- Components of drone systems.

UNIT II: DRONE CLASSIFICATION AND DESIGN

Types of drones: Fixed-wing drones-Multi-rotor drones-Lighter-than-air systems-Hybrid drones-Structural design and frame configurations-Propulsion systems-Flight controllers and stabilization mechanisms-Battery systems and power management.

UNIT III: NAVIGATION, CONTROL AND COMMUNICATION SYSTEMS

Drone flight control systems- Sensors and embedded systems -GPS and navigation technologies -Communication protocols and telemetry- Autonomous flight and autopilot systems- Cyber security challenges in UAV systems

UNIT IV: APPLICATIONS OF DRONE TECHNOLOGY

Drone Applications: Agriculture and precision farming- Smart healthcare-Disaster management-Surveillance and security-Logistics and drone delivery-Smart city applications

UNIT V: ARTIFICIAL INTELLIGENCE AND EMERGING TRENDS

AI and Machine Learning in drones- Drone swarm intelligence -IoT-enabled drone systems-Computer vision and image processing-Intelligent decision-making systems-Challenges and ethical considerations

UNIT VI: (OPTIONAL) FUTURE TRENDS AND ADVANCED DRONE SYSTEMS

High-altitude pseudo satellites (HAPS)- Military and defense drone systems-Autonomous drone networks-Regulatory framework and policy issues- Future research directions and innovations

COURSE OUTCOMES:

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

CO1: Understand the fundamental concepts of drone technology, principles of flight, and the basic components and operational dynamics of UAV systems.

CO2: Analyze various drone classifications, structural designs, propulsion systems, and evaluate their suitability for different operational requirements.

CO3: Explain drone navigation, control mechanisms, communication systems, and assess the role of embedded systems and cybersecurity in UAV operations.

CO4: Identify and evaluate the applications of drone technology in agriculture, healthcare, surveillance, logistics, and smart city solutions.

CO5: Apply concepts of Artificial Intelligence, Machine Learning, and IoT in drone systems to address automation, decision-making, and intelligent control challenges.

CO6: Examine emerging drone technologies, advanced autonomous systems, regulatory frameworks, and future research directions in UAV development.

Semester	Course Code			Title of the Paper						
III				DRONE TECHNOLOGY						
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	2	3	3	3
CO-2	3	3	3	2	2	2	2	3	3	3
CO-3	3	3	3	2	2	2	2	3	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

Year: II

NON-MAJOR ELECTIVE COURSE 2

Semester: III

Code:

**BIO-MEDICAL INSTRUMENTATION
(Theory)**

Credits: 2

COURSE OBJECTIVES:

1. To know the fundamentals of channel coding
2. To Introduce Fundamentals of Biomedical instrumentation
3. To study the communication mechanics in a biomedical system with few examples
4. To study measurement of certain important electrical and non-electrical parameters
5. To understand the basic principles in imaging techniques and to have a basic knowledge in life assisting and therapeutic devices

UNIT I: INTRODUCTION

Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals - Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow - Biomechanics of bone.

UNIT II: NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES

Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Plethysmography

UNIT III: ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS

Electrodes – Limb electrodes –floating electrodes – preclled disposability electrodes - Micro, needle and surface electrodes – Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG.

UNIT IV: IMAGING MODALITIES AND ANALYSIS

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography.

UNIT V: LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine - ICCU patient monitoring system - Nano Robots - Robotic surgery.

UNIT VI: APPLICATIONS

Medicine – Microbiology – Agriculture – Genetics.

Text books:

1. Khandpur, Hand book of Bio-Medical Instrumentation, 3rd Ed., 2024, Khanna Publishers.
2. Cromewell, Bio-Medical Instrumentation and Measurements, 2nd Ed., 2015, Pearson Education.

Reference Books:

1. R. AnanthaNatarajan, Bio-medical Instrumentation and measurements, 2009, PHI Learning Pvt. Ltd.

e-book Links:

Preview: Biomedical Instrumentation & Sensors | SWAYAM

COURSE OUTCOMES:

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

CO1: To familiarize the basic components of bio medical system.

CO2: To understand the basic working of medical devices.

CO3: To know the use of various amplifiers in ECG, EEG and EMG measurements.

CO4: To analyse the difference between radiographic and fluoroscopic techniques.

CO5: To get thorough knowledge of handling medical devices.

Semester	Course Code			Title of the Paper						
III				BIO-MEDICAL INSTRUMENTATION						
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
1	3	3	3	2	2	2	1	3	2	2
CO-2	3	3	3	2	2	2	1	3	2	2
CO-3	3	3	3	2	2	2	1	3	2	2
CO-4	3	3	3	3	3	2	1	3	2	2
CO-5	3	3	3	3	3	2	1	3	2	2

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

Year: II

CORE COURSE 7

Semester: IV

Code:

**PLC AND IT'S APPLICATIONS
(Theory)**

Credits: 4

COURSE OBJECTIVES:

1. To encourage the students to learn the requirements of Programmable Logic Controller in the Industry.
2. To familiarize with the main parts and functions of PLC.
3. To Understand the basic concepts of Ladder diagram
4. To learn PLC wiring
5. To gain knowledge about PLC installations and programming software

UNIT I: INTRODUCTION OF PLC

Programmable logic controller - PLC - Parts of a PLC - Principles of operation - Modifying the operation - PLC vs computers - PLC size and Applications – PLC Hardware Components - The I/O Section - Discrete I/O Modules - Analog I/O Modules - Special I/O Modules - I/O Specifications.

UNIT II: CPU AND FUNDAMENTALS OF LOGIC

The Central Processing unit (CPU) - Memory Design - Memory Types - Programming Terminal Devices - Recording and retrieving Data - Human Machine Interfaces (HMIs) - Fundamentals of Logic - Boolean Algebra - Developing Logic Gate circuits from Boolean expressions - Producing the Boolean Equation for a given Logic circuit - Hardwired Vs. Programmed Logic - Programming word level logic instructions.

UNIT III: PLC INSTRUCTIONS

Basics of PLC Programming - Processor Memory Organizations - Program Scan - PLC Programming Languages - Relay - type Instructions - Instruction Addressing - branch Instructions - Internal relay Instructions - Programming examine If closed and examine If open Instructions - Entering the Ladder Diagram – Modes of Operation

UNIT IV: PLC WIRING AND LADDER DIAGRAMS

Fundamental PLC wiring diagrams and ladder Logic diagrams – Electromagnetic Control relays - Latching Relays - Converting relay Schematics into PLC Ladder programs - Writing ladder programs - Programming Counters – Counter Instructions - Up - Counter - Down - Counter - Cascading Counters – Incremental Encoder - Counter Applications - combining Counter and Timer Functions.

UNIT V: INSTALLATION AND PROGRAMMING SOFTWARE

PLC Installation Practices - PLC Enclosures - Electrical Noise - Leaky inputs and outputs - Grounding - Voltage variations and Surges - Program Editing and

Commissioning - Programming and Monitoring - Preventive Maintenance - Troubleshooting - PLC Programming software - Control Logic Controllers - Memory and Project Organization - Bit - level programming.

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

PLC Applications: Washing Machines - Elevators and Traffic Light Controllers - Programming Applications with PLC

Text Books:

1. Frank D. Petruzella, Programmable Logic Controllers, Mc Graw Hill Publications, Fourth Edition
2. Dunning, G, Thomson, Introduction to Programmable logic controllers, Delmar learning. New Delhi

Reference Book:

1. Hugh Jack, Programmable Logic controller, 4. Max Rabiee, "Programmable Logic Controllers", The Good Heart – Willcox Company, Ireland, 2018

e-book Links:

1. www.ieee.org/resources/plc

COURSE OUTCOMES:

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

CO1: Identify the components of PLCs.

CO2: Familiarize with the ladder diagram

CO3: Use the PLC in Control systems

CO4: write PLC program to perform the various operations

CO5: Use PLC in Electronic Applications

Semester	Course Code			Title of the Paper						
IV				PLC AND IT'S 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	2	2	1	1	3	2	3
CO-2	3	3	3	2	2	1	1	3	2	3
CO-3	3	3	3	2	2	1	1	3	2	3
CO-4	3	3	3	3	3	1	1	3	2	3
CO-5	3	3	3	3	3	1	1	3	2	3

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

Year: II

CORE COURSE 8

Semester: IV

Code:

**SMART SENSORS AND THEIR
APPLICATIONS
(Theory)**

Credits: 4

COURSE OBJECTIVES:

1. To introduce the students about basics of smart sensors.
2. To provide the details of different types of sensor.
3. To get the knowledge of using smart sensors.
4. To analyze the working of sensor and know the implementation procedure.
5. To apply sensors in smart application.

UNIT I: Smart Sensor Design

Smart sensors- Interface Electronics-Calibration and Trimming- A smart Temperature sensor-Operating Principle- Interface Electronics- A smart Wind Sensor- Operating Principle- Interface Electronics- A smart hall sensor-Operating Principle- Interface Electronics.

UNIT II: Micro sensor

Design of acoustic wave sensors-Resonant sensor –Vibratory Gyroscope – Capacitive and Piezo-Resistive Pressure Sensors-Engineering Mechanics Behind these Micro sensors.

UNIT III: Fingerprint sensors

Spoofing techniques in fingerprint sensors-Fingerprint sensing technologies-Optical sensors-Frustrated total internal reflection (FTIR)-Multispectral Imaging-3D touch less imaging-TFT(thin film transistor)optical-Electro optical-Capacitive-Radio frequency(RF)-Thermal-Ultrasound sensor.

UNIT IV: Bio-mimetic systems classification and Authentication

Introduction –Electronic nose-E-nose sensors-Metal-oxide semiconductor sensors-Piezo-electric crystal sensors- Electronic Tongue-sensing principles-E-tongue based on Voltammetry-Measurement setup-Measurement Procedure-Applications of bio- mimetic systems.

UNIT V: Smart sensors for Environmental Monitoring in Industry 4.0

Introduction for smart sensors in Environmental Monitoring in Industry 4.0-Basic concepts of industry 4.0 and Environmental Monitoring-Overview of smart sensors and their applications in industry 4.0-Challenges in smart sensor design and implementation for environmental monitoring-Types of smart sensors for Environmental Monitoring in Industry 4.0-sensor networks and communication protocols.

UNIT VI: A novel hybrid smart appliances control framework for specially challenged persons

Introduction- features of smart home appliances – Materials and Methods- proposed smart appliances approach-conclusion and future scope.

Text Books:

1. Brojo Kishore Mishra, Dac-Nhuong Le and Sandipan Malik, Smart sensors for Industry 4.0, Fundamentals, Fabrication and IIOT Applications, 2024, John –Wiley & Sons.
2. Sergey Yurish, Sensors and Bio-sensors, MEMS Technologies and its applications, 2014, IFSA Publishing.
3. 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.

e-book Links:

1. <https://www.seia-conference.com/>
2. <https://www.edibon.com/en/mechatronics-automationcompumechatronics/mechatronics/electronics/sensors-and-electronic-instrumentation>
3. https://www.mdpi.com/journal/sensors/special_issues/SEIA_2020
4. Preview: Sensors and Actuators | SWAYAM

COURSE OUTCOMES:

CO1: To understand the working of sensors.

CO2: To design the sensor for smart applications.

CO3: To get the knowledge various types of sensors.

CO4: To identify the right choice of sensing devices.

CO5: To apply the sensors for environmental monitoring.

Semester	Course Code			Title of the Paper						
IV				SMART SENSORS AND THEIR 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	2	2	1	1	3	2	3
CO-2	3	2	3	2	2	1	1	3	2	3
CO-3	3	2	3	2	2	1	1	3	2	3
CO-4	2	2	3	2	2	1	1	3	2	3
CO-5	3	3	3	2	2	1	1	3	2	3

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

COURSE OBJECTIVES:

1. To understand the basic concepts of MEMS device and its fabrication technique
2. To analyze the basic functions and design of Power Electronics circuits
3. To implement the use of power electronics in real time applications
4. To study the principles of AC voltage controllers (On/Off control, phase control, cyclo-converters) and how they regulate power for various load types.
5. To explore the working mechanisms, control strategies, and performance of Step-up/Step-down choppers and switch-mode regulators (Buck, Boost, Buck-Boost, Cuk)

UNIT 1: OVERVIEW AND WORKING PRINCIPLES OF MEMS

MEMS and Microsystems: Typical MEMS and Microsystems products - Microsystems and Microelectronics - Miniaturization - Applications of Microsystems - Micro sensors - Micro actuation - Micro grippers - Micro motors - Micro accelerometer - Micro fluids

UNIT II: FABRICATION AND MICROSYSTEM DESIGN

Ions and Ionization-Doping-Substrate and wafers - Silicon as a substrate - Silicon compounds- Piezo Resistors - Piezo Crystals - Photolithography - Ion implantation - Diffusion - Oxidation - Chemical vapor deposition - sputtering - deposition by Epitaxy- Physical Vapor Deposition (PVD) - Etching - Surface Micromachining - LIGA process - Microsystems Design Considerations- Use of CAD and tools in Microsystems design - Process design - Design of silicon die for a micro pressure sensor-Computer Aided Design-Micro system packaging- Introduction to intelligence CAD tool for MEMS.

UNIT III: POWER ELECTRONIC DEVICES AND CIRCUITS

Review and Operations of SCR, DIAC, TRIAC and IGBT- **Thyristor Commutation:** Natural commutation - Forced commutation - Self commutation - Impulse commutation - Response pulse commutation - External pulse commutation - complementary commutation - **Controlled Rectifiers:** Principle of Phase controlled converter -Single-Phase full converter-Single-phase Semi converter-Principle of Three phase half wave converter

UNIT IV: AC VOLTAGE CONTROLLERS AND DC CHOPPERS

AC voltage controllers: Principle of On/Off Control - Principle of Phase Control - Single Phase Bi-Directional Controllers with Resistive and Inductive Loads - Cyclo-Converters - Single Phase Cyclo-Converters - **DC Choppers:** Principles of

Step-down Operation -Step down with RL load- Principle of Step-up Operation -
Switch mode regulators: Buck Regulator - Boost Regulator - Buck Boost Regulator -CUK Regulator

UNIT V: INVERTERSAND STATIC SWITCHES

Inverters: Principle of Operation -Single Phase Bridge Inverter - Three-Phase Inverter -PWM Voltage Control Power Supplies – Introduction to applications of power electronics in automotive system - **Power supplies:** DC Power Supplies - Switched Mode Power Supplies (SMPS) - UPS - AC Power Supplies: Switched mode AC power supply - Resonant AC Power supply - Bi-Directional AC Power supply - **AC and DC static switches:** Introduction - Single phase AC switches - Three phase AC switches - Three phase reversing switches - DC switches Static circuit breaker -AC and DC solid state relays

UNIT VI: CONTEMPORARY ISSUES

Micro systems Design Considerations and Use of CAD tools in Microsystems design

Text Books:

1. Tai-Ran-Hsu, “MEMS & Micro Systems Design and Manufacture”, Tata McGraw Hill Education Private Limited, 2002.
2. Muhammed Rashid, “Power Electronics, Circuits, devices and Applications”, Prentice Hall Edition, Third Edition, 2004
3. P.S.Bimbira, “Power Electronics”,Khanna Publishers,Fourth Edition,2011.

Reference Books:

1. James.J.Allen, “Micro Electro Mechanical System Design” Taylor & Francis Group, 2005
2. Sen “Power Electronics”–Mc Graw Hill International, 1989.
3. Jaganathan.V, “Power Electronics Devices and Circuits”, PHI Learning Pvt. Ltd, 2011.

e-book Links:

1. <http://nptel.ac.in/courses/117105082>
2. <https://nptel.ac.in/courses/108/108/108108113/>
3. <https://nptel.ac.in/courses/108/102/108102145/>

COURSE OUTCOMES:

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

CO1: Understand the basic terms of Micro System and concepts which are needed for Electronic and Communication

CO2: Understand basic concepts of MEMS device design and its fabrication methods

CO3: Apply the Power electronic components used for different Power Electronic Circuits

CO4: Analyze the problem-solving skills and proficiency in Power Electronics circuit analysis.

CO5: Express the basic working principles of Inverters and power supplies.

Semester	Course Code			Title of the Paper						
IV				MEMS						
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	1	1	2	2	3
CO-2	3	3	3	2	2	1	1	2	2	3
CO-3	3	3	3	2	2	1	1	2	2	3
CO-4	3	3	3	3	3	1	1	2	2	3
CO-5	3	3	3	3	3	1	1	2	2	3

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

Year: II

**DISCIPLINE CENTRIC ELECTIVE
COURSE 4**

Semester: IV

Code:

**1. EMBEDDED SYSTEM DESIGN
(Theory)**

Credits: 4

COURSE OBJECTIVES:

1. To introduce the fundamentals, characteristics, classifications, and applications of embedded systems.
2. To develop programming skills in Embedded C using data types, pointers, functions, dynamic memory management, and embedded software development tools.
3. To understand the concepts, architecture, enabling technologies, frameworks, and design principles of the Internet of Things (IoT).
4. To study the design and implementation of IoT-based applications in domains such as smart homes, smart cities, healthcare, agriculture, industry, and environmental monitoring.
5. To understand cloud computing concepts, IoT communication protocols, cloud platforms, and web service integration for IoT applications.

UNIT I: INTRODUCTION TO EMBEDDED SYSTEMS

Definition - Embedded Systems Vs General Computing Systems - History of Embedded Systems - Classification - Major Application Areas - Purpose of Embedded Systems - Characteristics and Quality Attributes of Embedded Systems.

UNIT II: EMBEDDED C PROGRAMMING

Data types - General concepts of object-oriented programming: pointers - functions - Dynamic memory allocation and de-allocation - Embedded software development tools - Basics of developing C program for embedded systems

UNIT III: FUNDAMENTALS OF IoT

Introduction - Definitions - Characteristics of IoT - IoT Architectures - Physical & Logical Design of IoT - Enabling Technologies in IoT - History of IoT - About Things in IoT - The Identifiers in IoT - Internet in IoT - IoT frameworks.

UNIT IV: APPLICATIONS OF IoT

Home Automation - Smart Cities - Energy - Retail Management - Logistics - Agriculture - Health and Lifestyle - Industrial IoT - Legal challenges - IoT design Ethics - IoT in Environmental Protection.

UNIT V: CLOUD COMPUTING

IoT Protocols - Communication Protocols - Cloud Platforms for IoT - Virtualization concepts and Cloud Architecture - Cloud computing - Benefits of Cloud services-

SaaS, PaaS, IaaS - Cloud providers - Study of IOT Cloud platforms - Thing Speak API and MQTT - Interfacing ESP8266 with Web services.

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

Key Concepts of M2M versus IoT- Remote Device Access - Connectivity – Making the choice - Scope in future - Data Collection and sharing - Advantages of IoT and M2M.

Text Books:

1. U. Dutta, V. Sharma and A. Passi, Embedded system Design using Atmega: A Practical Approach (Evince pub Publishing, 2018)
2. E. Balaguruswamy, Object Oriented Programming with C++, 6th Ed. (TMH Publishing, 2013)
3. H. Chaouchi, The Internet of Things Connecting Objects to the Web (Wiley Publications, 2013)
4. O. Hersent, D. Boswarthic and O. Elloumi, The Internet of Things: Key Applications and Protocols (Wiley Publications, 2011)
5. R. Singh, A. Gehlot, S. Choudhury and B. Singh, Embedded System Based on Atmega Microcontroller Simulation, Interfacing and Projects (2017)

Reference Books:

1. Tanenbaum and A. Woodhull, Operating Systems Design and Implementation, (Prentice Hall, 2006)
2. V. Madisetti and A. Bahga, Internet of Things: A Hands-on-Approach (VPT, 2014).
3. J. Biron and J. Follett, "Foundational Elements of an IoT Solution (O'Reilly Media, 2016).
4. P. Raj and A. C. Raman, The Internet of Things: Enabling Technologies, Platforms, and Use Cases (CRC Press)
5. I. C. Bertolotti and T. Hu, Embedded Software Development: The Open-Source Approach
6. D. Russell and M. Thornton, Introduction to Embedded Systems Using ANSI C and the Arduino Development Environment

e-book Links:

1. https://onlinecourses.nptel.ac.in/noc17_cs22/course

COURSE OUTCOMES:

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

CO1: Explain the fundamentals, architecture, characteristics, and application areas of embedded systems.

CO2: Develop Embedded C programs using appropriate programming constructs and software development tools for embedded applications.

CO3: Analyze IoT architectures, enabling technologies, communication models, and frameworks for designing IoT solutions.

CO4: Design and implement IoT-based applications for smart homes, healthcare, agriculture, industrial automation, and environmental monitoring while considering ethical and legal aspects.

CO5: Apply cloud computing concepts, IoT communication protocols, MQTT, Thing Speak API, and ESP8266 interfacing for cloud-enabled IoT applications.

Semester	Course Code			Title of the Paper						
IV				1. EMBEDDED SYSTEM 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	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

Year: II

**DISCIPLINE CENTRIC ELECTIVE
COURSE 4**

Semester: IV

Code:

**2. MOBILE COMMUNICATION
(Theory)**

Credits: 4

COURSE OBJECTIVES:

1. To understand the internal circuits and working principle of mobile Phones.
2. To use the knowledge in real time applications.
3. To design Mobile Apps for various applications
4. To gain practical and theoretical knowledge to design embedded systems.
5. To learn the architectural blocks of the AVR microcontroller, including the register file, ROM space, and hardware modules.

UNIT I: CELLULAR CONCEPT AND SYSTEM DESIGN FUNDAMENTALS

Introduction to wireless communication: Evolution of mobile communications - mobile radio systems - examples - trends in cellular radio and personal communications; Cellular Concept: Frequency reuse - channel assignment - hand off - Interference and system capacity - tracking and grade of service - Improving Coverage and capacity in Cellular systems

UNIT II: MOBILE RADIO PROPAGATION

Free space propagation model - reflection, diffraction, scattering - link budget design - Outdoor Propagation models - Indoor propagation models - Small scale Multipath propagation - Impulse model - Small scale Multipath measurements - parameters of Mobile multipath channels - types of small scale fading - statistical models for multipath fading channels.

UNIT III: MODULATION TECHNIQUES AND EQUALISATION

Modulation Techniques: Minimum Shift Keying - Gauss ion MSK, M-ary QAM, M-ary FSK - Orthogonal Frequency Division Multiplexing, Performance of Digital Modulation in Slow - Flat Fading Channels and Frequency Selective Mobile Channels; Equalization: Survey of Equalization Techniques - Linear Equalization, Non - linear Equalization, Algorithms for Adaptive Equalization - Diversity Techniques - RAKE receiver.

UNIT IV: CODING AND MULTIPLE ACCESS TECHNIQUES

Coding: Vocoder, Linear Predictive Coders, Selection of Speech Coders for Mobile Communication, GSM Codec, RS codes for CDPD. Multiple Access Techniques: FDMA, TDMA, CDMA, SDMA, Capacity of Cellular CDMA and SDMA.

UNIT V: WIRELESS SYSTEMS AND STANDARDS

Second Generation and Third Generation Wireless Networks - Standards - WLL - Blue tooth - AMPS - GSM -IS - 95 and DECT

UNIT VI: CURRENT CONTOURS (For Continuous Internal Assessment Only)

Over view of 5G Technology- Game theory applications for power control and sub carrier allocations- Millimetre wave technology for 5G networks-Energy efficient Mobile network operations for 4G-opportunistic multi- connect networks with P2P wi-fi and cellular networks- beyond 4G

Text Book:

1. T. S. Rappaport, Wireless Communications: Principles and Practice, 2nd Ed. (Pearson Education/ Prentice Hall 2003).

Reference Books:

1. R. Blake, Wireless Communication Technology (Thomson Delmar, 2003).
2. W. C. Y. Lee, Mobile Communications Engineering: Theory and applications, 2nd Ed. (McGraw - Hill International, 1998).
3. S. G. Wilson, Digital Modulation and Coding (Pearson Education, 2003).

e-book Links:

1. [www.classcentral.com/mobile development](http://www.classcentral.com/mobile%20development)
2. [www.edutopia.org/article/mobile learning resources.](http://www.edutopia.org/article/mobile%20learning%20resources)

COURSE OUTCOMES:

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

CO1: Understand the internal parts of Mobile phones

CO2: Analyze the problems involved in the phone and troubleshoot it.

CO3: Use mobile phone for smart home applications

CO4: Develop new mobile app for learning purposes

CO5: Utilize the knowledge to protect the user from mobile phone frauds.

Semester	Course Code			Title of the Paper						
IV				2. MOBILE COMMUNICATION						
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	3	3	3	3	3
CO-2	3	3	3	2	3	3	3	3	3	3
CO-3	3	3	3	2	3	3	3	3	3	3
CO-4	3	3	3	3	3	3	3	3	3	3
CO-5	3	3	3	3	3	3	3	3	3	3

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

Year: II

**ENTRPRENURSHIP/INDUSTRY
BASED COURSE**

Semester: IV

Code:

**INDUSTRY 4.0 APPLICATION
(Practical)**

Credits: 3

COURSE OBJECTIVES:

- To know the automated learning techniques.
- To study the techniques of knowledge representation.

UNIT 1: INDUSTRY4.0

Need – Reason for Adopting Industry4.0 – Definition – Goals and Design Principles- Technologies of Industry4.0 – Big Data – Artificial Intelligence (AI) – Industrial Internet of Things - Cyber Security - Cloud – Augmented Reality.

UNIT II: MACHINE LEARNING

Machine Learning – Introduction – Definition - Types of Machine Learning – Supervised, Unsupervised, Reinforcement Learning - Algorithms for Machine Learning - Problems solved by Machine Learning-Tools for Machine Learning - Applications areas of Machine Learning.

UNIT III: ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) – What & Why? – History of AI – Foundations of AI-The AI-environment - Societal Influences of AI - Application Domains and Tools- Associated Technologies of AI - Future Prospects of AI - Challenges of AI

UNIT IV: ROBOTIC PROCESS AUTOMATION(RPA)

Robotic Process Automation (RPA): Introduction to RPA – Need for automation – Programming constructs in RPA– Robots and Softbots– RPA architecture and process methodologies- Industries best suited for RPA –Risks & Challenges with RPA.

UNIT V: APPLICATIONS AND TOOLS OF INDUSTRY 4.0

Applications of IoT – Manufacturing – Healthcare – Education – Aerospace and Defense – Agriculture – Transportation and Logistics – Impact of Industry 4.0 on Society: Impact on Business, Government, People. Tools for Artificial Intelligence, Big Data and Data Analytics, Virtual Reality, Augmented Reality, IoT, Robotics.

UNIT VI: CONTEMPORARY ISSUES

Applications of Industrial Automation Systems using Machine Learning & Artificial Intelligence

Text Books:

1. P.Kaliraj,T.Devi, Higher Education for Industry4.0 and Transformation to Education5.0, 2020

Reference Books:

1. Stuart J. Russell, Peter Norvig, “Artificial Intelligence-A Modern Approach”, Third Edition, Pearson Publishers, 2015
2. S.N.Sivanandam, S.N.Deepa, “Principles of Soft Computing”, Second Edition, Wiley-India, 2007

e-book Links:

1. <https://nptel.ac.in/courses/106/105/106105195/>
2. <https://nptel.ac.in/courses/106/106/106106139/>
3. <https://nptel.ac.in/courses/106/105/106105077/>
4. <https://nptel.ac.in/courses/112/101/112101098/>

COURSEOUTCOMES:

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

CO1: Understand the representation of knowledge

CO2: Understand machine learning, AI and RPA techniques in developing real world applications.

COURSE OBJECTIVES:

Each candidate shall be required to take up a Project Work 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 student 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):**

- | | |
|--|------------|
| I. 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 |
| III. 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)

A candidate shall be declared to have passed in the Project work if he/she gets not less than 40% in each of the Project Report and Viva-voce but not less than 50% in the aggregate of both the marks for Project Report and Viva-voce.

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.

Year: II

VALUE ADDED COURSE 2

Semester: IV

Code:

**FUNDAMENTALS OF ROBOTICS
(Theory)**

Credits: 2*

COURSE OBJECTIVES:

1. Understand the classification, anatomy, degrees of freedom, and kinematic configurations of robotic systems.
2. Learn how to interface mechanical hardware with electrical components.
3. Implement digital control logic for automated assembly and process control.
4. Explore how robotics improve accuracy, productivity, and operational efficiency in manufacturing and other high-risk environments.
5. Applications can be done in welding, cutting and fabrication process control industries.

UNIT I: BASIC CONCEPTS

Introduction to robotics - history - laws of robotics - generations of robots. Degrees of Freedom - types of coordinates.

UNIT II: POWER SOURCES AND ACTUATORS.

Study of various drive systems and actuators- Hydraulic and pneumatic drive systems. Electric drives- Selection of motors and gear ratios - Mechanical, magnetic, vacuum, and adhesive grippers.

UNIT III: SENSORS AND MACHINE VISION

Understanding internal and external sensors used for robotic perception - Contact and non-contact sensors - Position, velocity, and force/torque sensors - Machine vision systems and image processing - Tactile and proximity sensors.

UNIT IV: KINEMATICS AND PATH PLANNING

The mathematical modeling of robot movement and spatial positioning- Direct and Inverse kinematics - Homogeneous transformations - Trajectory planning and joint space interpolation- Continuous path vs. point-to-point path planning.

UNIT V: ROBOT PROGRAMMING AND APPLICATIONS

Implementation of robots in automated manufacturing- Robot programming methods- Robotic programming languages: VAL, RAPID - ROS - Industrial applications: material handling, welding, and assembly- Robot safety standards.

UNIT VI: LATEST TRENDS IN ROBOTICS AND AUTOMATION

Artificial AI & Autonomous Systems - Humanoid Robots in Service - Collaborative Robots (Cobots) - Robotics as a Service (RaaS)- Mobile Manipulators.

Text Books:

1. "Fundamentals of Robotics" by D.K.Pratihar, Narosa Publishing House, 1st Edition, 2017, ISBN-10: 8184875770.
2. "Introduction to Robotics, Machines and Control" by John Craig, Pearson Education, 4th Edition, 2022, ISBN - 10, 9356062196.

Reference Books:

"Learn Robotics Programming" by Danny Staple, Ingram Publications, 1st Edition, 2018, ISBN-10: 1789340748.

e- books Links:

1. <https://www.ieee-ras.org/optimization-for-robotics/resources/books/>
2. <https://elcom-team.com/Subjects/%D8%B1%D9%88%D8%A8%D9%88%D8%AA%D8%A7%D8%AA/%D8%A7%D9%84%D9%83%D8%AA%D8%A8%20%D9%88%20%D8%A7%D9%84%D8%AD%D9%84%D9%88%D9%84/robotics-book-5ed.pdf>
3. <https://www.roboticsbook.org/intro.html>

COURSE OUTCOME:

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

CO1: Practical and theoretical skills to design, program, and integrate robotic systems.

CO2: This will make mastering robot kinematics, actuator selection, and industrial automation.

CO3: Can automate repetitive tasks, optimize production lines, and program.

CO4: Calculate forward and inverse kinematics to determine joint angles and end-effector positions.

CO5: Apply automation concepts to streamline manufacturing.

Semester	Course Code			Title of the Paper						
IV				FUNDAMENTALS OF ROBOTICS						
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	2	3	3	3
CO-2	3	3	3	2	2	2	2	3	3	3
CO-3	3	3	3	2	2	2	2	3	3	3
CO-4	3	3	3	3	3	3	3	3	3	3
CO-5	3	3	3	3	3	3	3	3	3	3

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