



गोंय विद्यापीठ

ताळगांव पठार

गोंय - ४०३ २०६

फोन: +९१-८६६९६०९०४८



Goa University

Taleigao Plateau, Goa - 403 206

Tel : +91-8669609048

Email : registrar@unigoa.ac.in

Website: www.unigoa.ac.in

(Accredited by NAAC)

GU/Acad –PG/BoS -NEP/2023/102/34

Date: 16.06.2023

CIRCULAR

The University has decided to implement the UGC Curriculum and Credit Framework for the Undergraduate Programme (CCFUP) of **Bachelor of Science in Electronics/Bachelor of Science in Electronics** (Honours) under the National Education Policy (NEP) 2020 from the Academic Year 2023-2024 onwards.

The approved Syllabus of Semesters I and II of the **Bachelor of Science in Electronics/Bachelor of Science in Electronics** (Honours) Programme is attached.

Principals of Affiliated Colleges offering the **Bachelor of Science in Electronics/Bachelor of Science in Electronics** (Honours) Programme are requested to take note of the above and bring the contents of this Circular to the notice of all concerned.

(Ashwin Lawande)

Assistant Registrar – Academic-PG

To,

1. The Principals of Affiliated Colleges offering the Bachelor of Science in Electronics/Bachelor of Science in Electronics (Honours) Programme.

Copy to:

1. The Director, Directorate of Higher Education, Govt. of Goa
2. The Dean, School of Physical and Applied Sciences, Goa University.
3. The Vice-Deans, School of Physical and Applied Sciences, Goa University.
4. The Chairperson, BOS in Electronics.
5. The Controller of Examinations, Goa University.
6. The Assistant Registrar, UG Examinations, Goa University.
7. Directorate of Internal Quality Assurance, Goa University for uploading the Syllabus on the University website.

Programme Structure for Semester I to VIII Under Graduate Programme- Electronics

Semester	Major -Core	Minor	MC	AE C	SEC	I	D	VA C	Total Credits	Exit
I	ELE-100: Electronic devices and circuits (3L+ 1P)	ELE-111: Analog Fundamentals- EDA (3L+1T)	ELE-131: Introduction to Electricity (1L+2T)		ELE-141: Electronics for Beginners (1L+2P)				20	
II		ELE-112: Digital Fundamentals - EDA (3L+1T)	ELE-132: Repair and Maintenance of Domestic Electrical appliances (3L)		ELE-142: PCB Designing and Fabrication (1L + 2P)				20	ELE-161 : CCTV Installation (2L + 2T)
III	ELE-200: Basic Circuit Theory and Network Analysis (4) ELE-201: Linear Integrated Circuits(4)	ELE-211: Digital Electronics(4)	ELE-231: Computer troubleshooting and Maintenance(3)		ELE-241: PLC and HMI (1L + 2P)				20	
IV	ELE-202: 8085-Microprocessor(4) ELE-203: Transducers and Instrumentation(4) ELE-204: Electronic Communication(4) ELE-205: Programming in C (2)	ELE-221: Robotics (Lab Course)(4)							20	ELE-261 - Repair and Maintenance of Electrical and Electronics equipment(4)
V	ELE-300: 8051-Microcontroller(4) ELE-301: Power Electronics(4)	ELE-321: Internet of Things and Application(4)				ELE-361: Inter-ns hip(2)			20	

	ELE-302: Operating System(4) ELE-303: Programming with Python(2)									
VI	ELE-304: Embedded Systems(4) ELE-305: Biomedical Instrumentation(4) ELE-306: Computer Networking and System Administration(4) ELE-307: Project(4)	ELE-322: Programming with MATLAB(4)							20	
VII	ELE-400: Augmented Reality and Virtual Reality(4) ELE-401: Artificial Intelligence(4) ELE-402: Fundamentals of Signal Processing(4) ELE-403: Optoelectronics(4)	ELE-411: Mobile App development(4)							20	
VIII	ELE-404: Agro Electronics(4) ELE-405: Digital Image Processing (4) ELE-406: VLSI Design(4)	ELE-412: Pharmaceutical Instrumentation(4)							20	

	ELE-407: Industrial Automation(4)								
--	-----------------------------------	--	--	--	--	--	--	--	--

Name of the Programme: BSc Electronics

Course Code: ELE 100

Title of the Course: Electronics Devices and Circuits

Number of Credits: 04 (3Lecture +1Practical)

Effective from AY: 2023-24

Pre-requisites for the Course:	Nil	
Course Objectives:	This course is intended to: <ul style="list-style-type: none">Introduces basic concepts of various electronic devices.Study and analyse characteristics of various amplifiers.Understand biasing and stability techniques for an amplifier.To understand different types of amplifiers and oscillators.	
Content:	Unit I Junction Diode and its applications: Conduction in Semiconductors, P type & N-type Semiconductor, PN junction diode (Ideal and practical)-constructions, Formation of Depletion Layer, Diode Equation and I-V characteristics. Idea of static and dynamic resistance, dc load line analysis, Quiescent (Q) point. Rectifiers- Half wave rectifier, Full wave rectifiers (centre tapped and bridge), circuit diagrams, working and waveforms, ripple factor and efficiency. Filter-Shunt capacitor filter, its role in power supply, output waveform, and working. Regulation- Line and load regulation	14 Hours
	Unit II Special Purpose Diode Zener and avalanche breakdown, Zener Diode, V-I Characteristics, Zener diode as voltage regulator: Load and line regulation. Power Diode, Schottky Diode, Varactor Diode, LASER Diode, Tunnel diode, PIN diode	5 Hours
	Unit III Bipolar Junction Transistor Bipolar Junction Transistor: Construction and working, Review of the characteristics of transistor in CB, CC and CE configurations, Comparison of the characteristics of CB, CC and CE, Regions of operation (active, cut off and saturation), Current gains α (α), β (β) and γ (Γ). Relations between α , β and Γ . dc load line and Q point, Transistor as switch, Transistor as Amplifier, Darlington Pair, Transistor biasing and Stabilization circuits: Fixed Bias, Emitter Bias and Voltage Divider Bias. Thermal runaway, stability and stability factor S. Power Amplifiers: Class A, Class B, Class AB Push Pull and Class C Amplifier operation.	12 Hours
	Unit IV Cascaded Amplifiers: Two stage RC Coupled Amplifier and its Frequency Response, Direct Coupled Amplifier and its Frequency Response	2 Hours
	Unit V Feedback in Amplifiers: Concept of feedback, negative and positive feedback, advantages of negative feedback (Qualitative only).	2 Hours
	Unit VI Sinusoidal Oscillators: Barkhausencriterion for sustained oscillations. Phase shift and Colpitt's oscillator. Determination of Frequency and Condition of oscillation.	4 Hours
	Unit VII Unipolar Devices JFET Construction, working and I-V characteristics (output and transfer), JFET as Amplifier, MOSFET: DE-MOSFET and E-MOSFET, Construction, working and I-V characteristics	6 Hours

Practical's	<p>(output and transfer), UJT Construction, working, equivalent circuit and I-V characteristics, UJT as Relaxation Oscillator.</p> <p>Any eight from below:</p> <ol style="list-style-type: none"> 1. Study of the I-V Characteristics of (a) p-n junction Diode, and (b) Zener diode. 2. Half wave: Ripple factor and load regulation. 3. Full wave: Ripple factor and load regulation. 4. Bridge rectifiers: Ripple factor and load regulation. 5. Zener regulator on the output of FWR. 6. Fixed Bias and Voltage divider bias configuration for CE transistor. 7. class A amplifier, class B amplifier, class C amplifier. 8. RC Phase Shift Oscillator and Colpitt's oscillator. 9. UJT as relaxation oscillator. 	30 Hours
Pedagogy:	Lectures/Tutorials/Practical's	
References/Readings:	<ol style="list-style-type: none"> 1. Floyd Thomas "Electronic Devices ", 5th Edition, Pearson Education Publication ,2022 2. Malvino Albert Paul "Electronic Principles", 3rd Edition Tata McGraw-Hill Publication,1994. 3. Mottershead Allan "Electronic Devices & Circuits" EEE Publication,1973. 	
Course Outcomes:	<p>Students will,</p> <ul style="list-style-type: none"> ● Understand a regulated power supply using rectifiers and filters. ● Learn transistor biasing circuit for class A, B, AB and C amplifier. ● Analyse a system as per the requirements and specifications. ● Learn about FET/MOSFET as amplifier. 	

Name of the Programme: BSc Electronics

Course Code: ELE-111

Title of the Course: Analog Fundamentals – EDA

Number of Credits: 04 (3 Lectures +1 Tutorials)

Effective from AY: 2023-24

Pre-requisites for the Course:	Nil	
Course Objectives:	This course is intended to: <ul style="list-style-type: none">Understand the basic concepts of electronic devices.Design and analyse characteristics of various amplifiers e.g.CB, CE and CC.Explains biasing and stability techniques for an amplifier.Design various types of amplifiers and oscillators.	
Content:	Unit I Introduction to basic components and circuit analysis Introduction to basic circuit components like resistors, capacitors, inductors. Circuit analysis: Concept of Voltage and Current Sources. Kirchhoff's Current Law, Kirchhoff's Voltage Law. Unit II Basic of Analog Electronics Introduction to basic circuit components like diodes, transistors, Op-Amps and Integrated Circuits (ICs). PN junction diode, diode as a rectifier, half wave rectifier circuit. Qualitative idea on construction of a transistor and its working. Transistor circuits such as transistor as a switch and transistor as an amplifier (single stage amplifier). Block diagram of an Op-Amp, symbol and ideal characteristics. Basic Op-Amp amplifier circuit such as Inverting and non-inverting amplifiers. Unit III Filters and Oscillators First order Low Pass Filters, first order High Pass filters. First order Low Pass Filters using Op-Amp, first order High Pass filter using Op-Amp. Qualitative idea on Oscillators. Basics of Phase shift Oscillator. Unit IV Introduction to EDA tools Introduction to EDA tools, Creating a New Project, Schematic Capture Window, zooming and panning, Visual Aids available to Design, Display Options, Design Overview. Unit V Basic Schematic Selecting Parts from the Library, Placing Objects on the Schematic, wiring and terminal connection, power connections, parts labels and annotation, Multi sheet designs and connectivity, Library parts, import devices, create new device, Graphics and pins, adding properties, attaching datasheets, indexing and library selection.	7 Hours 14 Hours 6 Hours 4 Hours 14 Hours
Tutorials	Discuss and demonstrated the below listed case studies with EDA: <ol style="list-style-type: none">Verify the KCL and KVL.Series and parallel LCR circuits.Half wave rectifier.The working of a transistor as switch.Trasitor working as an amplifier.Analyze the inverting and non-inverting amplifier using an Op-Amp for given gain.	15 Hours

	7. 1 st order active low pass and high pass filters for given cut-off frequency. 8. Phase shift oscillator for given frequency.	
Pedagogy:	Lectures/Tutorials	
References/ Readings:	<ol style="list-style-type: none"> 1. Mottershead Allan "Electronic Devices & Circuits" EEE Publication,1973. 2. Sudhakar A and Palli Shyammohan S "Circuits and Network Analysis and Synthesis",5th edition , Tata Mc Graw Hill,2017. 3. Gayakward Ramakant A. "Op-Amps and Linear Integrated Circuits", 4th Edition ,2015 4. https://labcenter.s3.amazonaws.com/downloads/Tutorials.pdf 	
Course Outcomes:	<p>Students will,</p> <ul style="list-style-type: none"> • Understand the basic concepts of analog circuit design. • Simulate basic analog circuits using EDA tools. • Analyze the performance of analog circuits using EDA tools. • Develop skills in using EDA tools like Proteus software. 	

Name of the Programme: BSc Electronics

Course Code: ELE-131

Title of the Course: Introduction to Electricity

Number of Credits: 03 (02Theory + 01Tutorial)

Effective from AY: 2023-24

Pre-requisites for the Course:	Nil	
Course Objectives:	<ul style="list-style-type: none">● Familiarize with various electrical terms and components.● Understand working principle of the electrical components, their ratings and uses.● Develop necessary skills for house/farm wiring circuit.● Develop necessary skills for indoor and outdoor lighting system.	
Content:	Unit I Introduction to Electrical Components Electrical Devices: Resistors, Capacitors, Inductors, Transformers: Symbols, specifications, working principle and their applications. Electrical Sources and loads: Definition of Current, Voltage, Energy, Power, power factor and measurements, Types of AC & DC sources and loads, Series and Parallel connection of sources and loads. Batteries: Chargeable and non-chargeable batteries, Battery bank installation and commissioning, Tools required for battery testing. Network laws: Ohms law, Kirchhoff's laws, voltage divider and current divider theorems, open and short circuits	10 Hours
	Unit II INTRODUCTION TO ELECTRICITY Line Voltage: Distribution, Mains supply standards, Meaning of Single phase and three phase supply, conventions followed, Advantages and disadvantages of three phase supply, Star and delta inter-connection of sources and loads. Importance of earthing and fuse: Introduction of Earthing, Need of earthing, Hazard, Types of earthing, Advantage of earthing, working of earthing, Importance of fuse, types of fuse, Circuit Breaker and their ratings House Wiring: Introduction of Wiring, types of wiring, advantage of wiring, wiring methods, electrical panel, House wiring diagram, 2 and 3-wire systems, selection of proper wire size and voltage drop. Load calculation for residential and commercial purpose. Lights and Lightning: Types of lights and their power consumption and luminance, comparison of incandescent, LED and CFL bulbs.	10 Hours
	Unit III Energy Consumption and Preventive Maintenance General safety Precautions: Danger of high voltage and currents, handling and maintenance for all types of electrical and electronic domestic Appliances, Energy consumption, Switches: Types and their ratings. Stabilizer and UPS: Types , their working Principles (Block level only), their ratings and applications	5 Hours
	Tutorials Discuss and demonstrated the below listed case studies: 1. Familiarization with various controls and use of CRO, Power Supply, Function Generator and Multi meter, Various Electronics components. 2. Battery fault detection and maintenance.	20 Hours

	3. Battery diagnostic and capacity testing. 4. Inverter connection for residential house. 5. Introduction, working, Connection and Energy meter reading: Electricity bill calculation. 6. Power Calculation of Load. 7. Demonstrate the single and three phase wiring (EDA).	
Pedagogy:	Lectures /Tutorials	
References/ Readings:	1. Chetan Singh Solanki, “Solar Photovoltaic technology and systems” PHI learning Private Ltd. EEE, 2013. 2. Sudhakar and Shyam Mohan, “Electrical analysis and Synthesis”, TMH, 2015. 3. Theraja and Theraja, Electrical Technology, Vol 1 by, PHI, 2016 . 4. Satheesh Kumar, ‘Electrical wiring, An Introduction’ Ane Book Pvt Ltd. 2 nd Edition, 2016.	
Course Outcomes:	Students will: <ul style="list-style-type: none"> ● Understand basics of electrical components. ● Understand electrical wiring and safety measures. ● Understand lighting and its applications ● Apply the knowledge and techniques to design wiring and lightning for housing and commercial setup. Get self-employed in ever growing battery industry	

Effective from AY: 2023-24

Pre-requisites for the Course:	Nil
Course Objectives:	<p>This course is intended to:</p> <ul style="list-style-type: none"> ● Introduce to students the basic of electronics. ● Understand how circuit diagrams are drawn and constructed on breadboard. ● To implement real life application based electronic circuits.
Content:	<p>Unit I Basics of Electronics Electricity, Measuring Charge and Current ,AC vs. DC, Current Flow,Voltage and Resistance,Picturing Voltage, Volts Are Relative, Relative Voltages and Ground Potential ,Resistance .</p> <p>Unit II Building circuit Schematics Circuit Requirements ,Basic Components(resistor , inductor, capacitor), Creating Your First Circuit,Adding Wires,Drawing Circuits,Drawing the Ground.</p> <p>Unit III Constructing and Testing Circuits The Solder-less Breadboard,Putting a Circuit onto a Breadboard ,Using Fewer Wires , Testing Circuits with a Multi-meter ,Using a Multi-meter with a Breadboard ,Measuring Current with a Multi-meter,Use of Function Generator and Oscilloscope to observe signals.</p> <p>Unit IV Sensors and actuators Working Principles of Diode , Transistor, LED, Buzzer,Switches,Sensors(PIR, Piezo-electric sensor etc.) and Actuators (Motors,Speaker etc).</p> <p>Unit V Applications(Circuit diagram and working) Simple touch sensor using transistor,Intruder Alarm,Water tank level indicator,LED chaser circuit,Rain detector,Light intensity measurement using LDR,LED flip flop,Smoke detector, Clap Switch,Door knock sensing doorbell,Motion detection using PIR sensors.</p> <p>1. Simple touch sensor using transistor 2. Intruder Alarm 3. Water tank level indicator 4. LED chaser circuit 5. Rain detector 6. Light intensity measurement using LDR 7. LED flip flop 8. Smoke detector 9. Clap Switch 10. Door knock sensing doorbell. 11. Motion detection using PIR sensor.</p>
Practical List (Any 08)	<p>2 Hours</p> <p>3 Hours</p> <p>5 Hours</p> <p>2 Hours</p> <p>3 Hours</p> <p>60Hours</p>
Pedagogy:	Lectures/Experiential/Practical's Learning
References/Readings:	<p>1. Bartlett Jonathan "Electronics For Beginners_ A Practical Introduction To Schematics, Circuits, And Microcontrollers" Apress ,2020.</p> <p>2. Boysen Earl, Muir Nancy C,"Electronics Projects For Dummies"Wiley,2006.</p>
Course Outcomes:	<p>Students will,</p> <ul style="list-style-type: none"> ● Understand the basics of Electronics. ● Learn to draw schematics and also the implement the circuit on breadboards. ● Implement electronics circuits of practical use.

Name of the Programme: BSc Electronics

Course Code: ELE-132

Title of the Course: : Repair and Maintenance of Domestic Electrical Appliances

Number of Credits: 03 (Lectures)

Effective from AY: 2023-24

Pre-requisites for the Course:	Nil	
Course Objectives:	<p>This course is intended to:</p> <ul style="list-style-type: none">• Develop understanding of domestic wiring and key elements of electrical appliances with basic safety practices.• Impart knowledge to analyse and repair electrical appliances.• Develop practice of maintenance of electrical equipment's.• Students will be demonstrated the various equipment's working while delivery of lectures.	
Content:	Unit I Introduction to Electricity Line Voltage: Distribution, Mains supply standards, Meaning of Single phase and three phase supply, conventions followed. Importance Of Earthing and Fuse: Introduction of Earthing, need of earthing, Hazard, Types of earthing, Advantage of earthing, working of earthing, Importance of fuse, types of fuses. House Wiring: Introduction of Wiring, types of wiring, advantage of wiring, wiring methods, electrical panel, House wiring diagram.	10 Hours
	Unit II Energy Consumption and Preventive Maintenance General Precautions, handling and maintenance for all types of electrical and electronic domestic Appliances, Energy consumption. Energy Meter: Introduction, working, Connection and Energy meter reading, Power Calculation of Load, Electricity Bill calculation.	07 Hours
	Unit III Heating Appliances Introduction, working principle, construction, operation, Installation, Maintenance and Repair (fault-finding and removal of faulty component): Electrical iron, Electric stove, Electric Toaster, Immersion heater, Electric geyser, Electric Oven, Induction Cooktop, Electric Roti Maker, Electric Kettle.	07 Hours
	Unit IV Motorized Appliances Introduction, working principle, construction, operation, Installation, Maintenance and Repair (fault-finding and removal of faulty component): Electric fan (Ceiling Fan and Table Fan), Electric Mixer grinder, Electric washing machine, Hairdryer, Vacuum cleaner.	07 Hours
	Unit V Electrical and Electronic Appliances Introduction, working principle, construction, operation, Installation, Maintenance and Repair (fault-finding and removal of faulty component): Electric gas lighter, Electric bell and buzzer, Emergency light, Voltage Stabilizer (Relay based), Linear Regulated Power Supply, Battery Charger, Solar Voltaic cell, Tube light.	07 Hours
	Unit VI Visual Electronic Appliances Introduction, block diagram, working principal and different sections of: Public Address System, CD/DVD player, LCD/LED Television.	07 Hours

Pedagogy:	Lectures/Experiential Learning
References/ Readings:	<ol style="list-style-type: none"> 1. Sotcher Fred "The Repair & Maintenance of Electrical Equipment: A Complete Guide to Troubleshooting Portable Electric Tools and Generators", Miramar Publishing Company, 1980 2. Khandpur R.S." Troubleshooting Electronic Equipment: Includes Repair and Maintenance" Second Edition, McGraw-Hill Education TAB,2006.
Course Outcomes:	<p>Students will,</p> <ul style="list-style-type: none"> ● Acquire the basic knowledge of electricity and domestic wiring. ● Understand the working of basic electrical appliances and their safety precautions. ● Able to do repair and maintenance of the basic electrical appliances.

Name of the Programme: BSc Electronics

Course Code: ELE-142

Title of the Course: PCB Designing and Fabrication

Number of Credits: 03(1Lecture +2Practical)

Effective from AY: 2023-24

Pre-requisites for the Course:	Nil	
Course Objectives:	<ul style="list-style-type: none">Understand the need for PCB Design and steps involved in PCB Design and Fabrication process.Familiarize Schematic and layout design flow using Electronic Design Automation (EDA) Tools.Develop necessary skills for designing single sided and double-sided PCBs using Electronic Design Automation (EDA) Tools.	
Content:	Unit I Introduction to PCB designing concepts Introduction & Brief History: Background and History of PCB, Definition and Need/Relevance of PCB, Classification of PCBs: Single-sided PCBs, Double-sided PCBs, Multi-layer PCBs, Rigid and Flexible PCBs. Platted through holes technology and Surface mount technology, Terminology in PCB Design, Basic Electronic Components: Active vs Passive components and their symbols, Resistors, Capacitor, Inductors, Potentiometers, Diodes, Transistors, and Integrated Circuits.	3 Hours
	Unit II Layout and Artwork PCB Design Process Layout Planning: Steps involved in layout design, General rules of Layout, Supply and Ground Conductors, Component Placing and Mounting, Cooling requirement, General design factor for digital and analog circuits. Artwork generation: Basic artwork approaches (manual and CAD), General Design guidelines for Artwork Preparation-Conductor orientation, Conductor routing, conductor spacing, Hole diameter and solder pad diameter, The square land pad, no conductor zones, pad conductor holes, conductor and solder joint pads.	3 Hours
	Unit III Laminates and Printed Circuit Board Production Techniques Types of Laminates, Properties of laminates, Photo printing, film-master production, reprographic camera, Basic process for single and double sided PCBs, Photo resists, Screen-printing process.	2 Hours
	Unit IV PCB Fabrication & Assembly Steps involved in fabrication of PCB. PCB Fabrication techniques-single, double sided and multilayer Etching: Introduction to PCB etching process, Dry Etching and Wet Etching, etching machine Post operations- stripping, black oxide coating and solder masking PCB component assembly processes: Solder connection, Solder joints, Solder alloys, soldering fluxes, Soldering & Desoldering tools.	2 Hours
	Unit V Transmission lines and crosstalk Transmission Line: Transmission lines and its effects, Significance of Transmission line in Board design, Types of Transmission lines. Crosstalk: The crosstalk in transmission lines, Crosstalk control in PCB design parts, planes, tracks, connectors, terminations,	2 Hours

Practical List (Any 8)	Minimization of crosstalk. Thermal issues: Thermal mapping of design. Unit VI PCB designing using EDA tools Different Electronic design automation (EDA) tools and comparison. (Proteus, OrCAD, Eagle, Kikad, etc), Selecting the Components Footprints as per design, Making New Footprints, Assigning Footprint to components, Netlist generation, PCB Layout Designing, Auto routing and manual routing, assigning specific text (silkscreen) to design, Generating (GERBER file) for design. Part-A: Creating Artwork and Printing of single sided PCB for the following circuits (any 4) 1. Regulator circuit using 7805/LM317 2. Adder circuit using op-amp IC 741 3. Bridge Rectifier 4. LED flasher using IC555 5. Twilight Switch 6. Touch plate switches – transistorized or 555 based 7. Clapping switch and IR switch 8. Cell charger/battery charger/mobile charger 9. Fire/smoke/intruder alarm 10. Water level controller 11. Displaying decimal number on 7-segment display using BCD to 7- segment decoder IC 12. Audio amplifier using op-amp IC 741 Part-B: Etching and drilling of single sided PCB (Compulsory) 13 Etching of single-side PCB for any one of the circuits mentioned in Part-A Part-C: Fabricate single-sided PCB (Compulsory) 14 Fabricate and test single-side PCB for any one of the circuits mentioned in Part-A by mounting and soldering components.	3 Hours
		60 Hours
Pedagogy:	Lectures/Experiential/Practical's Learning	
References/ Readings:	1. Khandpur R.S. "Printed Circuit Board Design, Fabrication Assembly and testing", TMH, 2006 2. Bosshart Walter C. "Printed circuit Board Design and technology," TMH, 1983 3. Clyde F. Coombs, Jr, Happy T. Holden "Printed Circuits Handbook", 6th edition, TMH Education, 2016. 4. Kwashnak Kenneth "A Basic Introduction for Designing a Printed Circuit Board (PCB) with EAGLE eCAD/CAM Software " SURVICE Engineering 4695 Millennium Drive Belcamp, 2020.	
Course Outcomes:	Students will, <ul style="list-style-type: none"> ● Explain and describe the steps involved in schematic, layout, fabrication, and assembly process of PCB design. ● Able to design a single- and double-layer PCB ● Able to fabricate the single land double layer PCB. ● Able to design and troubleshoot the circuit over PCB. ● Able to design his own circuit for any application. 	

Name of the Programme: BSc Electronics

Course Code: ELE-161

Title of the Course: CCTV Installation

Number of Credits: 04 (02 Lectures + 2 Tutorials)

Effective from AY: 2023-24

Pre-requisites for the Course:	Nil	
Course Objectives:	This course is intended to: <ul style="list-style-type: none">• Develop understanding of basics of Networks& CCTV Technology.• Acquire knowledge of CCTV Camera Installation.• Develop skills to perform trouble shooting and maintenance CCTV systems.	
Content:	Unit I Introduction to CCTV Technology (Lectures) Introducing CCTV & Uses -Elements of a basic CCTV system: - Camera, monitor and digital recorder, Connectors and cables, Basics of Networking -Tools and Equipment, Power Supply- Types (UPS and DCPS), Functionality and Termination.	08 Hours
	Unit II Types of CCTV Cameras (Lectures) Dome Camera - Bullet Type Camera - C-Mount Camera - Day/Night Camera - Infrared/Night Vision CCTV Camera - Varifocal Cameras -Wireless Cameras, PTZ and Bullet, indoor and outdoor, monochrome, Camera specifications: - Sensitivity, signal to noise ratio and resolution.	07 Hours
	Unit III Cables and Connectors Types (Fibre & Copper), uses, limitations, preparation and testing, Types of Connectors, Cable Conduit, Cable Tray, Industrial Standard, laying Method,	04 Hours
	Unit IV Networking Introduction to IP technology. Network Devices- Switches (configuration & installation), Routers (configuration & installation), OLT and ONT, Configuration and Termination: Server- Installation, Configuration (software), Network configuration (Normal & High security).	08 Hours
	Unit V Wireless Communication Types of Antennas, Radios, Configuration, Limitations.	03 Hours
	Unit VI Installation of CCTV(Tutorials) Planning for CCTV Camera Installation - Installing the Camera - Checking the Camera Functions, Connection to other security systems, Cable Termination method, Hard disk installation, Microphone configuration.	13 Hours
	Unit VI Maintenance of CCTV & Data Management (Tutorials) Trouble Shooting and maintenance: Hardware, Managing Data: Data Storage Devices - Cloud Storage Technology, Recording the footage: - Analogue and Digital video recorders. Backup and Archiving. Video Management Software- Adding and Deleting camera, recording mode, Fail Over, Logs, report, Monitoring, Client. Password Recovery.	10 Hours
	Unit VII Live Stream of Video on Mobile Device(Tutorials) The Benefits of Remote Viewing - Connecting Your Recorder - Enabling Remote Viewing - Installing Viewing Software - Connecting to Your Smartphone - Using Web Services - Potential Risks.	05 Hours
	Unit VIII Evidence Creation (Tutorials)	02 Hours

	Role of CCTV footage - Importance of CCTV footage - Retrieve CCTV footage – Authentication- Analyze CCTV footage	
Pedagogy:	Lectures/Experiential Learning	
References/ Readings:	1. Hill Thomas,” CCTV Handbook: Buying, Installing, Configuring, & Troubleshooting A User’s Guide to CCTV Security “,kindle edition,2019. 2. AISECT Content Group Participant's Guide for CCTV Installation Technician “, kindle edition,2018.	
Course Outcomes:	Students will, <ul style="list-style-type: none"> ● Understand basics of Network & CCTV Technology. ● Install CCTV System ● Maintain of CCTV systems. Note: Student can take some installation under guidance of lecture/entrepreneur.	