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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VALUE ADDED COURSES

SYLLABUS

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

A PRACTICAL COURSE ON EMBEDDED CONTROLLERS AND ITS APPLICATIONS IN ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE SYLLABUS

COURSE OBJECTIVES:

- To expose students to the field of Embedded Systems
- To enable students to implement their creative concepts to work

Course Code	Course Title	Theory / Practical
	EMBEDDED CONTROLLERS AND ITS APPLICATIONS IN ELECTRICAL AND ELECTRONICS ENGINEERING	**Theory**
Unit No	**Modules (Theory)**	**T (Hrs.)**
I	**Unit Title: Introduction: Microprocessor and Microcontroller** Microprocessor survey, RISC and CISC, CPU Architecture, Harvard and Von-Neumann. CPU Architecture. 8051 Microcontroller Architecture. Pin functions organizations Input Output pins, ports and circuits. Internal and External memory Architecture. 8051 Reg. banks and stack. 8051 flag bits and PSW Register. Special function Registers. Timer Counter. Serial data input output, Interrupts, program counter and ROM space in the 8051.	10
II	**Unit Title Recorders & Mounts, Enclosures & housing** Immediate and Register addressing modes. Accessing memory using various addressing modes. Bit addressing for I/o and RAM 8051 data types and directives. Jump Loop and CALL Instructions Arithmetic and Logic Instructions and programming I/o port programming. Assembly Language programs using various Instructions.	5
III	**Unit Title: 8051 programming in C and interfacing.** Compare types of video monitors and displays used in CCTV, Explain video amplifier usage in security systems Describe and name common cable connectors and which cable types they apply to, Explain the use of cabling standards	5
IV	**Unit Title: 8051 programming in C and interfacing.** Data types and time delay in 8051 C, I/o programming, Logic operation, data conversion programs, accessing Code ROM Space, data serialization. **8051 interfacing** to LCD and key board, DAC, stepper motor, DC Motor, Parallel and serial ADC. Elevator.	10
V	**Unit Title: Timer/ Counter, Serial communication and Interrupts in 8051.** Programming 8051 timer/ counter, programming timer 0 and 1 in 8051 C, Basics of serial communication, 8051 connections to **RS-232**. 8051 serial port programming in C, 8051 Interrupts, Programming Timer Interrupts, External hardware Interrupts and serial communication Interrupts. Interrupts priority & Interrupt programming in C.	5
VI	**Unit Title : Introduction to Advanced Microcontrollers** Salient Features of Advanced Microcontrollers. **MSP430F2013** Architecture and pin functions, Memory, Clock Generator, CPU Registers, Addressing modes, Instruction set and emulated Instruction set. Development Environment. Aspects of C for embedded system, Introduction to MSP 430 starter kit, parallel ports.	10
	Total	**45**

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Course Outcomes:

After studying this course ,Student will be able to:

- Learn architecture of 8051 and MSP 430.
- Learn programming skills using Assembly language and C
- Design and interfacing of microcontroller based embedded systems.
- Build projects

Textbooks:

1. "The 8051 Microcontroller and Embedded systems-using assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinaly,PHI,2006/pearson,2006
2. "MSP430 Microcontroller Basics" John H. Davis, Elsevier 2010.

Reference Books:1. "The 8051 Microcontroller architecture. Programming and applications", Kenneth J Alyala Thomson learning 2005.

2. "The 8051 Microcontroller: Hardware, Software and Applications" V. Udhayashankara and Mallikarjuna Swamy ,TMH., 2009.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
INDUSTRIAL SAFETY ENGINEERING

COURSE SYLLABUS

COURSE OBJECTIVES: This course will provide students with a strong overall understanding of the many safety practices and requirements as they relate to industrial settings, specifically power generation, transmission, and distribution.

Course Code	Course Title	Theory / Practical
	INDUSTRIAL SAFETY ENGINEERING	**Theory**
Unit No	**Modules (Theory)**	**T (Hrs.)**
I	**Unit I- Safety in Metal Working and Wood Working Machines** General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, Wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes- saws, types, hazards. Inspection of material handling equipments.	9
II	**Unit II -Safety in Welding and Gas Cutting** Gas welding and oxygen cutting, resistances welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing -explosive welding, selection, care and maintenance of the associated equipment and instruments – safety in generation, distribution and handling of industrial gases-colour coding – flashback arrestor – leak detection-pipe line safety storage and handling of gas cylinders..	9
III	**UNIT III -Safety in Cold Forming and Hot Working of Metals** Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal sheers-press brakes – Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills – hot bending of pipes, hazards and control measures – Safety in Gas Furnace Operation, Cupola, Crucibles, Ovens, Foundry Health Hazards, Foundry Processes.	9
IV	**UNIT IV- HAZARD ANALYSIS** Work Environment, Material Handling in Foundries, Foundry Production Cleaning And Finishing System Safety Analysis -Techniques - Fault Tree Analysis (FTA), Failure Modes and Effects Analysis (FMEA), HAZOP analysis and Risk Assessment	9
V	**Unit V- Industrial Safety** Advances in Industrial Ergonomics and safety, Work and protective clothing, Theory and practice of Industrial safety, Industrial Noise and Vibration, Machine Guarding and Industrial machine safety, Manual material handling, Modeling for safety and health.,	9
	Total	**45**

Course Outcomes:

Student will be able to:

The student will consider and analyze the various operating characteristics of different types of generation, transmission, and distribution equipment and systems.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

ELECTRICAL CONTROL AND PANEL DESIGNING

COURSE SYLLABUS

Course Objectives:

- Demonstrate sound knowledge and understanding of various international Electrical standards such as IEC, NEMA, NPFA/NEC, UL, CSA
- Demonstrate good understanding of relay logic and how to apply it in solving real life control problem
- Wire up relays, timers, contactors, counters, breakers in conjunction with sensors to control electric motors, solenoid, robots, valves and other field instruments

Course Code	Course Title	Theory / Practical
	ELECTRICAL CONTROL AND PANEL DESIGNING	**Theory**
Unit No	**Modules (Theory)**	**T (Hrs.)**
I	**Unit Title: Insdustrial Electric controls- Design and Installation** Basics of relays, contactor, mcb, mccb, elcb, acb, vcb etc working details of different types of electric motors. Designing of control circuits using contactors, relays, timers etc dol, star delta starter designing for 3 phase motors with specification. Practical wiring session on different controls. Motor drives- ac drives and dc drives. Safety and management concepts of designing a project.	**9**
II	**Unit Title: Control Panel Designing** Different types of panels. Basic components to be installed in a panel. Wiring details of panel. Specification and physical dimension of components. Earthing and cabling of panels- standard procedures. P&i diagram preparation.	**9**
III	**Unit Title: PLCS in Electrical Controls** Need of plc in electrical controls. Basics of plc. Architecture- modules no/ nc, timers, counters etc programming practice.	**9**
IV	**Unit title: PCC Panel** Basic Electrical calculations., FLC (full load current).,Power factor calculations, Total connected load, Selection of motor starters, Selection of switchgears, Power factor correction methods, Types of Electrical Control Panels, Motor Control Centers (MCC) panels, Power Control Centers (PCC) panels.	**9**
V	**Unit title: Panel Designing** APFC Panels, AMF Panels, Power Distribution Panels, ATS Panels, etc., Preparation of General Arrangement (GA) Drawings, Sizing of various compartments in panels, Non compartmental panels, Sizing of Cables & Cable entry, Busbar Routings., Cable terminations. Preparation of Fabrication (GA) Drawings.,(IP)Ingress Protection. Switchgear mountings., Cable supports., Busbar supports.	**9**
	Total	**45**

Course Outcomes:

After completion of the course the student is able to:

- Learn the Drawing reading & designing
- Understand the nomenclatures

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

A PRACTICAL COURSE ON SENSOR TECHNOLOGY

COURSE SYLLABUS

Course Objectives:

1. To provide basic knowledge in transduction principles, sensors and transducer technology and measurement systems.
2. To provide better familiarity with the Theoretical and Practical concepts of Transducers.
3. To provide familiarity with different sensors and their application in real life.
4. To provide the knowledge of various measurement methods of physical and electrical parameters

Course Code	Course Title	Theory / Practical
	SENSOR TECHNOLOGY	**Theory**
Unit No	**Modules (Theory)**	**T (Hrs.)**
	Unit Title: Introduction	
I	Sensors / Transducers: Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges -Inductive Sensors: Sensitivity and Linearity of the Sensor -Types-Capacitive Sensors: Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators, Ultrasonic Sensors	10
	Unit	
II	Thermal Sensors: Introduction ,Gas thermometric Sensors ,Thermal Expansion Type Thermometric Sensors ,Acoustic Temperature Sensor ,Dielectric Constant and Refractive Index thermo sensors ,Helium Low Temperature Thermometer ,Nuclear Thermometer ,Magnetic Thermometer ,Resistance Change Type Thermometric Sensors, Thermo emf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors	10
	Unit	
III	Velocity And Acceleration Measurement Relative velocity – Translational an Rotational velocity measurements – Revolution counters and Timers – Magnetic and Photoelectric pulse counting stroboscopic methods. Accelerometers- different types, Gyroscopes- applications. Density measurements – Strain Gauge load cell method – Buoyancy method – Air pressure balance method – Gamma ray method – Vibrating probe method.	5

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	Unit	
IV	Radiation Sensors: Introduction, Basic Characteristics, Types of Photo resistors/ Photo detectors, X-ray and Nuclear Radiation Sensors, Fibre Optic Sensors Electro analytical Sensors: The Electrochemical Cell, The Cell Potential – Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization, Concentration Polarization, Reference Electrodes, Sensor Electrodes, Electro ceramics in Gas Media.	10
	Unit	
V	Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing – Data Communication, Standards for Smart Sensor Interface, the Automation Sensors -Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing -Sensors for environmental Monitorin.	10
	Total	**45**

Course Outcomes:

After completion of the course the student is able to:

1. Identify suitable sensors and transducers for real time applications.
2. Translate theoretical concepts into working models.
3. Design the experimental applications to engineering modules and practices.
4. Design engineering solution to the Industry/Society needs and develop products.

Text Books:

1. Measurement Systems – Applications and Design – by Doeblin E.O., 4/e, McGraw Hill International, 1990.
2. Principles of Industrial Instrumentation – Patranabis D. TMH. End edition 1997

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
A CERTIFICATE COURSE ON ELECTRICAL SERVICE AND MAINTENANCE
COURSE SYLLABUS

Course Objectives:

This course is designed to introduce students to the basic terminology and structure of, electrical systems.

Course Code	Course Title	Theory / Practical
	ELECTRICAL SERVICE AND MAINTENANCE	**Theory**
Unit No	**Modules (Theory)**	**T (Hrs.)**
I	**Module- Electrical wiring** ISI safety, Health and Safety, PPE, Tools and measuring instruments, Electrical accessories, Types of Fuse & MCB, RCCB , ELCB, MCCB, ICDP and ICTP, Basic electricity, Circuits, testing and connections of parallel and series combination of wiring, fan and regulator connections, conductor, insulator, semi-conductor, earthing, wiring types, polarity testing, earth testing methods, types of cells and batteries, checking efficiency of battery, basic electronics, surface wiring, concealed wiring	**12**
II	**Module- Electrician** Magnetism and electromagnetism, properties and types of magnet, alternator, types of alternator, AC motor, transformer concepts	**11**
III	**Module- Motor Rewinding** Types of Conductors and insulators, vanishing methods, winding preparation, checking of wire gauge, preparation of winding coil, tapping of coil and vanishing, testing of insulation, single and three phase motor testing and fault finding, Winding diagrams and practice, single and double layer 3 phase AC motor winding diagrams, symmetric and asymmetric winding diagram, rewinding of different motors, fan motor rewinding, mixer motor winding	**12**
IV	**Module-Motor Winding** Motor rewinding practice	**10**
	Total	**45**

Course Outcomes:

After completion of the course the student is able to:

1. Students will understand basic electrical concepts and components.
2. Students will understand and perform a simple electrical design.
3. Students will understand and perform simple wiring diagrams and circuits.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

A PRACTICAL COURSE ON ARDUINO PROGRAMMING

COURSE SYLLABUS

Course Objectives:

- To provide basic knowledge in transduction principles, sensors and transducer technology and measurement systems.
- To provide better familiarity with the Theoretical and Practical concepts of Transducers.
- To provide familiarity with different sensors and their application in real life.
- To provide the knowledge of various measurement methods of physical and electrical parameters

Course Code	Course Title	Theory / Practical
	ARDUINO PROGRAMMING	**Theory**
Unit No	**Modules (Theory)**	**T (Hrs.)**
I	**Module- Introduction** Introduction to embedded system- Understanding Embedded System- Overview of basic electronics and digital electronics- Microcontroller vs. Microprocessor-Common features of microcontrollers- Comparison between the two-differing types of microcontrollers.	10
II	**Module-Getting Started with Arduino** Introduction to Arduino- Pin configuration and architecture-Device and platform features-Concept of digital and analog ports.- Familiarizing with Arduino Interfacing Board-Introduction to Embedded C and Arduino platform	5
III	**Module** Incorporating Arduinotime- delay function-delay Microseconds function-Millis function- micros function.	5
IV	**Module** Working with Serial Monitor- Line graph via serial monitor- Interfacing a 8 bit LCD to Arduino-Fixed one line static message display.- Running message display.- Using the LCD Library of Arduino.	5
V	**Module** Arduino – Humidity Sensor, Arduino – Temperature Sensor, Arduino – Water Detector /Sensor, Arduino – PIR Sensor, Arduino – Ultrasonic Sensor, Arduino – Connecting Switch (Magnetic relay switches)	5
VI	**Module** Types of Relay- Controlling Electrical appliances with electromagnetic relays-Working of a matrix keypad- Using the keypad library to interface with Arduino.- Interfacing Servo motors to Arduino- Interfacing a RF Module	5

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	Module	
VI	Types ofRelay- Controlling Electrical appliances with electromagnetic relays-Working of a matrix keypad- Using the keypad library to interface with Arduino.- Interfacing Servo motors to Arduino- Interfacing a RF Module	5
	Module	
VII	Using serial input.- Controlling LEDs with keys.- Keys as toggle .- Interfacing a piezo Buzzer- employing a buzzer as an alarm unit	5
	Module	
VIII	ParallelCommunication- Serial CommunicationModules- sorts of SerialCommunications- ArduinoUART	5
	Total	**45**

Learning Outcome
The students will:

? Learn the basics of electronics,including greadings chematics(electronicsdiagrams)
? Learn the thanks to prototype circuits with a bread board
? Learn the Arduino programming language and IDE
? Program basic Arduino examples
? Prototype circuits and connect them to the Arduino Program the Arduino microcontroller to make the circuits work
? Connect the Arduino micro controller to a serial terminal to understand communication and stand-alone use
? Explore the provided example code and online resources forextending knowledge about the capabilities of the Arduino microcontroller

Text Books:

1. Programming Arduino: Getting Started with Sketches (Tab) 2nd Edition, Kindle Edition
2. Arduino For Dummies 1st Edition by John Nussey.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
A CERTIFICATE COURSE ON E-CADD
COURSE SYLLABUS

Course Objectives

The primary objective of this courseware is to teach the student the basic commands necessary for professional 2D drawing, design, and drafting using AutoCAD. Upon completion of the course, the student will: Become familiar with the AutoCAD user interface. Understand the fundamental concepts and features of AutoCAD.

Course Code	Course Title	Theory / Practical
	E-CADD	**Theory**
Unit No	**Modules (Theory)**	**T (Hrs.)**
I	**Module 1-Fundamentals of Engineering Drawings** • Construction of plane and complex geometrical figures • Construction of Curves and Helix • Principles of Projections • Projections of Straight Lines and Solids • Section of Solids • Mechanical Parts Drawing	**10**
II	**Module 2-Fundamentals of Computers** • Introduction • Computer Hardware and Software Concepts • Introduction of Personal Computer and Operating Systems WINDOWS-XP, Windows-7, File Management	**7**
III	**Module 3- Drawing using AutoCAD** 1. Setting up a drawing starting from scratch 2. Setting up a drawing using a Wizard 3. Using and creating a template file 4. Opening an existing drawing 5. Screen layout 6. Pull-down menus 7. Screen icons 8. Command line 9. status bar 10. Dialogue boxes 11. Drawing Commands 12. Lines, Ray, Construction Line 13. Multiline and polylines 14. Rectangles	**20**

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Date :

	Module 3- Drawing using AutoCAD		
III	1. Setting up a drawing starting from scratch 2. Setting up a drawing using a Wizard 3. Using and creating a template file 4. Opening an existing drawing 5. Screen layout 6. Pull-down menus 7. Screen icons 8. Command line 9. status bar 10. Dialogue boxes 11. Drawing Commands 12. Lines, Ray, Construction Line 13. Multiline and polylines 14. Rectangles 15. Arc, Circle and Ellipse 16. Polygon, Spline 17. Co-ordinate input methods (directive, absolute, relative and polar) 18. Starting a New Drawing/Opening an existing drawing 19. Drawing Commands 20. Hatching Command Text (multi-line & single line) and Formatting Text Styles 21. View Commands & Drawing Settings and Aids 22. Modify Command – 1) Hatching 2) Text (multi-line & single line) and Formatting Text Styles 23. Dimension Command Formatting Dimension Style and Multi-leader Style 24. Drawing Settings and Aids 25. Saving and Plotting		20
	Module 4		
IV	Isometric Drawing		8
		Total	45

Learning Outcome
The students will:

- Draw symbolic representation of electrical components manually.
- Draw free hand sketches, isometric and orthographic views of electrical machines and components.
- Use CAD tools to draw simple electrical components and machines.
- Use CAD to create electrical circuits with components.
- Edit electrical line drawings and control panel layouts in CAD.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

ADD ON COURSES

SYLLABUS

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

ELECTRIC VEHICLE TECHNOLOGY

COURSE SYLLABUS

Course Objectives:

This course aims to study about the evolution of the car, classification and terminologies related to the internal combustion engine and automotives. This course also aims to build working fundamental of various automotive systems and subsystems.

Course Code	Course Title	Theory / Practical
	ELECTRIC VEHICLE TECHNOLOGY	**Theory**
Unit No	**Modules (Theory)**	**T (Hrs.)**
I	**Module-I** **Review of Conventional Vehicle:** Introduction to Hybrid Electric.	**5**
II	**Module-II** **Vehicles:** Types of EVs, Hybrid Electric Drive-train, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains, Electric Propulsion unit, Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, switched reluctance motor, Introduction to Energy Storage.	**10**
III	**Module-III** **Requirements in Hybrid and Electric Vehicles:** Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system, Design of Hybrid Electric Vehicle and Plug-in Electric Vehicle, Energy Management Strategies, Automotive networking and communication, EV and EV charging standards, V2G, G2V, V2B, V2H.	**10**
IV	**Module-IV** Braking System: Purpose of brakes, Principle of brakes, Co-efficient of friction. Types of brake: internal expanding, Hydraulic and Pneumatic brake, function of parts, brake fluid. Properties of friction lining, friction pad materials, power brakes	**7**
V	**Module -V** EV: Opportunities and challenges: Need for alternative energy sources, CNG, LPG, Biogas, Bio-diesel, solar, Hybrid technology, advantages and disadvantages of EV.	**7**
VI	**Module-VI** **Simulations and case studies** in above mentioned areas.	**6**
	Total	**45**

Learning Outcome

The students will:

1. Understand the architecture and vehicle dynamics of electric and hybrid vehicles
2. Analyze and model the power management systems for electric and hybrid vehicles
3. Devise power electronics based control strategies for electric and hybrid vehicles

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

ADD ON COURSES

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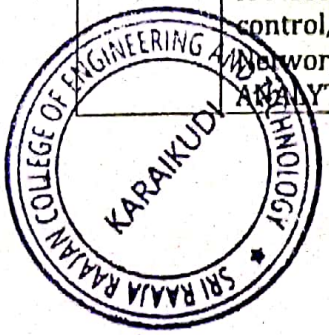
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

INDUSTRIAL INTERNET OF THINGS
COURSE SYLLABUS

Course Objectives:

- Students will learn the new evolution in hardware, software, and data.
- While the promise of the Industrial Internet of Things (IIoT) brings many new business prospects, it also presents significant challenges ranging from technology architectural choices to security concerns.
- Students acquire upcoming Industrial IoT: Roadmap to the Connected World Course offers important insights on overcoming the challenges and thrive in this exciting space.

Course Code	Course Title	Theory / Practical
	INDUSTRIAL INTERNET OF THINGS	**Theory**
Unit No	**Modules (Theory)**	**T (Hrs.)**
I	**UNIT 1-INTRODUCTION** Introduction to IoT, IoT Vs. IIoT, History of IIoT, Components of IIoT -Sensors, Interface, Networks, People &Process, Hype cycle, IOT Market, Trends& future Real life examples, Key terms of IoT–IoT Platform, Interfaces, API, clouds, Data Management Analytics, Mining &Manipulation; Role of IIoT in Manufacturing Processes Use of IIoT in plant maintenance practices, Sustainability through Business excellence tools Challenges and Benefits in implementing IIoT.	9
II	**UNIT 2- SENSORS AND INTERFACING** ARCHITECTURES: Overview of IoT components: Various Architectures of IoT and IIoT, Advantages & disadvantages, Industrial Internet -Reference Architecture; IIoT System components: Sensors, Gateways, Routers, Modem, Cloud brokers, servers and its integration, WSN, WSN network design for IoT. SENSORS AND INTERFACING: Introduction to sensors, Transducers, Classification, Roles of sensors in IIoT, Various types of sensors, Design of sensors, sensor architecture, special requirements for IIoT sensors, Role of actuators, types of actuators. Hardwire the sensors with different protocols such as HART, MODBUS-Serial & Parallel, Ethernet, BACnet, Current, M2M etc.	9
III	**UNIT3- PROTOCOLS AND CLOUD** Needof protocols; Types of Protocols, Wi-Fi, Wi-Fi direct, Zigbee, Z wave, BACnet, BLE, Modbus, SPI, I2C, IIoT protocols –COAP, MQTT, 6LoWPAN, LWM2M, AMPQ IIoT cloud platforms: Overview of COTS cloud platforms, Predix, PTC Thing Worx, Microsoft Azure etc. Data analytics, cloud services, Business models: SaaS, PaaS, IaaS.	9
IV	**UNIT 4 -SECURITY** SECURITY: Introduction to web security, Conventional web technology and relationship with IIoT, Vulnerabilities of IoT, Privacy, Security requirements, Threat analysis, Trust, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity, Non-repudiation and availability, Security model for IoT, Network security techniques Management aspects of cyber security. ANALYTICS: IoT Analytics: Role of Analytics in IoT, Data visualization Techniques.	9



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	UNIT 5-DIGITAL TWIN		
V	DIGITAL TWIN: Introduction to Digital Twin, need for Digital Twin, Elements of Digital Twin, Digital Twin process design and information requirements, Digital twin conceptual architecture -create, communicate, Aggregate, Analyze, Insight, Act, driving business value through digital twin. DIGITAL TWIN FOR ASSET: Digitalizing asset behaviour using simulated mathematical modelling and building Digital Twin -Need, Benefits, Architecture, Models and Use cases -Predictive and Prescriptive maintenance.		9
		Total	**45**

Course outcomes:

At the end of the course the student will be able to:

- Discover key IIoT concepts including identification, sensors, localization, wireless protocols, data storage and security
- Explore IoT technologies, architectures, standards, and regulation
- Realize the value created by collecting, communicating, coordinating, and leveraging the data from connected devices
- Examine technological developments that will likely shape the industrial landscape in the future
- Understand how to develop and implement own IoT technologies, solutions, and applications
- At the end of the program, students will be able to understand how to develop and implement their own IoT technologies, solutions, and applications.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PLC AND SCADA

COURSE SYLLABUS

Course Objectives:

- To explain advantages and disadvantages, main parts and their functions, basic sequence of operation of PLC.
- To describe the hardware components: I/O modules, CPU, memory devices, other support devices and the functions of PLC memory map.
- To describe program scan sequence, the communication of information to the PLC using different languages, internal relay instruction.
- To explain identification of common operating modes found in PLCs, writing and entering the ladder logic programs

Course Code	Course Title	Theory / Practical
	PLC AND SCADA	**Theory**
Unit No	**Modules (Theory)**	**T (Hrs.)**
I	**Module-Introduction** Programmable Logic Controllers: Introduction, Parts of a PLC, Principles of Operation, Modifying the Operation, PLCs versus Computers, PLC Size and Application. PLC Hardware Components: The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs). Basics of PLC Programming: Processor Memory Organization, 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.	9
II	**Module** Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs: Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches, Sensors, Output Control Devices, Seal-In Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Writing a Ladder Logic Program Directly from a Narrative Description. Programming Timers: Mechanical Timing Relays, Timer Instructions, On-Delay Timer Instruction, Off-Delay Timer Instruction, Retentive Timer, Cascading Timers.	9

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III	**Module** Programming Counters: Counter Instructions, Up-Counter, Down-Counter, Cascading Counters, Incremental Encoder-Counter Applications, Combining Counter and Timer Functions. Program Control Instructions: Master Control Reset Instruction, Jump Instruction, Subroutine Functions, Immediate Input and Immediate Output Instructions, Forcing External I/O Addresses, Safety Circuitry, Selectable Timed Interrupt, Fault Routine, Temporary End Instruction, Suspend Instruction.	9
IV	**Module** Data Manipulation Instructions: Data Manipulation, Data Transfer Operations, Data Compare Instructions, Data Manipulation Programs, Numerical Data I/O Interfaces, Closed-Loop Control. Math Instructions: Math Instructions, Addition Instruction, Subtraction Instruction, Multiplication Instruction, Division Instruction, Other Word-Level Math Instructions, File Arithmetic Operations.	9
V	**Module** Sequencer and Shift Register Instructions: Mechanical Sequencers, Sequencer Instructions, Sequencer Programs, Bit Shift Registers, Word Shift Operations. Process Control, Network Systems, and SCADA: Types of Processes, Structure of Control Systems, On/Off Control, PID Control, Motion Control, Data Communications, Supervisory Control and Data Acquisition (SCADA).	9
	Total	**45**

Course outcomes:

At the end of the course the student will be able to:

•Discuss history of PLC and describe the hardware components of PLC: I/O modules, CPU, memory devices, other support devices, operating modes and PLC programming.
•Describe field devices Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits, and Latching Relays commonly used with I/O module.
•Analyze PLC timer and counter ladder logic programs and describe the operation of different program control instructions
•Discuss the execution of data transfer instructions, data compare instructions and the basic operation of PLC closed-loop control system.
•Describe the operation of mechanical sequencers, bit and word shift registers, processes and structure of control systems and communication between the processes.

Textbook

1 Programmable Logic Controllers Frank D Petruzella McGraw Hill, 4th Edition, 2011

Reference Books

1 Programmable Logic Controllers an Engineer's Guide E A Parr Newnes 3rd Edition, 2013
2 Introduction Programmable Logic Controllers Gary Dunning Cengage 3rd Edition,

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
CERTIFICATE COURSE ON ADVANCED RENEWABLE ENERGY SYSTEMS
COURSE SYLLABUS

Course Objectives:

1. To introduce new course for the students and to eradicate unemployment.
2. Develop Undergraduate and research level programs for creating professional manpower in solar technology
3. For the present competitive world Establish linkages with educational institution and industries to share experience and knowledge.
4. To understand appliances available in the market that promote solar usage.

Course Code	Course Title	Theory / Practical
	ADVANCED RENEWABLE ENERGY SYSTEMS	**Theory**
Unit No	**Modules (Theory)**	**T (Hrs.)**
I	**Module 1** Hours Introduction, Definition of Power and energy, difference between power and energy, the role of energy in development, Limitation of renewable energy sources their usefulness seasonal nature, requirement, need for the use of new energy sources.	**11**
II	**Module-2** Hours Conventional energy sources Hydro Electric, Thermal, Nuclear, Non-Conventional Energy sources Bio-mass, geo-thermal, solar, wind energy, ocean energy, wave energy, advantages and disadvantages, challenges.	**11**
III	**Module- 3** Commercial energy sources, fosial-fuels coal, oil, natural gas, hydro electric power, nuclear, Non-commercial energy sources, wood, animal wastes, agricultural waste, cost of raw materials, transport problems, issues	**12**
IV	**Module- 4** Hours Solar system: Energy from the sun, solar window, atmospheric effects, diffused radiations, Air mass, effect of Air Mass, seasonal effects, environmental effects on standard test conditions.	**11**
	Total	**45**

Course outcomes:

Able to understand the solar energy operation and its characteristics.

To educate the wind energy operation and its types.

To educate the tidal and geothermal energy principles and its operation.

Able to understand the biomass energy generation and its technologies.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

AN APPLICATION OF MATLAB FOR ELECTRICAL ENGINEERING PROBLEMS

COURSE SYLLABUS

Course Objectives:

1. To Impart the Knowledge to the students with MATLAB software. [This enhances programming knowledge in Research and Development].
2. To provide a working introduction to the Matlab technical computing environment. [Themes of data analysis, visualization, and programming].
3. To introduce students the use of a high-level programming language, Matlab. [scientific problem solving with applications and examples from Engineering].

Course Code	Course Title	Theory / Practical
	AN APPLICATION OF MATLAB FOR ELECTRICAL ENGINEERING PROBLEMS	**Theory**
Unit No	**Modules (Theory)**	**T (Hrs.)**
I	**Module- Introductory Sessions Of MATLAB Training Course** Why MATLAB- What Are Toolboxes-MATLAB Interface-Introduction To Arrays And Matrices -MATLAB File Types- Basics Of MATLAB Programming	7
II	**Module -Handling Data And Data Flow In MATLAB** Data Types- Creating Variables- Scalars, Vectors And Matrix Operations & Operators- Importing & Exporting Of Data- File Input-Output	7
III	**Module- File Editing And Debugging In MATLAB** Writing Script Files -Writing Function Files -Inserting Breakpoints And Debugging - Error Correction	7
IV	**Module- MATLAB Graphics I** Simple Graphics & Types -Plotting Functions -Creating And Editing Plots (2D & 3D) -Handling Graphics	7
V	**Module-MATLAB Graphics II** Introduction To Graphical User Interfaces (GUI) -GUI Tools -Creating Functioning GUIs	7
VI	**Module- Introduction To SIMULINK** What Is SIMULINK –Importance -SIMULINK Interface -Libraries & Tools-Sources & Sinks - Building Systems -Mathematical Modeling -Converting Mathematical Model Into SIMULINK Model -Creating Systems & Subsystems -Solver Configuration	10
	Total	**45**

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Date :

Course outcomes:

By the end of this course, the student will be able to

1. Understand the basics of Matlab
2. Break a complex task up into smaller, simpler tasks
3. Case Study (Any two Modules)
4. Tabulate results and Analyse

Text Book:

1. MATLAB for engineering applications,William j.Palm III,| McGraw-Hill
2. MATLAB Programming for EngineersAuthor Stephen J. Chapman has a lot of coveted accolades and accomplishments.
3. Essential MATLAB for Engineers and Scientists,Brian Hahn and Daniel T. Valentine

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PLC PROGRAMMING

COURSE SYLLABUS

Course Objectives:

1. Characteristics of a PLC
2. Know general PLC issues
3. Understanding of PLC programming, ladder logic.
4. Understand and design basic input and output wiring

Course Code	Course Title	Theory / Practical
	PLC PROGRAMMING	**Theory**
Unit No	**Modules (Theory)**	**T (Hrs.)**
I	**Module-1** Introduction to Industrial Automation, different parts and types of Industrial automation, Introduction to PLC hardware, role of PLC in Industrial automation.	9
II	**Module -2** Introduction to field devices attached to PLC. PLC Fundamentals. Detail Information about PLC, Power supply CPU, I/O modules Communication Bus Various ranges available in PLCs.	9
III	**Module -3** Types of inputs and outputs. Source sink concept in PLC, Concept of flags, Scan Cycle execution, Introduction to programming software, Addressing concept. Programming instructions arithmetic and logical	9
IV	**Module -4** Load/AND/OR/OUT/READ/WRITE MOVE block applications, Compare/Add/Sub/And/or blocks Advanced Instructions, Leading edge/trailing edge instruction, Timer Blocks Programming, Set/reset Function Counter Block Programming, Upload, download, Monitoring of programs, Standard procedure to be followed in wiring/writing ladder etc.	9
V	**Module -5** **Hands on experience on writing programs** Motor control Slide control, Timer applications, Lighting pattern, Counter applications, Milling machine programming, Paint Plant application, Bottling Plant application, Auto Drilling application, Car parking application, Sorting of objects application, Traffic light control	9
	Total	**45**

Course outcomes:

By the end of this course, the student will be able to

1. Describe typical components of a Programmable Logic Controller.
2. Explain the basic concepts of a Programmable Logic Controller.
3. State basic PLC terminology and their meanings.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
A CERTIFICATE COURSE ON SUSTAIN AND ENHANCE TECHNICAL KNOWLEDGE IN SOLAR ENGERGY SYSTEMS
COURSE SYLLABUS

Course Objectives:

The course gives a broad description of different energy systems and deepened knowledge in some energy technology questions of importance, of current interest and related to research and development within the area. The course will give an understanding for and practical application of theories and models for analysis and planning of sustainable energy systems as well as development of the individual ability of the student in: written presentations, search for information, critical review of information, literature and other material.

Course Code	Course Title	Theory / Practical
	SUSTAIN AND ENHANCE TECHNICAL KNOWLEDGE IN SOLAR ENGERGY SYSTEMS	**Theory**
Unit No	**Modules (Theory)**	**T (Hrs.)**
I	**Module-1** Introduction to Renewable and Solar Energy: What is Renewable Energy, Why do we need Renewable Energies & its types ,Pros & Cons of Solar energy and its Applications Status of Solar energy in India & Solar resource ,Solar energy Conversion	5
II	**Module-2** Solar Energy &Climate Change , Differences of Fossil Fuel & Solar Energy , Effects of Solar energy with Earth's Atmosphere & Carbon Footprint ,Climate Change and Global Warming Action Plan for India , Administrative Functions and Basics of Enterprise Man Tools	5
III	**Module-3** Screw Drivers, Measuring tape, Wrench, Pliers, Hammers, Hacksaw, Cutters, Chisels, Allen Keys, Hand Drill & drill bit, Try Square, Gimlet, vice, Plumb bob, Pipe cutter, Crimping tool, Neon tester, Mallet, Wire stripper, Centre punch, Hand grinder,	5
IV	**Module-4** Electromagnetism (Electricity & Magnetism) •,Brief Introduction to Electricity & Electrical circuits , Laws of Resistance, Ohms law's, Kirchhoff's law , Instrument for Measuring Electric Power , Magnetism, Magnetic Needle, Electric & Magnetic fields, Law	5
V	**Module-5** Wires &Cables -Understanding Electrical Wire , Understanding Electrical Cable, Insulating material, Standard wire gauge, Continuity tester, Soldering. , Safety and its importance, PPEs, Safety Signs, Safety Slogans, Safety Rules, Fire Extinguisher	5
VI	**Module-6** Photovoltaic Technology , Solar/PV cells ,Types of Solar cells(Crystalline Silicon, Thinfilm, Organic Photovoltaic cell/3rd generation PV cell) , Cell, Module, String, Array , STC & NOCT conditions , Solar cell I-V Characteristics Curves ,Factors affect	7

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	Module-7	
VII	PV System Design, Sizing & Installation Requirements ,How to Design a Solar PV system ,PV System Sizing: Determine Power Consumption demands Size the PV Panels Battery, Inverter, Charge Controller Sizing's System Wiring Solar PV system Installation	7
	Module-8	
VIII	Installation of Solar Home System Site Assessment , Installation of Solar Module , Installation of Charge Controller /Regulator , Installation of Battery ,Wiring of Solar Home System Components ,Lamp, Switch & Power Socket Installation Procedures	6
	Total	**45**

Course outcomes:

After completion of the course the student shall be able to:

- explain the principles that underlie the ability of various natural phenomena to deliver solar energy.
- outline the technologies that are used to harness the power of solar energy.
- discuss the positive and negative aspects of solar energy in relation to natural and human aspects of the environment.

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