1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

| I.  | To provide students good foundation in mathematical, scientific, engineering fundamentals and hardware-software programming intelligence. |
| II. | To develop among students, the ability to develop embedded systems based smart solutions for purpose of system automation |
| III. | To promote student awareness, for life-long learning and introduce them to professional ethics and code of practice. |
| IV. | To encourage students, to work in interdisciplinary groups. |

2. PROGRAMME OUTCOMES (POs):

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<td>1.</td>
<td>An ability to independently carry out research/investigation and development work to solve practical problems</td>
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<td>An ability to write and present a substantial technical report/document</td>
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<td>3.</td>
<td>Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program</td>
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<td>Be able to design and develop Embedded system automation based on dedicated ICs that have computation, networking and control capacity</td>
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<td>5.</td>
<td>Skill to work on professional software languages, standard modeling and analysis tools &amp; commercial packages with communication protocols and computation platforms for analysis and design of system automation</td>
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<td>To involve in research on an industrial problem or develop an innovative smart system with automation as a consumer product through project management and finance with due concerned for socio economic values</td>
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4. PEO/PO Mapping:

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1,2,3,-, scale against the correlation PO’s with PEO’s
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### ANNA UNIVERSITY: CHENNAI 600 025
### NON AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY
### REGULATIONS – 2021
### CHOICE BASED CREDIT SYSTEM
### M.E. EMBEDDED SYSTEM TECHNOLOGIES
### I TO IV SEMESTERS CURRICULUM AND SYLLABUS

#### SEMESTER I

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# Semester IV

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### FOUNDATION COURSES (FC)

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**TOTAL CREDITS** 32

### RESEARCH METHODOLOGY AND IPR COURSES (RMC)

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**Total Credits:** 18

## Professional Electives

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AUDIT COURSES - I
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OBJECTIVES:
- To understand the techniques of Fourier transform to solve partial differential equations.
- To become familiar with graph theory for modelling the embedded system.
- To understand various optimization techniques for utilizing system and network resources.
- To understand the basic concepts of probability to apply in embedded technology.
- To understand the basic concept of random variables and queuing theories to address stochastic and dynamic environment in embedded technology.

UNIT I    FOURIER TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS 12

UNIT II   GRAPH THEORY 12
Introduction to paths, trees, vector spaces - Matrix coloring and directed graphs - Some basic algorithms – Shortest path algorithms – Depth - First search on a graph – Isomorphism – Other Graph - Theoretic algorithms – Performance of graph theoretic algorithms – Graph theoretic computer languages.

UNIT III  OPTIMIZATION TECHNIQUES 12
Linear programming - Basic concepts – Graphical and simplex methods – Big M method - Two phase simplex method - Revised simplex method - Transportation problems – Assignment problems.

UNIT IV   PROBABILITY AND RANDOM VARIABLES 12
Probability – Axioms of probability – Conditional probability – Baye’s theorem - Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Exponential, Normal distributions – Two dimensional random variables - Poisson process.

UNIT V    QUEUEING THEORY 12
Single and multiple servers - Markovian queuing models - Finite and infinite capacity queues – Finite source model – Queuing applications.

TOTAL: 60 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to
- Apply Fourier transform techniques to solve PDE technology.
- Model the networks in embedded systems using graph theory.
- Use the ideas of probability and random variables in solving engineering problems.
- Address stochastic and dynamic behavior of data transfer using queuing theories in embedded systems technologies.

REFERENCES:
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RM4151 RESEARCH METHODOLOGY AND IPR

UNIT I RESEARCH DESIGN
Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

UNIT II DATA COLLECTION AND SOURCES
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

UNIT III DATA ANALYSIS AND REPORTING
Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT IV INTELLECTUAL PROPERTY RIGHTS

UNIT V PATENTS

TOTAL : 30 PERIODS

REFERENCES
COURSE OBJECTIVES:
1. To provide knowledge on the basics, building blocks of Embedded System.
2. To discuss Input/output Interfacing & Bus Communication with processors.
3. To teach automation using scheduling algorithms and Real time operating system.
4. To discuss on different Phases & Modeling of a new embedded product.
5. To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.

UNIT I     INTRODUCTION TO EMBEDDED SYSTEMS

UNIT II    EMBEDDED NETWORKING BY PROCESSORS

UNIT III   RTOS BASED EMBEDDED SYSTEM DESIGN
Introduction to basic concepts of RTOS- Need, Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication-context switching, interrupt latency and deadline shared memory, message passing-, Interprocess Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: VxWorks, uC/OS-II, RT Linux.

UNIT IV    MODELLING WITH HARDWARE/SOFTWARE DESIGN APPROACHES

UNIT V     EMBEDDED SYSTEM APPLICATION DEVELOPMENT
Objective, Need, different Phases & Modelling of the EDLC.choice of Target Architectures for Embedded Application Development-for Control Dominated-Data Dominated Systems-Case studies on Digital Camera, Adaptive Cruise control in a Car, Mobile Phone software for key inputs.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will
CO1: Demonstrate the functionalities of processor internal blocks, with their requirement.
CO2: Analyze that Bus standards are chosen based on interface overheads without sacrificing processor performance
CO3: Explain the role and features of RT operating system, that makes multitask execution possible by processors.
CO4: Illustrate that using multiple CPU based on either hardcore or softcore helps data overhead management with processing-speed reduction for uC execution.

CO5: Recommend Embedded consumer product design based on phases of product development.

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REFERENCES:
2. Peckol, ”Embedded system Design”,JohnWiley&Sons,2010
6. Advanced Computer architecture , By Rajiv Chopra, S Chand , 2010
UNIT III      C PROGRAMMING TOOL-CHAIN IN LINUX
C preprocessor - Stages of Compilation - Introduction to GCC - Debugging with GDB - The Make utility - GNU Configure and Build System - GNU Binary utilities - Profiling - using gprof - Introduction to GNU C Library.

UNIT IV       PYTHON PROGRAMMING
Introduction - Parts of Python Programming Language - Control Flow Statements - Functions - Strings - Lists - Dictionaries - Tuples and Sets.

UNIT V       MODULES, PACKAGES AND LIBRARIES IN PYTHON

COURSE OUTCOMES:
At the end of this course, the students will demonstrate the ability to
CO1: Demonstrate C programming and its salient features for embedded systems
CO2: Deliver insight into various programming languages/software compatible to embedded process development with improved design & programming skills.
CO3: Develop knowledge on C programming in Linux environment.
CO4: Possess ability to write python programming for Embedded applications.
CO5: Have improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded programming skills.

TOTAL: 45 PERIODS

REFERENCES:
COURSE OBJECTIVES:
1. To teach the architecture of PIC Microcontroller and RISC processor.
2. To compare the architecture and programming of 8, 16, 32 bit RISC processor.
3. To teach the implementation of DSP in ARM processor.
4. To discuss on memory management, application development in RISC processor.
5. To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts
   acquired over the 5 Units of the subject for improved employability skills.

UNIT I  PIC MICROCONTROLLER

UNIT II  ARM ARCHITECTURE

UNIT III  PERIPHERALS OF PIC AND ARM MICROCONTROLLER

UNIT IV  ARM MICROCONTROLLER PROGRAMMING
ARM general Instruction set – Thumb instruction set – Introduction to DSP on ARM – Implementation example of Filters

UNIT V  DESIGN WITH PIC AND ARM MICROCONTROLERS

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Understand the basics and requirement of processor functional blocks.
CO2: Observe the specialty of RISC processor Architecture.
CO3: Incorporate I/O hardware interface of a processor based automation for consumer application with peripherals.
CO4: Incorporate I/O software interface of a processor with peripherals.
CO5: Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in commercial embedded processors
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REFERENCES:

ET4104 VLSI DESIGN AND RECONFIGURABLE ARCHITECTURE LT P C 3 0 0 3

COURSE OBJECTIVES

1. To expose the students to the fundamentals of sequential system design, synchronous and Asynchronous circuits.
2. To understand the basic concepts of CMOS and to introduce the IC fabrication methods
3. To introduce the Reconfigurable Processor technologies, To provide an insight and architecture significance of SOC.
4. To introduce the basics of analog VLSI design and its importance.
5. To learn about the programming of Programmable device using Hardware description Language.

UNIT I INTRODUCTION TO ADVANCED DIGITAL SYSTEM DESIGN 9
Modeling of Clocked Synchronous Sequential Network(CSSN), Design of CSSN, Design of Asynchronous Sequential Circuits (ASC), Designing Vending Machine Controller, Races in ASC, Static and Dynamic Hazards, Essential Hazards, Designing Hazard free circuits.

UNIT II CMOS BASICS & IC FABRICATION 9
UNIT III  ASIC AND RECONFIGURABLE PROCESSOR AND SoC DESIGN
Introduction to ASIC, ASIC design flow- programmable ASICs- Introduction to reconfigurable processor- Architecture -Reconfigurable Computing, SoC Overview, recent trends in Reconfigurable Processor & SoC, Reconfigurable processor based DC motor control.

UNIT IV  ANALOG VLSI DESIGN
Introduction to analog VLSI- Design of CMOS 2stage-3 stage Op-Amp –High Speed and High frequency op-amps-Super MOS- Analog primitive cells- Introduction to FPAA.

UNIT V  HDL PROGRAMMING
Overview of digital design with VHDL, structural, data flow and behavioural modeling concepts- logic synthesis-simulation-Design examples, Ripple carry Adders, Carry Look ahead adders, Multiplier, ALU, Shift Registers, Test Bench.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability to

CO1: Incorporate synchronous and asynchronous switching logics, with clocked circuits design

CO2: Deliver insight into developing CMOS design techniques and IC fabrication methods.

CO3: Explain the need of reconfigurable computing, hardware-software co design and operation of SoC processor.

CO4: Design and development of reprogrammable analog devices and its usage for Embedded applications.

CO5: Illustrate and develop HDL computational processes with improved design strategies.

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REFERENCES:
COURSE OBJECTIVES:
1. To involve the students to Practice on Workbench /Software Tools/ Hardware Processor Boards with the supporting Peripherals.
2. To teach the concepts of algorithm development & programming on software tools and Digital processors with peripheral interfaces.
3. To encourage students to practice in open source software / packages /tools
4. To train though hands-on practices in commercial and licensed Hardware-software suites
5. Practicing through the subdivisions covered within experiments listed below to expose the students into the revising the concepts acquired from theory subjects.

<table>
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<tr>
<th>DOMAIN</th>
<th>EXPERIMENT DETAILS</th>
<th>EQUIPMENT/ SUPPORTS REQUIRED</th>
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<tbody>
<tr>
<td>1.</td>
<td>Programming with 8 bit Microcontrollers # Assembly programming</td>
<td>8051/ other 8 bit Microcontrollers with peripherals; IDE, Board Support Software Tools / Compiler/others</td>
</tr>
<tr>
<td>2.</td>
<td>Programming with 8 bit Microcontrollers # C programming</td>
<td>8051 Microcontrollers with peripherals; IDE, Board Support Software Tools / C Compiler/others</td>
</tr>
<tr>
<td>3.</td>
<td>I/O Programming with 8 bit Microcontrollers I/O Interfacing: Serial port programming/ LCD/Sensor Interfacing /PWM Generation/ Motor Control</td>
<td>8051 Microcontrollers with peripherals; Board Support Software Tools, peripherals with interface</td>
</tr>
<tr>
<td>4.</td>
<td>Programming with PIC Microcontrollers: ✓ Assembly ✓ C programming</td>
<td>PIC Microcontrollers with peripherals; ;IDE, Board Support Software Tools /C Compiler/others</td>
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<tr>
<td>5.</td>
<td>I/O Programming with PIC Microcontrollers I/O Interfacing: PWM Generation/ Motor Control/ADC/DAC/ LCD/Sensor Interfacing</td>
<td>PIC Microcontrollers with peripherals; Board Support Software Tools, peripherals with interface</td>
</tr>
</tbody>
</table>

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Experiment insight into various embedded processors of CISC and RISC architecture / computational processors with peripheral interface.
CO2: Understand the fundamental concepts of how process can be controlled with uC.
CO3: Experimenting on programming logic of Processor based on software suites(simulators, emulators)
CO4: Incorporate I/O software interface of a processor with peripherals.
CO5: Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in interfacing and use of commercial embedded processors
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REFERENCES:
COURSE OBJECTIVES:
1. To involve the students to Practice on Workbench /Software Tools/ Hardware Processor Boards with the supporting Peripherals.
2. To teach the concepts of algorithm development & programming on software tools and Digital processors with peripheral interfaces.
3. To encourage students to practice in open source softwares / packages /tools
4. To train though hands-on practices in commercial and licensed Hardware-software suites
5. Practicing through the subdivisions covered within experiments listed below to expose the students into the revising the concepts acquired from theory subjects.

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<th>DOMAIN</th>
<th>EXPERIMENT DETAILS</th>
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<tbody>
<tr>
<td>1.</td>
<td>Programming in Higher Level Languages/Open Source Platforms</td>
<td>C/C++/Java/Embedded C/Embedded Java/ Compilers &amp;Platforms/cloud</td>
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<tr>
<td>2.</td>
<td>Programming with Arduino Microcontroller Board</td>
<td>Arduino Boards with peripherals ;IDE, Board Support Software Tools /Compiler/others</td>
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<tr>
<td>3.</td>
<td>HDL Programming in FPGA processors</td>
<td>Processor Boards with Board Support Tools &amp; Interfaces</td>
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<tr>
<td>4.</td>
<td>Programming &amp; Simulation in Simulators /Tools/others</td>
<td>Simulation Tools as Proteus/ ORCAD</td>
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<td>5.</td>
<td>Programming &amp; Simulation in Simulators /Tools/others</td>
<td>Simulation Tools as MATLAB /others</td>
</tr>
</tbody>
</table>

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will demonstrate the ability in
CO1: Developing Optimized code for embedded processor
CO2: Understanding the fundamental concepts of how process can be realized using Software Modules
CO3: Circuit and System level simulators to develop solution for embedded based applications.
CO4: Incorporate I/O software interface of a processor with peripherals.
CO5: Improved Employability and entrepreneurship capacity due to knowledge up gradation on Embedded computing and algorithm development with programming concepts.
ET4201                                      REAL TIME OPERATING SYSTEM                                    LT P C
                                                 3 0 0 3

COURSE OBJECTIVES:
1. To expose the students to the fundamentals of interaction of OS with a computer and User computation.
2. To teach the fundamental concepts of how process are created and controlled with OS.
3. To study on programming logic of modeling Process based on range of OS features
4. To compare types and Functionalities in commercial OS, application development using RTOS
5. To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

UNIT I   REVIEW OF OPERATING SYSTEMS
Basic Principles - Operating System structures – System Calls – Files – Processes – Design and Implementation of processes – Communication between processes – Introduction to Distributed operating system – Embedded operating systems

UNIT II  OVERVIEW OF RTOS

UNIT III   REALTIME MODELS AND LANGUAGES
Event Based – Process Based and Graph based Models – Real Time Languages – RTOS Tasks – RT scheduling - Interrupt processing – Synchronization – Control Blocks – Memory Requirements.

UNIT IV   REALTIME KERNEL
Principles – Design issues – Polled Loop Systems – RTOS Porting to a Target – Comparison and Basic study of various RTOS like – VX works – Linux supportive RTOS – C Executive.

UNIT V   APPLICATION DEVELOPMENT
Discussions on Basics of Linux supportive RTOS – uCOS-C Executive for development of RTOS Application – Case study
COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Outline Operating System structures and types.
CO2: Insight into scheduling, disciplining of various processes execution.
CO3: Illustrate knowledge on various RTOS support modelling
CO4: Demonstrate commercial RTOS Suite features to work on real time processes design.
CO5: Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in RTOS and embedded automation design.

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REFERENCES:

ET4202 EMBEDDED SYSTEM NETWORKING

COURSE OBJECTIVES:
1. To expose the students to the fundamentals of wired embedded networking techniques.
2. To introduce the concepts of embedded ethernet.
3. To expose the students to the fundamentals of wireless embedded networking.
4. To discuss the fundamental building blocks of digital instrumentation.
5. To introduce design of Programmable measurement & control of electrical Device.

UNIT I EMBEDDED PROCESS COMMUNICATION WITH INSTRUMENT BUS

UNIT II EMBEDDED ETHERNET
UNIT III WIRELESS EMBEDDED NETWORKING

UNIT IV BUILDING SYSTEM AUTOMATION

UNIT V COMMUNICATION FOR LARGE ELECTRICAL SYSTEM AUTOMATION
Data Acquisition, Monitoring, Communication, Event Processing, and Polling Principles, SCADA system principles – outage management– Decision support application - substation automation, extended control feeder automation, Performance measure and response time, SCADA Data Models, need, sources, interface

TOTAL : 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1 Analyze the different bus communication protocols used for embedded networking
CO 2 Explain the basic concepts of embedded networking
CO 3 Apply the embedded networking concepts in wireless networks
CO 4 Relate different data acquisition concepts
CO 5 Build a system automation for different applications

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REFERENCES:
3. Jan Axelson ‘Embedded Ethernet and Internet Complete’, Penram publications
5. Control and automation of electrical power distribution systems, James Northcote-Green, Robert Wilson, CRC, Taylor and Francis, 2006
COURSE OBJECTIVES:
1. To provide the control concept for electrical drives
2. To emphasis the need for embedded system for controlling the electrical drives
3. To provide knowledge about various embedded system based control strategy for electrical drives
4. To Impart the knowledge of optimization and machine learning techniques used for electrical drives
5. To familiarize the high performance computing for electrical drives.

UNIT I  INTRODUCTION ELECTRICAL DRIVES  9

UNIT II  OVERVIEW OF EMBEDDED PROCESSOR  9
Embedded Processor architecture-RTOS – Hardware/software co-design-Programming with SoC processors.

UNIT III  INDUCTION MOTOR CONTROL  9
Types- Speed control methods-PWM techniques- VSI fed three-phase induction motor- Fuzzy logic Based speed control for three phase induction motor-FPGA based three phase induction motor control.

UNIT IV  BLDC MOTOR CONTROL  9
Overview of BLDC Motor -Speed control methods -PWM techniques- ARM processor based BDLC motor control- ANN for BLDC Motor control and operation.

UNIT V  SRM MOTOR CONTROL  9
Overview of SRM Motor -Speed control methods -PWM techniques- FPGA based SRM motor control-DNN for SRM Motor control and operation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Interpret the significance of embedded control of electrical drives
CO2: Deliver insight into various control strategy for electrical drives.
CO3: Developing knowledge on Machine learning and optimization techniques for motor control.
CO4: Develop embedded system solution for real time application such as Electric vehicles and UAVs.
CO5: Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded system skills required for motor control strategy.

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REFERENCES:

ET4251 IoT FOR SMART SYSTEMS LT P C 3 0 0 3

COURSE OBJECTIVES:
1. To study about Internet of Things technologies and its role in real time applications.
2. To introduce the infrastructure required for IoT
3. To familiarize the accessories and communication techniques for IoT.
4. To provide insight about the embedded processor and sensors required for IoT
5. To familiarize the different platforms and Attributes for IoT

UNIT I INTRODUCTION TO INTERNET OF THINGS Overview, Hardware and software requirements for IOT, Sensor and actuators, Technology drivers, Business drivers, Typical IoT applications, Trends and implications.


UNIT III PROTOCOLS AND WIRELESS TECHNOLOGIES FOR IOT PROTOCOLS: NFC, SCADA and RFID, Zigbee MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIe GSM, CDMA, LTE, GPRS, small cell.

Wireless technologies for IoT: WiFi (IEEE 802.11), Bluetooth/Bluetooth Smart, ZigBee/ZigBee Smart, UWB (IEEE 802.15.4), 6LoWPAN, Proprietary systems-Recent trends.

UNIT IV IOT PROCESSORS Services/Attributes: Big-Data Analytics for IOT, Dependability, Interoperability, Security, Maintainability.

Embedded processors for IOT: Introduction to Python programming - Building IOT with RASPBERRY PI and Arduino.
UNIT V CASE STUDIES

Industrial IoT, Home Automation, smart cities, Smart Grid, connected vehicles, electric vehicle charging, Environment, Agriculture, Productivity Applications, IOT Defense

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Analyze the concepts of IoT and its present developments.
CO2: Compare and contrast different platforms and infrastructures available for IoT
CO3: Explain different protocols and communication technologies used in IoT
CO4: Analyze the big data analytic and programming of IoT
CO5: Implement IoT solutions for smart applications

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REFERENCES:

COURSE OBJECTIVES:

- To involve the students to Practice on Workbench /Software Tools/ Hardware Processor Boards with the supporting Peripherals.
- To teach the concepts of algorithm development & programming on software tools and Digital processors with peripheral interfaces.
- To encourage students to practice in open source softwares / packages /tools
- To train though hands-on practices in commercial and licensed Hardware-software suites
- Practicing through the subdivisions covered within experiments listed below to expose the students into the revising the concepts acquired from theory subjects.

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<th>Sl.No</th>
<th>EXPERIMENT DETAIL</th>
<th>EQUIPMENT/ SUPPORTS REQUIRED</th>
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<tbody>
<tr>
<td>1.</td>
<td>Programming ARM processor : ARM7 / ARM9/ARM Cortex Study on Incircuit Emulators, crosscompilers, debuggers</td>
<td>Microcontrollers with peripherals; IDE, Board Support Software Tools /Keil/uCOS Compiler/others</td>
</tr>
<tr>
<td>3.</td>
<td>Programming with Rasberry Pi Microcontroller Board : Study on incircuit Emulators, crosscompilers, debuggers</td>
<td>Rasberry Pi Boards with peripherals ;IDE, Board Support Software Tools /Compiler/others</td>
</tr>
<tr>
<td>5.</td>
<td>Programming with DSP processors</td>
<td>Processor Boards with Board Support Tools &amp; Interfaces</td>
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</table>

TOTAL : 60 PERIODS
COURSE OUTCOMES:
At the end of this course, the students will have the ability to

CO1: Experiment and demonstrate with simulators, in programming processor boards, processor interfacing/ designing digital controllers

CO2: Design & simulate Arithmetic, Logic programs, Filters, Signal analysis with simulators/experiments, in programming processor boards, processor interfacing/ Tools

CO3: Develop real time solution for embedded applications.

CO4: Program and compile in various tools & software domains.

CO5: Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in commercial embedded processors and its programmable interfacing.

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ET4212 EMBEDDED PROGRAMMING LABORATORY - II LT P C 0 0 4 2

COURSE OBJECTIVES:

1. To involve the students to Practice on Workbench/Software Tools/ Hardware Processor Boards with the supporting Peripherals.

2. To teach the concepts of algorithm development & programming on software tools and Digital processors with peripheral interfaces.

3. To encourage students to practice in open source softwares/packages/tools

4. To train through hands-on practices in commercial and licensed Hardware-software suites

5. Practicing through the subdivisions covered within experiments listed below to expose the students into the revising the concepts acquired from theory subjects.
<table>
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<th>Sl.No</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Programming in Freeware softwares/ Platforms</td>
<td>Programming Compilers&amp;Platforms on freeware</td>
</tr>
<tr>
<td>2.</td>
<td>Software &amp; Modelling tools</td>
<td>Personal Computers, Software &amp; programming/modelling tools</td>
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<td>✓ Study on MEMS Tools</td>
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<td>✓ Study on process Controller modeling</td>
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<td>✓ PLC/SCADA/PCB</td>
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<td>✓ one type CAD Tool</td>
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<td>3.</td>
<td>Programming &amp; Simulation in GUI Simulators/Tools/others</td>
<td>Simulation Tools as Labview/others</td>
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<td>✓ Graphical User interface simulations &amp; modeling of instrumentation &amp; controllers</td>
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<td>Linux programming Tool chain</td>
<td>PC with Linux OS</td>
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TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will demonstrate the ability in
CO1: Developing Optimized algorithms for embedded processor on IDE and compilers.
CO2: Outline the concepts of how process can be realized using Software Modules.
CO3: Compare and analyze device, Circuit and System level simulators/emulators to develop embedded applications.
CO4: Incorporate I/O software interface using IDE and High level languages with processor.
CO5: Improved Employability and entrepreneurship capacity due to knowledge up gradation on Embedded programming concepts.

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COURSE OBJECTIVES
1. To provide a hands on skills by training on domains of embedded systems technologies
2. To improve the design ability and the oral, written presentation skills of the students
3. To provide an insight of developing optimized embedded solution for system automation
4. To emphasize the need of Hardware & Software design tools usage for real time applications.
5. To enhance capacity to compete for placement and developing ability for entrepreneurship.

COURSE OUTCOMES:
At the end of this course, the students will have the ability in

CO1: Any of the listed Domains their Design, Development capability in Building Automation for a process through Hardware & Software Tools.

CO2: Interpreting Pre-Requisites insists choice of project title from the enlisted broad domain of research topics for Project work:

CO3: Demonstrate project work to enhance students’ capacity to work in Research Areas of the Department interests or of Industrial importance.

CO4: Demonstrate the skill in Oral and Written Communication as presented in the Thesis Book via Viva-Voce Examination

CO5: Improved Employability and entrepreneurship capacity due to knowledge up gradation with getting skilled up through learning & practicing in Design / development through simulation/ experimental analysis with project report submission (relevant to the candidates project area) by individuals.

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COURSE OBJECTIVES:
The objectives of this course are to make the student
1. To study the Channel planning for Wireless Systems
2. To study the Mobile Radio Propagation and Equalization and Diversity
3. To study the Equalization and Diversity
4. To provide insight about wideband code division based access.
5. To study the Wireless multiple access and IP

UNIT I THE CELLULAR CONCEPT

UNIT II MOBILE RADIO PROPAGATION: LARGE-SCALE PATH LOSS:

UNIT III MOBILE RADIO PROPAGATION:
Small Scale Fading and Multipath: Small Scale Multipath propagation-Factors influencing small scale fading, Doppler shift, Impulse Response Model of a multipath channel-Relationship between Bandwidth and Received power, Small-Scale Frequency Domain Channels Sounding, Parameters of Mobile Multipath Channels-Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time, Types of Small-Scale Fading-Fading effects Due to Multipath Time Delay Spread, Flat fading, Frequency selective fading, Fading effects Due to Doppler Spread-Fast fading, slow fading, Fundamentals of Equalization, Training A Generic Adaptive Equalizer, Equalizers in a communication Receiver, Linear Equalizers, Nonlinear Equalization

UNIT IV WIDEBAND CODE DIVISION MULTIPLE ACCESS
CDMA system overview-air interface—physical and logical channel—speech coding, multiplexing and channel coding—spreading and modulation: frame structure, spreading codes-uplink-downlink—physical layer procedures: cell search and synchronization-establishing a connection-power control-handover-overload control

UNIT V IP MOBILITY FRAMEWORK

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Understand Cellular communication concepts
CO2: Explain the mobile radio propagation
CO3: Perceive the wireless network different type of MAC protocols
CO4: Analyse the Equalization and Diversity
CO5: Build the Wireless multiple access and IP

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REFERENCES:
5. Wireless Digital Communications –KamiloFeher, 1999, PHI.

ET4002 VIRTUAL INSTRUMENTATION

COURSE OBJECTIVES:
1. Understanding the difference between conventional and graphical programming.
2. Introducing the basics of Lab VIEW and programming concepts.
3. Differentiating the real time and virtual instrument.
4. Represent and review signals acquire process in digital domain.
5. Analyzing the basics of data acquisition and learning the concepts of data acquisition with Lab VIEW.

UNIT I FUNDAMENTALS OF VIRTUAL INSTRUMENTATION
Fundamental Concepts of Virtual Instrumentation (VI) and Graphical Programming - Virtual instruments and Traditional instruments, Hardware and Software in virtual instrumentation, Data Flow Programming - Data Types – Customization of VI Properties - VI Documentation.

UNIT II VI PROGRAMMING STRUCTURES
Software Environment - Modular programming - Formula Nodes - Loops - Shift Registers - Local and Global Variables – Case and Sequence Structures - Arrays and Clusters - Graphs and Charts - State Machines - String and File I/O.

UNIT III DATA ACQUISITION AND INTERFACING STANDARDS
UNIT IV  ADVANCED PROGRAMMING

UNIT V  CASE STUDIES

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability in

CO1: Infer and Interpret the fundamentals of Virtual Instrumentation and data Acquisition.
CO2: Explain the difference between the traditional and virtual instrumentation.
CO3: Illustrate the theoretical concepts to realize practical systems.
CO4: Analyze and evaluate the performance of Virtual Instrumentation Systems
CO5: Build a VI system to solve real time problems using data acquisition.

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REFERENCES:
COURSE OBJECTIVES

1. To learn about basic concepts of embedded system
2. To learn about ARM architecture
3. To learn C language and assembly programming.
4. To learn Object orientation for programming and C++.
5. To learn software modelling fundamentals.

UNIT I         EMBEDDED CONCEPTS                  9

UNIT II       ARM ARCHITECTURE AND OVERVIEW OF CORTEX                          9

UNIT III     CORTEX-M3/M4 PROGRAMMING                                                  9

UNIT IV       UNIFIED MODELING LANGUAGE                                          9

UNIT V       EMBEDDED SOFTWARE DEVELOPMENT TOOLS AND RTOS                   9
The compilation process – libraries – porting kernels – C extensions for embedded systems – emulation and debugging techniques – RTOS - system design using RTOS.

COURSE OUTCOMES:

At the end of this course, the students will have the ability in

CO 1: Demonstrate about basic concepts of embedded system
CO 2: Build ARM architecture
CO 3: Understand C language and assembly programming.
CO 4: Build and compile Object orientation for programming and C++.
CO 5: Create software modelling

TOTAL: 45 PERIODS
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REFERENCES:

ET4004 AUTOMOTIVE EMBEDDED SYSTEM LT P C 3003

COURSE OBJECTIVES:
1. To expose the students to the fundamentals and building of Electronic Engine Control systems.
2. To teach on functional components and circuits for vehicles.
3. To discuss on programmable controllers for vehicles management systems.
4. To teach logics of automation & commercial techniques for vehicle communication.
5. To introduce the embedded systems concepts for E-vehicle system development.

UNIT I BASIC OF ELECTRONIC ENGINE CONTROL SYSTEMS Overview of Automotive systems, fuel economy, air-fuel ratio, emission limits and vehicle performance; Automotive microcontrollers- Electronic control Unit- Hardware & software selection and requirements for Automotive applications – open source ECU- RTOS - Concept for Engine management-Standards; Introduction to AUTOSAR and Introduction to Society SAE- Functional safety ISO 26262- Simulation and modeling of automotive system components.

UNIT II SENSORS AND ACTUATORS FOR AUTOMOTIVES Review of sensors- sensors interface to the ECU, conventional sensors and actuators, Modern sensor and actuators - LIDAR sensor- smart sensors- MEMS/NEMS sensors and actuators for automotive applications.
UNIT III VEHICLE MANAGEMENT SYSTEMS

UNIT IV ONBOARD DIAGNOSTICS AND TELEMATICS

UNIT V ELECTRIC VEHICLES

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability in
CO1: Insight into the significance of the role of embedded system for automotive applications.
CO2: Illustrate the need, selection of sensors and actuators and interfacing with ECU
CO3: Develop the Embedded concepts for vehicle management and control systems.
CO4: Demonstrate the need of Electrical vehicle and able to apply the embedded system technology for various aspects of EVs
CO5: Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design and its application in automotive systems.

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REFERENCES:

ET4005 INTELLIGENT CONTROL AND AUTOMATION

COURSE OBJECTIVES

- To Impart the knowledge of various optimization techniques and hybrid schemes.
- To introduce the concept, Analysis and implementation of ANN and Fuzzy logic controllers.
- To Emphasis the need for Genetic algorithm and its role for automation.
- To provide the basics of automation and its requirements
- To demonstrate the role of Intelligent controller in automation applications.

UNIT I ARTIFICIAL NEURAL NETWORK & FUZZY LOGIC


UNIT II GENETIC ALGORITHM

Basic concept of Genetic algorithm and detail algorithmic steps- Hybrid genetic algorithm - Solution for typical control problems using genetic algorithm. Concept on some other search techniques like Tabu search, Ant-colony search and Particle Swarm Optimization

UNIT III HYBRID CONTROL SCHEMES


UNIT IV AUTOMATION


UNIT V INTELLIGENT CONTROLLER FOR AUTOMATION APPLICATION

Applications of Intelligent controllers in Industrial Monitoring, optimization and control- Smart Appliances- Automation concept for Electrical vehicle- Intelligent controller and Automation for Power System.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will have the ability in
CO1: Demonstrate the basic architectures of NN and Fuzzy logics
CO2: Design and implement GA algorithms and know their limitations.
CO3: Explain and evaluate hybrid control schemes and PSO
CO4: Interpret the significance of Automation concepts.
CO5: Develop the intelligent controller for automation applications.

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REFERENCES:


ET4006                                      UNMANNED AERIAL VEHICLE                LT P C
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course Objectives:

1. To make the students to understand the basic concepts and components of UAV systems.
2. To teach the UAV design concepts.
3. To provide an insight about the hardware structure for UAVs.
4. To emphasis the communication protocol requirements and control strategy for UAVs.
5. To highlight the need and the role of UAVs for real time applications and development of real time UAVs.

unit I                                introduction to UAV 9
Overview and background - History of UAV –classification – societal impact and future outlook
Unmanned Aerial System (UAS) components --models and prototypes – System Composition-
applications
UNIT II THE DESIGN OF UAV SYSTEMS
Introduction to Design and Selection of the System- Aerodynamics and Airframe Configurations- Characteristics of Aircraft Types- Design Standards-Regulatories and regulations - Design for Stealth--
control surfaces-specifications.

UNIT III HARDWAREs for UAVs
Real time Embedded processors for UAVs - sensors-servos-accelerometer –gyros-actuators- power supply- integration, installation, configuration, and testing –MEMS/NEMS sensors and actuators for UAVs- Autopilot – AGL.

UNIT IV COMMUNICATION PAYLOADS AND CONTROLS
Payloads-Telemetry-tracking-Aerial photography-controls-PID feedback-radio control frequency range –modems-memory system-simulation-ground test-analysis-trouble shooting.

UNIT V THE DEVELOPMENT OF UAV SYSTEMS

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability in

CO1: Identify different hardware for UAV.
CO2: Determine preliminary design requirements for an unmanned aerial vehicle.
CO3: Design UAV system.
CO4: Identify and Integrate various systems of unmanned aerial vehicle.
CO5: Design micro aerial vehicle systems by considering practical limitations.

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REFERENCES:
COURSE OBJECTIVES:
1. To understand various representation methods of DSP system
2. To provide insight about different DSP algorithms
3. To familiarize the various architectures of DSP system
4. To perform analysis of DSP architectures and to learn the implementation of DSP system in programmable hardware
5. To learn the details of DSP system interfacing with other peripherals

UNIT I REPRESENTATION OF DSP SYSTEM
9

UNIT II DSP ALGORITHMS
9
DSP algorithms - Convolution, Correlation, FIR/IIR filters, FFT, adaptive filters, sampling rate converters, DCT, Decimator, Expander and Filter Banks. DSP applications. Computational characteristics of DSP algorithms and applications, Numerical representation of signals-word length effect and its impact, Carry free adders, Multiplier.

UNIT III SYSTEM ARCHITECTURE
9
Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Features for External Interfacing. VLIW architecture. Basic performance issue in pipelining, Simple implementation of MIPS, Instruction Level Parallelism, Dynamic Scheduling, Dynamic Hardware Prediction, Memory hierarchy. Study of Fixed point and floating point DSP architectures

UNIT IV ARCHITECTURE ANALYSIS ON PROGRAMMABLE HARDWARE
9
Analysis of basic DSP Architectures on programmable hardwares. Algorithms for FIR, IIR, Lattice filter structures, architectures for real and complex fast Fourier transforms, 1D/2D Convolutions, Winograd minimal filtering algorithm. FPGA: Architecture, different sub-systems, design flow for DSP system design, mapping of DSP algorithms onto FPGA.

UNIT V SYSTEM INTERFACING
9
Examples of digital signal processing algorithms suitable for parallel architectures such as GPUs and multIGPUs. Interfacing: Introduction, Synchronous Serial Interface CODE, A CODEC Interface Circuit, ADC interface.

COURSE OUTCOMES:
At the end of this course, the students will have the ability in
CO 1: Evaluate the DSP system using various methods.
CO 2: Design algorithm suitable for different DSP applications.
CO 3: Explain various architectures of DSP system.
CO 4: Implement DSP system in programmable hardware.
CO 5: Build interfacing of DSP system with various peripherals.

TOTAL : 45 PERIODS
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### REFERENCES
1. Sen M Kuo, Woon Seng S Gan, Digital Signal Processors
2. Digital Signal Processing and Application with C6713 and C6416 DSK, Rulph Chassaing, Worcester Polytechnic Institute, A Wiley Interscience Publication
6. RulphChassaing, Digital signal processing and applications with C6713 and C6416 DSK, Wiley, 2005

**ET4072**

**MACHINE LEARNING AND DEEP LEARNING**

**L T P C**

3 0 0 3

**COURSE OBJECTIVES:**
The course is aimed at
1. Understanding about the learning problem and algorithms
2. Providing insight about neural networks
3. Introducing the machine learning fundamentals and significance
4. Enabling the students to acquire knowledge about pattern recognition.
5. Motivating the students to apply deep learning algorithms for solving real life problems.

**UNIT I**

**LEARNING PROBLEMS AND ALGORITHMS**
Various paradigms of learning problems, Supervised, Semi-supervised and Unsupervised algorithms

**UNIT II**

**NEURAL NETWORKS**
UNIT III  MACHINE LEARNING – FUNDAMENTALS & FEATURE SELECTIONS & CLASSIFICATIONS  9
Classifying Samples: The confusion matrix, Accuracy, Precision, Recall, F1- Score, the curse of dimensionality, training, testing, validation, cross validation, overfitting, under-fitting the data, early stopping, regularization, bias and variance. Feature Selection, normalization, dimensionality reduction, Classifiers: KNN, SVM, Decision trees, Naïve Bayes, Binary classification, multi class classification, clustering.

UNIT IV  DEEP LEARNING: CONVOLUTIONAL NEURAL NETWORKS  9
Feed forward networks, Activation functions, back propagation in CNN, optimizers, batch normalization, convolution layers, pooling layers, fully connected layers, dropout, Examples of CNNs.

UNIT V  DEEP LEARNING: RNNS, AUTOENCODERS AND GANS  9
State, Structure of RNN Cell, LSTM and GRU, Time distributed layers, Generating Text, Autoencoders: Convolutional Autoencoders, Denoising autoencoders, Variational autoencoders, GANs: The discriminator, generator, DCGANs

TOTAL : 45 PERIODS

COURSE OUTCOMES (CO):
At the end of the course the student will be able to
CO1 : Illustrate the categorization of machine learning algorithms.
CO2: Compare and contrast the types of neural network architectures, activation functions
CO3: Acquaint with the pattern association using neural networks
CO4: Elaborate various terminologies related with pattern recognition and architectures of convolutional neural networks
CO5: Construct different feature selection and classification techniques and advanced neural network architectures such as RNN, Autoencoders, and GANs.

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REFERENCES:
COURSE OBJECTIVES:

1. To introduce the fundamentals of Human and Computer Vision.
2. To introduce the major ideas, concepts, methods and techniques in Computer Vision.
3. To impart Computer Vision knowledge by way of learning related algorithms.
4. To make them familiar with both the Theoretical and Practical aspects of Computing with Images.
5. To provide the student with programming experience for implementing Computer Vision algorithms.

UNIT I  INTRODUCTION TO COMPUTER VISION  9

UNIT II  IMAGE PROCESSING CONCEPTS AND IMAGE FEATURES  9

UNIT III  IMAGE PROCESSING WITH OPENCV  9
Introduction to OpenCV and Python: Setting up OpenCV – Image Basics in OpenCV – Handling Files and Images – Constructing Basic Shapes in OpenCV. Image Processing in OpenCV: Image Processing Techniques – Constructing and Building Histograms – Thresholding Techniques.

UNIT IV OBJECT DETECTION  9

UNIT V APPLICATIONS AND CASE STUDIES  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Understand the major concepts and techniques in computer vision and image processing
CO2: Infer known principles of human visual system
CO3: Demonstrate a thorough knowledge of Open CV
CO4: Develop real-life Computer Visions Applications.
CO5: Build design of a Computer Vision System for a specific problem.
REFERENCES:

UNIT V  SYNCHRONIZATION AND MANAGEMENT  
Notion of synchronization, presentation requirements, reference model for synchronization, Introduction to SMIL, Multimedia operating systems, Resource management, process management techniques.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Deploy the right multimedia communication models.
CO2: Apply QoS to multimedia network applications with efficient routing techniques.
CO3: Solve the security threats in the multimedia networks.
CO4: Develop the real-time multimedia network applications
CO5: Improve to synchronize and manage the multimedia systems.

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REFERENCES

ET4009  EMBEDDED NETWORKING AND AUTOMATION  
OF ELECTRICAL SYSTEM  
COURSE OBJECTIVES:
1. To discuss the fundamentals building blocks of a digital instrument.
2. Introduce wired, WSN for configuring metering network
3. Discuss requirements for grid automation using meters.
4. To discuss networking configuration to develop PAN.
5. To discuss the functions of digital instrument Power quality monitoring

UNIT I  BUILDING SYSTEM AUTOMATION  
UNIT II  EMBEDDED NETWORKING OF INSTRUMENT CLUSTER  

UNIT III  AUTOMATION OF SUBSTATION  

UNIT IV  METERING OF SMART GRID  
Characteristics of Smart Grid- Generation by Renewable Energy Sources based on solar grid-Challenges in Smart Grid and Microgrids- electrical measurements with AMI -Smart meters for EV plug in electric vehicles power management -Home Area Netmetering and Demand side Energy Management applications.

UNIT V  SMART METERS FOR PQ MONITORING  
Power Quality issues of Grid connected Renewable Energy Sources -Smart meters for Power Quality monitoring and Control - Power Quality issues -Surges – Flicker - Interharmonics - Transients – Power Quality Benchmarking – Power Quality Meters- Meter data management In Smart Grid-, communication enabled Power Quality metering

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Demonstrate criteria of choice of sensors, components to build meters.
CO2: Illustrate the demand for BUS communication protocols are introduced
CO3: Analyse the need and standards in Substation automation
CO4: Deployment of PAN for metering networked commercial applications
CO5: Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded networked communications.

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REFERENCES:
1. Control and automation of electrical power distribution systems, James Northcote-Green, Robert Wilson, CRC, Taylor and Francis, 2006

46

ET4010 SMART SYSTEM DESIGN L T P C
3 0 0 3

COURSE OBJECTIVES:
1. To understand about the smart system technologies and its role in real time applications
2. To expose students to different open-source platforms and attributes.
3. To teach the architecture and requirements of Home Automation.
4. To provide an insight into smart appliances and energy management concepts.
5. To familiarize the design and development of embedded system based system design.

UNIT I INTRODUCTION 9
Overview of a smart system - Design Requirements - Hardware and software selection & co-design - Smart sensors and Actuators – Communication protocols used in smart systems – Data Analytics: Need & Types – Open-source Analytics Platform for embedded systems (IFTTT &Thingspeak) – Smart Microcontrollers - Embedded system for Smart card design and development – Recent trends.

UNIT II HOME AUTOMATION 9

UNIT III SMART APPLIANCE AND ENERGY MANAGEMENT 9

UNIT IV SMART WEARABLE DEVICES 9
Application of Smart Wearables in Healthcare & Activity Monitoring - Functional requirements– Selection of body sensors, Hardware platform, OS and Software platform – Selection of suitable communication protocol. Case Study: Design of a wearable, collecting heart-beat, temperature and monitoring health status using a smartphone application.

UNIT V EMBEDDED SYSTEMS AND ROBOTICS 9

TOTAL: 45 PERIODS
COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Understand the concepts of smart system design and its present developments.
CO2: Illustrate different embedded open-source and cost-effective techniques for developing solution for real time applications.
CO3: Acquire knowledge on different platforms and Infrastructure for Smart system design.
CO4: Infer about smart appliances and energy management concepts.
CO5: Apply and improve Employability and entrepreneurship capacity due to knowledge upgradation on embedded system technologies.

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REFERENCES:

COURSE OBJECTIVES:
1. To expose the students to the fundamentals of Network communication technologies.
2. To teach the fundamentals of Java, Internet and Java card
3. To develop distributed embedded system with Java
4. To teach the smart card and Apps development
5. To involve Discussions/ Practice in familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.

UNIT I NETWORK INFRASTRUCTURE
UNIT II  JAVA TECHNOLOGY FOR EMBEDDED SYSTEMS  9
Basic concepts of Java - IO streaming – Object serialization – Networking – Threading – RMI –
distributed databases — Advantages and limitations of Internet – Web architecture for embedded
systems – security model for embedded systems.

UNIT III  SMART CARD TECHNIQUES  9
Smart Card basics – Java card technology overview – Java card Types - Card components SMART
CARD MICROCONTROLLERS - Contactless Cards - Smart Card Operating Systems– smart card
Security Techniques.

UNIT IV  ANDROID FRAMEWORK  9
Android SDK – Access to Hardware - Framework development - Peer-to-Peer communication-
Android security design and architecture – Case study.

UNIT V  DEVELOPING DISTRIBUTED REAL-TIME SYSTEM APPLICATIONS  9
Developing MATLAB Real-Time Targets - Using the xPC Target - Building various Distributed Real
Time Applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Deliver insight into involving JAVA concepts & internet based Communication to establish
decentralized control mechanism of system
CO2: Interpret the software and hardware architecture for distributed computing
CO3: Develop solution for smart card
CO4: Develop Apps based on android SDK.
CO5: Improved Employability and entrepreneurship capacity due to knowledge up gradation on
recent trends in embedded system computing environment.

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REFERENCES:
1. Amitava Gupta, Anil Kumar Chandra and Peter Luksch “Real-Time and Distributed Real-
Number-13: 978-1-4665-9849-2 (eBook - PDF)
2. Wolfgang Rankl and Wolfgang Effing “Smart Card Handbook” John Wiley & Sons Ltd ,
COURSE OBJECTIVES:
1. To introduce the fundamentals related to Cryptography and Data Security
2. To teach the mathematical foundations for Cryptography.
3. To impart knowledge about Embedded Cryptography and Data Protection Protocols
4. To make them understand the practical aspects of Embedded System Security.
5. To involve the students in Discussions/Tutorials/Programming to familiarize the concepts for improved employability skills.

UNIT I BACKGROUND AND INTRODUCTION

UNIT II SYMMETRIC CIPHERS

UNIT III EMBEDDED SYSTEMS SECURITY

UNIT IV EMBEDDED CRYPTOGRAPHY AND DATA PROTECTION PROTOCOLS

UNIT V PRACTICAL EMBEDDED SYSTEM SECURITY

COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Explain the significance of Security.
CO2: Understand the major concepts and techniques related to Cryptography.
CO3: Demonstrate thorough knowledge about the aspects of Embedded System Security.
CO4: Delivers insight onto role of Security Aspects during Data Transfer and Communication.

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ET4013 ROBOTICS AND AUTOMATION L T P C 3 0 0 3

COURSE OBJECTIVES:
1. To teach the need of embedded system technology for robot building
2. To study the Various Parts of Robots and Fields of Robotics.
3. To study the Various Kinematics and Inverse Kinematics of Robots.
4. To study the Trajectory Planning for Robot.
5. To study the Control of Robots for Some Specific Applications.

UNIT I INTRODUCTION TO ROBOTICS & AUTOMATION

UNIT II SENSORS AND DRIVE SYSTEMS
UNIT III   MANIPULATORS AND GRIPPERS 9

UNIT IV   KINEMATICS AND PATH PLANNING 9

UNIT V   CASE STUDIES 9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Choose suitable embedded boards for robots
CO2: Demonstrate the concepts of robotics & automation and Working of Robot
CO3: Analyze the Function of Sensors and actuators In the Robot
CO4: Develop Program to Use a Robot for a Typical Application
CO5: Apply and improve Employability and entrepreneurship capacity due to knowledge upgradation on Embedded system based robot development

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COURSE OBJECTIVES:
1. To familiarize the need and role of Reconfigurable Processor for embedded system applications.
2. To introduce the Reconfigurable Processor technologies
3. To teach the salient features and architecture of FPGA.
4. To provide an insight and architecture significance of SoC.
5. To impart the knowledge of Reconfigurable embedded Processor for real time applications.

UNIT I  INTRODUCTION
Introduction to reconfigurable processor- Reconfigurable Computing-Programming elements and Programming Tools for Reconfigurable Processors, ASIC design flow- Hardware/Software Co-design-FPAA Architecture overview- recent trends in Reconfigurable Processor &SoC.

UNIT II  FPGA TECHNOLOGIES

UNIT III  FPGA ARCHITECTURE
FPGA architecture overview- Challenges of FPGA processor design-Opportunities of FPGA processor design- Designing SoftCore Processors – Designing Hardcore Processors – hardware/software co simulation- FPGA to multi core embedded computing- FPGA based on-board computer system.

UNIT IV  RECONFIGURABLE SOC PROCESSORS
SoC Overview –Architecture and applications of Virtex II pro ,Zynq-7000, Excalibur, Cyclone V - A7, E5- FPSLIC- Multicore SoCs.

UNIT V  RECONFIGURABLE PROCESSOR AND SOC APPLICATIONS
Reconfigurable processor based DC motor control- digital filter design- mobile phone development-
High Speed Data Acquisition -Image Processing application-controller implementation for mobile robot- Crypto-processor.

COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Illustrate the need of reconfigurable computing and hardware-software co design
CO2: Demonstrate the significance of FPGA technology.
CO3: Apply the concept of FPGA technology and understand FPGA architectures.
CO4: Interpret the operation of SoC processor.
CO5: Relate and improve Employability and entrepreneurship capacity due to knowledge up-gradation on reconfigurable computing and SoC design.
REFERENCES:
2. Ian Grout, "Digital system design with FPGAs and CPLDs" Elsevier, 2008

COURSE OBJECTIVES:
1. To introduce the diverse technological and functional approaches of MEMS/NEMS and applications.
2. To understand the microstructures and fabrication methods.
3. To provide an insight of micro and nano sensors, actuators.
4. To emphasis the need for NEMS technology.
5. To update the ongoing trends and real time applications of MEMS and NEMS technology.

UNIT I       INTRODUCTION TO MEMS and NEMS
Overview of Micro electro mechanical systems and Nano Electro mechanical systems, devices and technologies, Laws of scaling- Survey of materials- Smart Sensors-Applications of MEMS and NEMS.

UNIT II      MICRO-MACHINING AND MICROFABRICATION TECHNIQUES
Photolithography- Film deposition, Etching Processes- wafer bonding- Bulk micro machining, silicon surface micro machining- LIGA process.

UNIT III     MICRO SENSORS AND MICRO ACTUATORS
Transduction mechanisms in different energy domain- Micromachined capacitive, Piezoelectric , piezoresistive and Electromechanical and thermal sensors/actuators and applications
UNIT IV  NEMS TECHNOLOGY
Atomic scale precision engineering- Nano Fabrication techniques - NEMS in measurement, sensing, actuation and systems design.

UNIT V  MEMS and NEMS APPLICATION
Introduction to Micro/Nano Fluids and applications- Bio MEMS- Optical NEMS- Micro and Nano motors- Recent trends in MEMS and NEMS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Explain the material properties and the significance of MEMS and NEMS for industrial automation.
CO2: Demonstrate knowledge delivery on micromachining and micro fabrication.
CO3: Apply the fabrication mechanism for MEMS sensor and actuators.
CO4: Apply the concepts of MEMS and NEMS to models, simulate and process the sensors and actuators.
CO5: Improved Employability and entrepreneurship capacity due to knowledge up gradation on MEMS and NEMS technology.

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REFERENCES:
COURSE OBJECTIVES
1. To develop an understanding on business promotion process.
2. To expose students on the skills required for success in business.
3. To impart embedded system technology based entrepreneurship. Architecture
4. Creative thinking in developing automation into consumer products of market value
5. Developing an embedded product with hardware-software components.

UNIT I       INTRODUCTION TO ENTREPRENEURSHIP
Entrepreneurial culture and structure -theories of entrepreneurship - entrepreneurial motivation - establishing entrepreneurial systems - financial information and intelligence, rewards and motivation - concept bank -Role of industrial Fairs- challenges in entrepreneurship.

UNIT II RESPONSIBILITIES IN ENTREPRENEURSHIP
Steps for starting a small industry -selection of type of organization -Incentives and subsidies - Central Govt. schemes and State Govt. Schemes -Incentives to SSI -registration, Registration and Licensing requirements for sales tax, CST, Excise Duty -Power -Exploring export possibilities- incentives for exports -import of capital goods and raw materials- Entrepreneurship development programmes in India- Role and Improvement in Indian Economy.

UNIT III CONCEPTS OF PRODUCT DEVELOPMENT

UNIT IV APPROACHES FOR NEW PRODUCT DEVELOPMENT

UNIT V SCOPE IN EMBEDDED SYSTEM FIELD
Entrepreneurship opportunities in Embedded system technologies - Embedded system Product development -Entrepreneurial skills for embedded system hardware and software architecture, software and hardware co-design and challenges; problems of entrepreneurship in Embedded system field- case studies: Mobile phone development- automation components-Washing machine- Food Processing system and devices- High Performance embedded computers- Industrial Controllers

COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Analyze the internal/external factors affecting a business/organization to evaluate business opportunities.
CO2: Demonstrate extemporaneous speaking skills developed through in-class discussion of text materials, case study analyses, and current entrepreneurship-related issues.
CO3: Apply and Relate Key concepts underpinning entrepreneurship and its application in the recognition and exploitation of product/ service/ process opportunities.
CO4: Interpret various aspects of design such as industrial design, design of Consumer specific product, its Reverse Engineering manufacture, economic analysis through CO5: Improved Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded systems design.

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REFERENCES
3 Greene, Entrepreneurship: Ideas in Action, Thomson Learning, Mumbai, 2000
5 Gupta and Smivasan, Entrepreneurial Development, New Delhi, Sultan Chand, 1992

ET4017 EMBEDDED SYSTEM FOR BIOMEDICAL APPLICATIONS LT P C 3 0 0 3

COURSE OBJECTIVES:
1. To Introduce Fundamentals of Biomedical Engineering
2. To understand the concept of wearable health devices
3. To study the hardware for image processing applications
4. To have a basic knowledge of Embedded system in diagnostic applications
5. To study about the various assist devices used in the hospitals.

UNIT I INTRODUCTION TO BIOMEDICAL ENGINEERING 9
UNIT II WEARABLE HEALTH DEVICES

UNIT III EMBEDDED SYSTEM FOR MEDICAL IMAGE PROCESSING
Introduction to embedded image processing . ASIC vs FPGA - memory requirement-, power consumption- parallelism - Design issues in VLSI implementation of Image processing algorithms - interfacing. Hardware implementation of image processing algorithms: Segmentation and compression

UNIT IV EMBEDDED SYSTEM FOR DIAGNOSTIC APPLICATIONS
ICCU patient monitoring system – ECG-EEG-EMG acquisition system-MRI scanner - CT scanner- Sonography.

UNIT V CASE STUDY
Respiratory measurement using spirometer- IPPB unit for monitoring respiratory parameters - ventilators- -Defibrillator- Glucometer-Heart- Lung machine.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Demonstrate the fundamental art of biomedical engineering.
CO2: Illustrate about wearable health devices and its importance.
CO3: Implement image processing applications using software and hardware.
CO4: Compare various embedded diagnostic applications.
CO5: Build and analyze of some biomedical equipment.

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REFERENCES:
COURSE OBJECTIVES:
- To provide knowledge about the stand alone and grid connected renewable energy systems.
- To equip with required skills to derive the criteria for the design of power converters for renewable energy applications.
- To analyse and comprehend the various operating modes of wind electrical generators and solar energy systems.
- To design different power converters namely AC to DC, DC to DC and AC to AC converters for renewable energy systems.
- To develop maximum power point tracking algorithms.

UNIT I INTRODUCTION
Introduction to renewable energy systems, environmental aspects of electric energy conversion, impacts of renewable energy penetration to grid. Grid Codes in India and other countries. Basic power electronic converters for renewable energy integration to grid-Qualitative analysis -Boost and buck-boost converters, three phase AC voltage controllers- AC-DC-AC converters, PWM Inverters, Grid Interactive Inverters-matrix converters.

UNIT II PHOTO VOLTAIC ENERGY CONVERSION SYSTEMS
Introduction, Photo Voltaic (PV) effect, Solar Cell, Types, Equivalent circuit of PV cell, PV cell characteristics (I/V and P/V) for variation of insolation, temperature and shading effect, Stand-alone PV system, Grid connected PV system, Design of PV system-load calculation, array sizing, selection of converter/inverter, battery sizing.

UNIT III WIND ENERGY CONVERSION SYSTEMS
Introduction, Power contained in wind, Efficiency limit in wind, types of wind turbines, Wind control strategies, Power curve and Operating area. Types of wind generators system based on Electrical machines-Induction Generator and Permanent Magnet Synchronous Generator(PMSG), Grid Connected-Single and Double output system, Self-excited operation of Induction Generator and Variable Speed PMSG.

UNIT IV MPPT TECHNIQUES IN SOLAR AND WIND SYSTEMS
Case studies of PV-Maximum Power Point Tracking (MPPT) and Wind Energy system

UNIT V HYBRID STORAGE SYSTEMS AND GRID MANAGEMENT
Energy Storage systems, Need for Hybrid Systems, Features of Hybrid Systems, Range and types of Hybrid systems (Wind-Diesel, PV-Diesel and Wind-PV),

TOTAL : 45 PERIODS

COURSE OUTCOMES:
- CO1 Relate the power generation of different renewable energy sources to grid impact and grid codes
- CO2 Explain the design principles of solar energy management systems
- CO3 Understand the power conversion system of wind generators
- CO4 Analyze the different Maximum Power Point tracking Techniques
CO5  Build grid connected and stand alone renewable energy management system

REFERENCES:
5. Gray, L. Johnson, “Wind energy system”, prentice hall linc, 1995

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PX4291  ELECTRIC VEHICLES AND POWER MANAGEMENT  3104

OBJECTIVES:
- To understand the concept of electric vehicles and its operations
- To present an overview of Electric Vehicle (EV), Hybrid Electric vehicle (HEV) and their architecture
- To understand the need for energy storage in hybrid vehicles
- To provide knowledge about various possible energy storage technologies that can be used in electric vehicles

UNIT I ELECTRIC VEHICLES AND VEHICLE MECHANICS  12

Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings- Comparisons of EV with internal combustion Engine vehicles- Fundamentals of vehicle mechanics.
UNIT II   ARCHITECTURE OF EV’s AND POWER TRAIN COMPONENTS  12
Architecture of EV’s and HEV’s – Plug-n Hybrid Electric Vehicles (PHEV)- Power train components
and sizing, Gears, Clutches, Transmission and Brakes.

UNIT III  POWER ELECTRONICS AND MOTOR DRIVES  12
Electric drive components – Power electronic switches- four quadrant operation of DC drives –
Induction motor and permanent magnet synchronous motor-based vector control operation –
Switched reluctance motor (SRM) drives- EV motor sizing.

UNIT IV    BATTERY ENERGY STORAGE SYSTEM  12
Battery Basics- Different types- Battery Parameters-Battery life & safety impacts -Battery
modeling-Design of battery for large vehicles.

UNIT V  ALTERNATIVE ENERGY STORAGE SYSTEMS  12
Introduction to fuel cell – Types, Operation and characteristics- proton exchange membrane (PEM)
fuel cell for E-mobility– hydrogen storage systems –Super capacitors for transportation
applications.

TOTAL : 60 PERIODS

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

CO1: Understand the concept of electric vehicle and energy storage systems.
CO2: Describe the working and components of Electric Vehicle and Hybrid Electric Vehicle
CO3: Know the principles of power converters and electrical drives
CO4: Illustrate the operation of storage systems such as battery and super capacitors
CO5: Analyze the various energy storage systems based on fuel cells and hydrogen storage

REFERENCES:
4. C.C. Chan and K.T. Chau, 'Modern Electric Vehicle Technology”; OXFORD University
   & Sons, 2017.

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COURSE OBJECTIVES:
1. Students will understand and be able to use the basic programming principles such as data types, variable, conditionals, loops, recursion and function calls.
2. Students will learn how to use basic data structures such as List, Dictionary and be able to manipulate text files and images.
3. To make the students familiar with machine learning concepts & techniques.
4. Students will understand the process and will acquire skills necessary to effectively attempt a machine learning problem and implement it using Python.
5. To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved research/employability skills

UNIT I  INTRODUCTION TO MACHINE LEARNING AND PYTHON
Introduction to Python and its significance – Difference between C, C++ and Python Languages; Compiler and Interpreters – Python3 Installation & Running – Basics of Python Programming Syntax: Variable Types, Basic Operators, Reading Input from User – Arrays/List, Dictionary and Set – Conditional Statements – Control Flow and loop control statements

UNIT II  PYTHON FUNCTIONS AND PACKAGES

UNIT III  IMPLEMENTATION OF MACHINE LEARNING USING PYTHON

UNIT IV  CLASSIFICATION AND CLUSTERING CONCEPTS OF ML
Types of Clustering Algorithms & Techniques – K-means Algorithm, Mean Shift Algorithm & Hierarchical Clustering Algorithm – Introduction to Python Visualization using Matplotlib: Plotting 2-dimensional, 3-dimensional graphs; formatting axis values; plotting multiple rows of data in same graph – Implementation of K-means Algorithm and Mean Shift Algorithm using Python
UNIT V       INTRODUCTION TO NEURAL NETWORKS AND EMBEDDED MACHINE LEARNING 9
Introduction to Neural Networks & Significance – Neural Network Architecture – Single Layer
Perceptron & Multi-Layer Perceptron (MLP) – Commonly Used Activation Functions - Forward
Propagation, Back Propagation, and Epochs – Gradient Descent – Introduction to Tensorflow and
Keras ML Python packages – Implementation of MLP Neural Network on Iris Dataset – Introduction to
Convolution Neural Networks – Implementation of Digit Classification using MNIST Dataset
ML for Embedded Systems: Comparison with conventional ML – Challenges & Methods for
Overcoming – TinyML and Tensorflow Lite for Microcontrollers – on-Board AI – ML Edge Devices:
Arduino Nano BLE Sense, Google Edge TPU and Intel Movidius

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Develop skill in system administration and network programming by learning Python.
CO2: Demonstrating understanding in concepts of Machine Learning and its implementation using
Python
CO3: Relate to use Python’s highly powerful processing capabilities for primitives, modelling etc
CO4: Improved Employability and entrepreneurship capacity due to knowledge up gradation on
recent trends in embedded systems design.
CO5: Apply the concepts acquired over the advanced research/employability skills

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REFERENCES:
1. Mark Lutz,"LearningPython,Powerful OOPs,O’reilly,2011
COURSE OBJECTIVES

- To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure.
- To know about the function of smart grid.
- To familiarize the power quality management issues in Smart Grid.
- To familiarize the high performance computing for Smart Grid applications
- To get familiarized with the communication networks for Smart Grid applications

UNIT I  INTRODUCTION TO SMART GRID
Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, Comparison of Micro grid and Smart grid, Present development & International policies in Smart Grid, Smart Grid Initiative for Power Distribution Utility in India – Case Study.

UNIT II  SMART GRID TECHNOLOGIES
Technology Drivers, Smart Integration of energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/Var control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV) – Grid to Vehicle and Vehicle to Grid charging concepts.

UNIT III  SMART METERS AND ADVANCED METERING INFRASTRUCTURE
Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit (PMU) & their application for monitoring & protection. Demand side management and demand response programs, Demand pricing and Time of Use, Real Time Pricing, Peak Time Pricing.

UNIT IV  POWER QUALITY MANAGEMENT IN SMART GRID

UNIT V  HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS
Architecture and Standards -Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), PLC, Zigbee, GSM, IP based Protocols, Basics of Web Service and CLOUD Computing, Cyber Security for Smart Grid.

TOTAL : 45 PERIODS

COURSE OUTCOME:
Students able to
CO1: Relate with the smart resources, smart meters and other smart devices.
CO2: Explain the function of Smart Grid.
CO3: Experiment the issues of Power Quality in Smart Grid.
CO4: Analyze the performance of Smart Grid.
CO5: Recommend suitable communication networks for smart grid applications
REFERENCES


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COURSE OBJECTIVES
1. Teach how to improve writing skills and level of readability
2. Tell about what to write in each section
3. Summarize the skills needed when writing a Title
4. Infer the skills needed when writing the Conclusion
5. Ensure the quality of paper at very first-time submission

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING 6
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II PRESENTATION SKILLS 6

UNIT III TITLE WRITING SKILLS 6
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV RESULT WRITING SKILLS 6
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V VERIFICATION SKILLS 6
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first-time submission

TOTAL: 30 PERIODS

COURSE OUTCOMES
CO1 – Understand that how to improve your writing skills and level of readability
CO2 – Learn about what to write in each section
CO3 – Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion
CO5 – Ensure the good quality of paper at very first-time submission

REFERENCES
COURSE OBJECTIVES
1. Summarize basics of disaster
2. Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
3. Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
4. Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
5. Develop the strengths and weaknesses of disaster management approaches.

UNIT I INTRODUCTION
Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS

UNIT III DISASTER PRONE AREAS IN INDIA
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics.

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT
Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT

TOTAL: 30 PERIODS

COURSE OUTCOMES
CO1: Ability to summarize basics of disaster
CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CO5: Ability to develop the strengths and weaknesses of disaster management approaches.
REFERENCES

AX4093 CONSTITUTION OF INDIA

COURSE OBJECTIVES
Students will be able to:
1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals’ constitutional role.
3. Role and entitlement to civil and economic rights as well as the emergence of nationalhood in the early years of Indian nationalism.
4. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION
History, Drafting Committee, (Composition & Working)

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION
Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES

UNIT IV ORGANS OF GOVERNANCE
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V LOCAL ADMINISTRATION

UNIT VI ELECTION COMMISSION
Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS
COURSE OUTCOMES
Students will be able to:
- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party (CSP) under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

SUGGESTED READING
1. The Constitution of India, 1950 (Bare Act), Government Publication.
UNIT III அவல்களப்பிறைவுகள் 6

1. கலந்தவிலைபுரிவு

- திட்டப்பிள்ளை எனுக்கொண்டு

2. மேல்வரை துற்றமையாகிவிடு

- கிளாகம்ப்பிறல்களமையாகிவிடு

UNIT IV அளவியுகங்கள் 6

1. சில்பாசார்பைப்புணர்வு

- பங்களித்துக் கொள்ள்ந தம்சாதை, பால் மற்றும் கொண்டுபைப்புகள்

2. தூத்துக்கை

- அற்றவியல் பரிமங்களின்

3. கிளாசிக்கள் (617, 618)

- துறைப்பியாசிரியர்

4. சுருக்காக்கங்கள் பரிமங்களிற்கு விளக்கம்

5. பங்களித்துகை

- சில்பாசார்பைப்புணர்வு

6. ஆக்காண்டு (4) - மூலநம்

தேர்புரை (11) - செங்கு

கல்லிக்காக்க (11) - பார்வை, பொரு

உத்திரங்கள் 50 (27) - பார்வை

அல்மதும் பங்களித்து விளக்கம்
UNIT V

1. சாத்தலக்குறிகள்,
   - தமிழ்விளக்கப்படிகள்,
   - தமிழ்ப் படிகள்,
   - கான் விளக்கப்படிகள்,
   - பாரதவிளக்கப்படிகள்,
   - நாடகம்,

2. ராணி விளக்கத்தை பாரம்பரிய குரிய திறக்கப்படும்,
3. தமிழ் விளக்கத்தை பாரம்பரிய திறக்கப்படும்,
4. பாரதவிளக்கத்தை பாரம்பரிய பிபிக்கும் பாரம்பரிய திறக்கப்படும்,
5. அரியக் குரிய,
6. தலங்கற்பைத்து குரிய,
7. கான் விளக்கம் பாரம்பரிய திறக்கப்படும்.

தீர்மடைந்து வெறியிட்டு / பதிகங்கள்

1. தமிழ் விளக்கநலம் வினைத்தல நூறு (Tamil Virtual University)
   - www.tamilvu.org
2. தமிழ் விளக்கநலம் வினைத்தல நூறு (Tamil Wikipedia)
   - https://ta.wikipedia.org
3. காண்பத் அறிவு தொடர்பு
4. பாரத விளக்கநலம்
   - தமிழ்விளக்கநலம், கான்
5. தமிழ்விளக்கநலம்
6. அதிலிங்கத்தியம்

- தமிழப்பொருள்கல்கம், தானார்

TOTAL: 30 PERIODS