Programme Educational Objective

1) To prepare students for successful careers in industry that meets the needs of Indian and global industries as employable professionals.
2) To develop the ability among students to synthesize data and technical concepts for application to product design, system development of societal importance.
3) To provide opportunity for students to work as part of teams on multi disciplinary projects to solve engineering, technical issues of societal demands.
4) To provide the P.G students with a sound foundation in the mathematical, scientific and engineering fundamentals necessary to formulate, solve and analyze engineering problems and to prepare them for employability and higher studies.
5) To promote student awareness of the life long learning and to introduce them to professional ethics and codes of professional practice.

Program Outcomes

a) To Offer the P.G Program in Embedded System Technology with imparting domain knowledge in Electrical circuits, electronic devices, information technology and communication engineering to develop inter-process communication techniques based on hardware–software approaches for real time process automations.

b) To enhance teaching & research contributions in Embedded System Technology with an ability to design and construct hardware and software systems, component or process keeping in tune with the latest developments and Industry requirements particularly for electrical and allied consumer electronics industries.

c) An ability to design and conduct experiments as well as to organize, analyze and interpret data on multidisciplinary domains onto role of electronics, computer science, communication engineering for electrical applications.

d) Be able to identify problems in major issues of Electrical Systems, analyse problems, coordinate through all options in design & developments and solve them using the knowledge base of Embedded Technology.

e) To extend advanced teaching & training sessions with promoting industry based internships, leading to development of self-employable entrepreneurs and globally employable professionals.

f) To provide guidance and supervision in identified domains of Embedded Application Development for Electrical & related Industries with realistic concerns such as economic, environmental, ethical, health and safety, manufacturability and technology sustainability.

g) An ability to effectively communicate technical information in speech, presentation, and in writing.
h) An understanding of professional, legal and ethical issues and responsibilities as it pertains to engineering profession with engaging in life-long learning with knowledge of contemporary issues.

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**MAPPING – PG- EMBEDDED SYSTEM TECHNOLOGIES**

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<td>3.</td>
<td>IN5092</td>
<td>Digital Instrumentation</td>
<td>PE</td>
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# Semester II

<table>
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<tr>
<th>S.No</th>
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<th>Category</th>
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<th>L</th>
<th>T</th>
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<tr>
<td>1.</td>
<td>ET5002</td>
<td>Embedded Linux</td>
<td>PE</td>
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<td>2.</td>
<td>ET5071</td>
<td>Advanced Digital Signal Processing</td>
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<td>ET5003</td>
<td>Python Programming</td>
<td>PE</td>
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<td>ET5004</td>
<td>Embedded Product Development</td>
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<td>5.</td>
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<td>Automotive Embedded System</td>
<td>PE</td>
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<td>6.</td>
<td>ET5006</td>
<td>Reconfigurable Processor and SoC Design</td>
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# Semester III

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<tr>
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<tr>
<td>1.</td>
<td>ET5092</td>
<td>Digital Image Processing</td>
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<td>2.</td>
<td>ET5007</td>
<td>Embedded Networking and Automation of Electrical System</td>
<td>PE</td>
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<td>Smart System Design</td>
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<td>7.</td>
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<td>Smart Grid</td>
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<td>8.</td>
<td>PS5073</td>
<td>Electric Vehicles and Power Management</td>
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<td>9.</td>
<td>ET5012</td>
<td>Soft Computing and Optimization Techniques</td>
<td>PE</td>
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<td>10.</td>
<td>ET5013</td>
<td>Wireless And Mobile Communication</td>
<td>PE</td>
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<td>11.</td>
<td>ET5014</td>
<td>Cryptography And Network Security</td>
<td>PE</td>
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<td>IN5079</td>
<td>Robotics and Control</td>
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# Employability Enhancement Courses (EEC)

<table>
<thead>
<tr>
<th>S.No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Category</th>
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<tr>
<td>1.</td>
<td>ET5311</td>
<td>Project Work Phase I</td>
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<td>ET5411</td>
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OBJECTIVES:

- The main objective of this course is to demonstrate various analytical skills in applied mathematics and extensive experience with the tactics of problem solving and logical thinking applicable for the students of electrical engineering. This course also will help the students to identify, formulate, abstract, and solve problems in electrical engineering using mathematical tools from a variety of mathematical areas, including matrix theory, calculus of variations, probability, linear programming and Fourier series.

UNIT I MATRIX THEORY
Cholesky decomposition - Generalized Eigenvectors - Canonical basis - QR Factorization - Least squares method - Singular value decomposition.

UNIT II CALCULUS OF VARIATIONS
Concept of variation and its properties – Euler’s equation – Functional dependant on first and higher order derivatives – Functionals dependant on functions of several independent variables – Variational problems with moving boundaries – Isoperimetric problems - Direct methods : Ritz and Kantorovich methods.

UNIT III PROBABILITY AND RANDOM VARIABLES

UNIT IV LINEAR PROGRAMMING
Formulation – Graphical solution – Simplex method – Big M method - Two phase method - Transportation and Assignment models.

UNIT V FOURIER SERIES

TOTAL : 60 PERIODS

OUTCOMES:

After completing this course, students should demonstrate competency in the following skills:

- Apply various methods in matrix theory to solve system of linear equations.
- Maximizing and minimizing the functional that occur in electrical engineering discipline.
- Computation of probability and moments, standard distributions of discrete and continuous random variables and functions of a random variable.
- Could develop a fundamental understanding of linear programming models, able to develop a linear programming model from problem description, apply the simplex method for solving linear programming problems.
- Fourier series analysis and its uses in representing the power signals.
REFERENCES:


ET5101  ADVANCED DIGITAL PRINCIPLES AND DESIGN  LT P C
3 2 0 4

COURSE OBJECTIVES:

- To expose the students to the fundamentals of sequential system design, Asynchronous circuits, switching errors.
- To teach the fundamentals of modeling through comparative study on the classification of commercial family of Programmable Device.
- To study on Fault identification in digital switching circuits.
- To introduce logics for design of Programmable Devices.
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.

UNIT I  SEQUENTIAL CIRCUIT DESIGN  12

UNIT II ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN  12
Analysis of Asynchronous Sequential Circuit (ASC) – Flow Table Reduction – Races in ASC – State Assignment Problem and the Transition Table – Design of ASC – Static and Dynamic Hazards – Essential Hazards – Designing Hazard free circuits.

UNIT III  FAULT DIAGNOSIS AND TESTABILITY ALGORITHMS  12

UNIT IV  ARCHITECTURES &DESIGN USING PROGRAMMABLE DEVICES  12
UNIT V HDL PROGRAMMING

Overview of digital design with VHDL, hierarchical modelling concepts, gate level modelling, data flow modelling, behavioural modelling, task & functions, logic synthesis-simulation-Design examples, Ripple carry Adders, Carry Look ahead adders, Multiplier, ALU, Shift Registers, Multiplexer, Comparator, Test Bench

Note: Class room discussions and tutorials can include the following guidelines for improved teaching/learning process: Discussions / Practice on Workbench : Logic Synthesis and Simulation for digital designs

TOTAL : 45+ 30=75 PERIODS

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

- Analyze and design sequential digital circuits
- Design and use programming tools for implementing digital circuits of industry standards
- Identify the requirements and specifications of the system required for a given application
- Learners can acquire knowledge about HDL programming.
- Improved Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in digital design for embedded systems.

REFERENCES:

ET5151 MICROCONTROLLER BASED SYSTEM DESIGN

COURSE OBJECTIVES
- To introduce the fundamentals of microcontroller based system design.
- To teach I/O and RTOS role on microcontroller.
- To know Microcontroller based system design, applications.
- To teach I/O interface in system Design
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills
UNIT I  8051 ARCHITECTURE

UNIT II  8051 PROGRAMMING

UNIT III  PIC MICROCONTROLLER

UNIT IV  PERIPHERAL OF PIC MICROCONTROLLER

UNIT V  SYSTEM DESIGN – CASE STUDY
Interfacing LCD Display – Keypad Interfacing - Generation of Gate signals for converters and Inverters - Motor Control – Controlling DC/ AC appliances – Measurement of frequency - Stand alone Data Acquisition System.

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process:

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

• 8-bit microcontrollers, learn assembly and C-programming of PIC.
• learn Interfacing of Microcontroller.
• Learners will study about PIC microcontroller and system design.
• The course would enable students to enrich their knowledge with hands on experiments and project based learning
• Effectively utilize microcontroller software development tools such as a compiler, make files, or compile scripts

REFERENCES:
COURSE OBJECTIVES
- To provide a clear understanding on the basic concepts, Building Blocks of Embedded System
- To teach the fundamentals of Embedded processor Modeling, Bus Communication in processors, Input/output interfacing
- To introduce on processor scheduling algorithms, Basics of Real time operating system
- To discuss on aspects required in developing a new embedded processor, different Phases & Modeling of embedded system
- 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
Introduction to Embedded Systems –Structural units in Embedded processor, selection of processor & memory devices- DMA, Memory management methods- memory mapping, cache replacement concept, Timer and Counting devices, Watchdog Timer, Real Time Clock

UNIT II EMBEDDED NETWORKING AND INTERRUPTS SERVICE MECHANISM

UNIT III RTOS BASED EMBEDDED SYSTEM DESIGN
Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication-shared memory, message passing-, Interprocess Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance-comparison of commercial RTOS features - RTOS Lite, Full RTOS, VxWorks, µC/OS-II, RT Linux,

UNIT IV SOFTWARE DEVELOPMENT TOOLS
Software Development environment-IDE, assembler, compiler, linker, simulator, debugger, Incircuit emulator, Target Hardware Debugging, need for Hardware-Software Partitioning and Co-Design.

UNIT V EMBEDDED SYSTEM APPLICATION DEVELOPMENT
Objectives, different Phases & Modeling of the Embedded product Development Life Cycle (EDLC), Case studies on Smart card- Adaptive Cruise control in a Car -Mobile Phone software for key inputs.

Note: Class Room Discussions and Tutorials can include the following Guidelines for improved Teaching /Learning Process: Practice through any of Case studies through Exercise/Discussions on Design , Development of embedded Products like : Smart card -Adaptive Cruise control in a Car -Mobile Phone -Automated Robonoid

TOTAL: 45 PERIODS
OUTCOMES: After the completion of this course the student will be able to:

- An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems
- Design real time embedded systems using the concepts of RTOS.
- Foster ability to understand the role of embedded systems in industry

REFERENCES

ET5191 SOFTWARE FOR EMBEDDED SYSTEMS L T P C 3 0 0 3

COURSE OBJECTIVES
- To expose the students to the fundamentals of embedded Programming.
- To Introduce the GNU C Programming Tool Chain in Linux.
- To study basic concepts of embedded C, Embedded OS&Python Programming
- To introduce time driven architecture, Serial Interface with a case study.
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

UNIT I EMBEDDED PROGRAMMING

UNIT II 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 - Memory Leak Detection with valgrind - Introduction to GNU C Library
UNIT III  EMBEDDED C

UNIT IV  EMBEDDED OS
Creating embedded operating system: Basis of a simple embedded OS, Introduction to sEOS, Using Timer 0 and Timer 1, Portability issue, Alternative system architecture, Important design considerations when using sEOS- Memory requirements - embedding serial communication & scheduling data transmission - Case study: Intruder alarm system.

UNIT V  PYTHON PROGRAMMING

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process:
Discussions/Practice on Workbench : Program Development and practice in exercises with C, C++ Linux and Python Programming Environments.

TOTAL : 45 PERIODS

OUTCOMES : After the completion of this course the student will be able to:
• Ability to use GNU C to develop embedded software.
• knowledge and understanding of fundamental embedded systems design paradigms, architectures, possibilities and challenges, both with respect to software and hardware
• Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

REFERENCES
<table>
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<tr>
<th>Sl.No</th>
<th>Experiment Detail</th>
<th>Equipment/ Supports Required</th>
<th>Training outcomes</th>
<th>Related programme outcomes</th>
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<tbody>
<tr>
<td>1.</td>
<td>Programming in Higher Level Languages/ Platforms</td>
<td>C/C++/Java/Embedded C/Embedded Java/ Compilers&amp;Platforms</td>
<td>The students will learn design with simulators/programming environments</td>
<td>a,b,c,d</td>
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<tr>
<td>2.</td>
<td>Programming with 8 bit Microcontrollers: ✓ Assembly programming Study on incircuit Emulators, crosscompilers, debuggers</td>
<td>8051 Microcontrollers with peripherals; ;IDE, Board Support Software Tools /C Compiler/others</td>
<td>The students will learn design with simulators/experiments,in programming processor boards, processor interfacing/designing digital controllers</td>
<td>2,3,4,a,c,d</td>
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<tr>
<td>3.</td>
<td>I/O Programming with 8 bit Microcontrollers I/O Interfacing: Timers/ Interrupts/ Serial port programming/PWM Generation/ Motor Control/ADC/DAC / LCD/ RTC Interfacing/ Sensor Interfacing</td>
<td>8051 Microcontrollers with peripherals;Board Support Software Tools, peripherals with interface</td>
<td></td>
<td>a,f</td>
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<tr>
<td>4.</td>
<td>Programming with AVR/ PIC Microcontrollers: ✓ Assembly ✓ C programming ✓ programming ✓ Interfacing peripherals Study on incircuit Emulators, crosscompilers,</td>
<td>AVR/ PIC Microcontrollers with peripherals; ;IDE, Board Support Software Tools /C Compiler/others</td>
<td>The students will learn design with simulators/experiments,in</td>
<td>a,b,c,d</td>
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<tr>
<td></td>
<td>debuggers</td>
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<tr>
<td>5.</td>
<td>I/O Programming with AVR/ PIC Microcontrollers I/O Interfacing : Timers/ Interrupts/ Serial port programming/PWM Generation/ Motor Control/ADC/DAC / LCD/ RTC Interfacing/ Sensor Interfacing</td>
<td>AVR/ PIC Microcontrollers with peripherals; Board Support Software Tools, peripherals with interface</td>
<td>programming processor boards, processor interfacing/ designing digital controllers</td>
<td>2,3,4,a,c,d</td>
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<tr>
<td>6.</td>
<td>Programming with Arduino Microcontroller Board : Study on incircuit Emulators, crosscompilers, debuggers</td>
<td>Arduino Boards with peripherals ; IDE, Board Support Software Tools / Compiler/others</td>
<td></td>
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<tr>
<td>7.</td>
<td>VHDL Programming in FPGA processors</td>
<td>Processor Boards with Board Support Tools &amp; Interfaces</td>
<td>The students will learn design, modeling &amp; simulation of Combinational, Sequential, Synchronous, Asynchronous circuits with simulators/experiments, in programming processor boards, processor interfacing/designing reprogrammable system</td>
<td>a,f</td>
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<tr>
<td>8.</td>
<td>Verilog HDL Programming in FPGA processors</td>
<td>Processor Boards with Board Support Tools &amp; Interfaces</td>
<td>The students will learn design, modeling &amp; simulation of Combinational, Sequential, Synchronous, Asynchronous circuits with simulators/experiments, in programming processor boards, processor interfacing/designing reprogrammable system</td>
<td>a,f</td>
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<tr>
<td>9.</td>
<td>Programming &amp; Simulation in Simulators /Tools/others</td>
<td>Simulation Tools as Proteus/ ORCAD</td>
<td>The students will learn design with experiments, in programming suites/ simulators/ Tool</td>
<td>a,b,c,d</td>
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<td>10.</td>
<td>Programming &amp; Simulation Tools as Matlab</td>
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</table>
Simulation in Simulators /Tools/others

TOTAL : 60 PERIODS

Note: Laboratory training, discussions can include the given guidelines for improved teaching /learning process: Hands on experiences can be with Case specific experiments in domains on range of processors, programmes, simulators, circuits that support theory subjects.

REFERENCE:

ET5251 REAL TIME OPERATING SYSTEMS LT P C 3 0 0 3

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

UNIT II  OVERVIEW OF RTOS
RTOS Task and Task state – Multithreaded Preemptive scheduler- Process Synchronisation-
Message queues– Mail boxes -pipes – Critical section – Semaphores – Classical synchronisation
problem – Deadlocks

UNIT III  REAL TIME 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  REAL TIME KERNEL
Principles – Design issues – RTOS Porting to a Target – Comparison and Basic study of various
RTOS like – VX works – Linux supportive RTOS – C Executive.

UNIT V  INTRODUCTION TO EMBEDDED OS
Discussions on Basics of Linux supportive RTOS – uCOS-C Executive for development of RTOS
Application – introduction to Android Environment - The Stack – Android User Interface – Preferences,
the File System, the Options Menu and Intents, with one Case study

Note: Class room discussions and tutorials can include the following guidelines for improved
teaching /learning process: Discussions/Practice on Workbench :on understanding the scheduling
techniques, timing circuitary, memory allotment scheme , overview of commercial Embedded OS.

TOTAL : 45 PERIODS

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

- Real-time scheduling and schedulability analysis, including clock-driven and priority-driven
  scheduling
- Theoretical background (specification/verification) and practical knowledge of real-time
  operating systems.
- After completing the course students will appreciate the use of multitasking techniques in real-
  time systems, understand the fundamental concepts of real-time operating systems
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on
  recent trends in embedded systems design.

REFERENCES:
   Hill,2006.
COURSE OBJECTIVES
- To expose the fundamentals of wireless sensor technology, classification
- To teach the infrastructure of WSN processor and its functions in networking
- To study on challenges in on interconnectivity of networks & Network communication
- To discuss on commercial wireless technology
- To involve Discussions/ Practice/ Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

UNIT I  WIRELESS SENSOR DEVICES & NETWORKING  12
Challenges for Wireless Sensor Networks- Characteristic requirements for WSN , WSN vs Adhoc Networks - introduction to Sensor node networking with any Commercially available sensor nodes – Physical layer and transceiver design considerations in WSNs, - Applications of sensor networks

UNIT II  BUILDING PERVERSE SENSOR NETWORK  12

UNIT III. WIRELESS TECHNOLOGY  6

UNIT IV  OVERVIEW OF SENSOR NETWORK PROTOCOLS  9
Introduction to fundamentals of Wireless sensor network MAC Protocols - Low duty cycle protocols and wakeup concepts - Contention-based protocols - Schedule-based protocols - IEEE 802.15.4 MAC protocol- Energy usage profile, Choice of modulation scheme-basic principle for data transfer and energy management for SMAC , Leach & Zigbee communication

UNIT V  WIRELESS NETWORKING OF DEVICES  6
Classification of Wireless Networking of Devices, introduction to RF WPAN 802.15.1 & Blutooth - protocol stack, frame, link manager layer – Bluetooth piconet– application.

Note: Class room discussions and tutorials can include the following guidelines for improved teaching / learning process: Discussions/ Exercise/ Practice on Workbench: on the basics of Zigbee protocols, sensor motes, role of special microcontrollers for Zigbee communication etc

TOTAL : 45 PERIODS

OUTCOMES: After the completion of this course the student will be able to:
- Relate to current trends in pervasive computing and develop a sense of their practicality
- Identify distinguishing features of the different mobile device categories, namely, Pocket PCs, Personal Digital Assistants (PDAs), and wireless phones.
• Recognize the difference between writing code for workstations and servers on one hand and for resource-constrained devices on the other hand.
• The learning process delivers insight onto building of sensor networks, communication in zigbee network and sensor networks protocols are studied.
• Design and develop a pervasive computing device for a specific need.
• Develop a framework for pervasive computing.

REFERENCES
9. Mullet, "Introduction to wireless telecommunications systems and networks", cengage learning, 2010
UNIT IV MEMORY PROTECTION AND MANAGEMENT
Protected Regions-Initializing MPU, Cache and Write Buffer-MPU to MMU-Virtual Memory-Page Tables-TLB-Domain and Memory Access Permission-Fast Context Switch Extension.

UNIT V DESIGN WITH ARM MICROCONTROLLERS

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: Discussions/Exercise/Practice on Workbench : on Programming practices on the KEIL Work Bench for Simple ASM/C / Input & output interfacing programs with ARM 7/ARM 9/Nuvoton Processors

TOTAL : 60 PERIODS

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

• Describe the programmer’s model of ARM processor and create and test assembly level programming.
• Analyze various types of coprocessors and design suitable co-processor interface to ARM processor.
• Identify the architectural support of ARM for operating system and analyze the function of memory Management unit of ARM.
• Students will develop more understanding on the concepts ARM Architecture, programming and application development.
• The learning process delivers insight into various embedded processors of RISC architecture / computational processors with improved design strategies.

REFERENCES
1. Steve Furber, ‘ARM system on chip architecture’, Addison Wesley
2. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield ‘ARM System
7. Trevor Martin, ‘The Insider’s Guide To The Philips ARM7-Based Microcontrollers,
8. An Engineer’s Introduction To The LPC2100 Series’ Hitex (UK) Ltd.,

ET5203 INTERNET OF THINGS 3 0 0 3

COURSE OBJECTIVES
• To Study about Internet of Things technologies and its role in real time applications
• To familiarize the accessories and communication techniques for IOT.
• To familiarize the different platforms and Attributes for IOT

UNIT I INTRODUCTION TO INTERNET OF THINGS
Overview, Technology drivers , Business drivers,Typical IoT applications , Trends and implications
UNIT II  IOT ARCHITECTURE:  

UNIT III PROTOCOLS AND WIRELESS TECHNOLOGY FOR IOT  
Protocols : NFC, RFID, Zigbee MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIe Wired vs. Wireless communication,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.

UNIT IV DATA ANALYTICS FOR IOT  
Services/Attributes: Big-Data Analytics and Visualization,Dependability,Security,Maintainability.

Data analytics for IoT: A framework for data-driven decision making , Descriptive, Predictive and Prescriptive Analytics , Business Intelligence and Artificial Intelligence Importance of impact and open innovation in data-driven decision making.

UNIT V CASE STUDIES  
Home Automation, smart cities, Smart Grid, Electric vehicle charging, Environment, Agriculture, Productivity Applications

TOTAL : 45 PERIODS

OUTCOMES
- Students will develop more understanding on the concepts of IOT and its present developments.
- Students will study about different IOT technologies.
- Students will acquire knowledge about different platforms and Infrastructure for IOT
- Students will learn the art of implementing IOT for smart applications and control

Note: Class Room Discussions and Tutorials can include the following Guidelines for improved Teaching/Learning Process: Practice through any of Case studies through Exercise/Discussions on Design, Development of embedded solutions using wireless communication by processor support

REFERENCES:

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Experiment Detail</th>
<th>Equipment/ Supports Required</th>
<th>Training outcomes</th>
<th>Related programme outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Programming ARM processor : ARM7 / ARM9/ARM Cortex</td>
<td>Microcontrollers with peripherals; IDE, Board Support Software Tools /Keil/uCOS Compiler/ others</td>
<td></td>
<td>a,b,c,d</td>
</tr>
<tr>
<td></td>
<td>Study on incircuit Emulators, crosscompilers, debuggers</td>
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<tr>
<td>2.</td>
<td>I/O Programming with ARM processor : ARM7 / ARM9/ARM Cortex</td>
<td>ARM processor : ARM7 / ARM9/ARM Cortex Microcontrollers with peripherals;Board Support Software Tools, peripherals with interface</td>
<td></td>
<td>2,3,4,a,c,d</td>
</tr>
<tr>
<td></td>
<td>I/O Interfacing : Timers/ Interrupts/ Serial port programming/PWM Generation/ Motor Control/ADC/DAC/ LCD/ RTC Interfacing/ Sensor Interfacing</td>
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<tr>
<td>3.</td>
<td>Programming with Raspberry Pi Microcontroller Board :</td>
<td>Raspberry Pi Boards with peripherals ;IDE, Board Support Software Tools /Compiler/others</td>
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<td>a,f</td>
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<tr>
<td></td>
<td>Study on incircuit Emulators, crosscompilers, debuggers</td>
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<tr>
<td>2.</td>
<td>Programming with DSP</td>
<td>Processor Boards with Board</td>
<td>The students</td>
<td>a,b,c,d</td>
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ET 5211 EMBEDDED SYSTEM LAB II

LT P C
0 0 4 2
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<tbody>
<tr>
<td>processors</td>
<td>Support Tools &amp; Interfaces</td>
<td>will learn design &amp; simulation of Arithmetic, Logic programs, Filters, Signal analysis with simulators/experiments, in programming processor boards, processor interfacing/Tools</td>
</tr>
<tr>
<td>5.</td>
<td>Programming in Freeware softwares/Platforms</td>
<td>Programming Compilers &amp; Platforms on freeware</td>
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<tr>
<td></td>
<td>The students will learn programming, compiling in various tools &amp; software domains</td>
<td></td>
</tr>
<tr>
<td>✓ Study on MEMS Tools</td>
<td></td>
<td></td>
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<tr>
<td>✓ Study on process Controller modeling</td>
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<td></td>
</tr>
<tr>
<td>✓ PLC/SCADA/PCB</td>
<td></td>
<td></td>
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<tr>
<td>✓ one type CAD Tool</td>
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<tr>
<td>7.</td>
<td>Programming &amp; Simulation in GUI Simulators /Tools/others</td>
<td>Simulation Tools as Labview /others</td>
</tr>
<tr>
<td>✓ Graphical User interface simulations &amp; modeling of instrumentation &amp; controllers</td>
<td></td>
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<tr>
<td>8.</td>
<td>Study of one type of Real Time Operating Systems (RTOS)</td>
<td>Compilers &amp; Platforms with VXWorks/ Keil/ Android/ Tiny OS/ Linux Support/any RTOS</td>
</tr>
<tr>
<td>10</td>
<td>Programming with wired/wireless communication protocol/Network Simulators</td>
<td>Learning Communication Protocols &amp; Support Software Tools for BUS &amp; network communication</td>
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<tr>
<td></td>
<td>Learning Communication Protocols &amp; Experimenting with Support Software Tools for communication interfaces</td>
<td></td>
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<tr>
<td>TOTAL: 60 PERIODS</td>
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</tbody>
</table>
Note: Laboratory training, discussions can include the given guidelines for improved teaching/learning process: Hands on experiences with Case specific experiments in domains on range of work Benches, programmable Test suites, simulators, circuit boards that support the practical skill training supportive to theory subjects.

REFERENCES:

ET5311 PROJECT WORK PHASE I

Pre-requisites: choice of project title for project can also be done as per broad domain of research topic listed.

<table>
<thead>
<tr>
<th>domains</th>
<th>Course objectives : to expose to many of the following by choice for learning</th>
<th>Training outcomes</th>
<th>Related programme outcomes</th>
</tr>
</thead>
</table>
| 1.0     | ✓ Programming in C / Embedded C / C++ / JAVA  
✓ Network Simulators  
✓ Network programming  
✓ Python programming  
✓ Programming on Pervasive Computing  
✓ Java for Wireless Devices | Skill development in software programming/working in simulators, emulators, learn using the commercial packages for wired, wireless communications | a,b,c,d |
| 2.0     | Embedded Processors  
✓ uC, ARM processors  
✓ DSP / Image / Video Processors  
✓ VHDL Programming in processors | The students will learn design with simulators/experiments, in programming processor boards, processor interfacing/designing reprogrammable system | 2,3,4,a,c,d |
| 3.0     | ✓ Android / LINUX OS Internals/VxWorks/Keil  
✓ MPLAB/Os/any RTOS tool suite | The students will skill through OS programming through API, libraries | a,f |
### Guidelines onto Topics:

1. **Network Simulators**
   - Design and Implement many processor based network deployment
   - involve IOT or sensor network with use of monitoring tool to record sensor values, establish communication, get network statistics like packets sent and received, percentage errors, desktop grabbing, remote monitoring etc.

2. **Embedded Processors**
   - Implement an IO peripheral interface ARM/ PIC / MSP 430 /Arduino/RPi/ other advanced embedded Processor through Study of CAN / I2C / Ethernet/any serial bus communication /any other communication protocol for IO interface

3. **Virtual Instrumentation programming**
   - to design smart metering Design and Implement though GUI suite /tool to record Sensor data recording with signal analysis to discuss on system performance and implement controller scheme.

4. **Study on process Controller modelling**
   - with math lab suite with modeling, analysis for Embedded control of systems/vehicle modeling/communication of systems

5. **VHDL Programming on Programmable Logic Devices**
   - Design and Implementation with using Xilinx/Altera FPGA / CPLD on Design, verification of simple Combinational/Sequential Circuits

6. **Study on CAD Tool**
   - device modeling, codesign, verification, analysis on Tools.

7. **DSP / Image / Video Processing**
   - Simulation / Implementation of any few of its algorithms

8. **Network simulation**
   - using NS2/ Programming of TCP/IP protocol stack / any network simulator tools - Network Deployment / Design and Implement a GUI or text based network monitoring tool to record network statistics like packets sent and received, percentage errors, security concepts

9. **Programming in C/ Embedded C / Python/C++ / JAVA/others**
   - Embedded Application development

10. **Android / LINUX OS Internals/VxWorks/Keil**
    - Study on programming of the OS through one API for Driver interfaces, Disk driver and Terminal drivers

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A table is provided for the guidelines:

<table>
<thead>
<tr>
<th>4.0</th>
<th><strong>Guidelines</strong></th>
<th><strong>Notes</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Virtual Instrumentation programming✓ Simulink/Matlab Tools✓ Study on MEMS Tools✓ Study on process Controller modeling✓ PLC/SCADA/PCB/ORCAD✓ one CAD Tool</td>
<td>The students will apply programming logic for modeling/simulating for embedded application/products &amp; service development</td>
<td>a,f</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5.0</th>
<th><strong>Guidelines</strong></th>
<th><strong>Notes</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Entrepreneurship development</td>
<td>The students will know to pickup skills for product development/establish consultancy services with an outlook into selecting commercially viable market for technical demands</td>
<td>d,e,f,g,h,</td>
</tr>
</tbody>
</table>

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Guidelines onto Topics:

1. Network Simulators-Design and Implement many processor based network deployment /involve IOT or sensor network with use of monitoring tool to record sensor values, establish communication, get network statistics like packets sent and received, percentage errors, desktop grabbing, remote monitoring etc.

2. Embedded Processors- Implement an IO peripheral interface ARM/ PIC / MSP 430 /Arduino/RPi/ other advanced embedded Processor through Study of CAN / I2C / Ethernet/any serial bus communication /any other communication protocol for IO interface

3. Virtual Instrumentation programming to design smart metering Design and Implement though GUI suite /tool to record Sensor data recording with signal analysis to discuss on system performance and implement controller scheme.

4. Study on process Controller modelling - with math lab suite with modeling, analysis for Embedded control of systems/vehicle modeling/communication of systems

5. VHDL Programming on Programmable Logic Devices - Design and Implementation with using Xilinx/Altera FPGA / CPLD on Design, verification of simple Combinational/Sequential Circuits

6. Study on CAD Tool- device modeling, codesign, verification, analysis on Tools.

7. DSP / Image / Video Processing - Simulation / Implementation of any few of its algorithms

8. Network simulation- using NS2/ Programming of TCP/IP protocol stack / any network simulator tools - Network Deployment / Design and Implement a GUI or text based network monitoring tool to record network statistics like packets sent and received, percentage errors, security concepts.

9. Programming in C/ Embedded C / Python/C++ / JAVA/others - Embedded Application development

10. Android / LINUX OS Internals/VxWorks/Keil - Study on programming of the OS through one API for Driver interfaces, Disk driver and Terminal drivers
11. Programming on Pervasive Computing on mobile device application Platform through any one Operating System /Palm OS / Windows CE/ Embedded Linux -J2ME / Symbian /Android/others

12. Java for Wireless Devices to Set up the development environment with Basic Data types, Libraries ,Wireless Messaging,Architecture for messaging application,Messaging API, Making a device connection using HTTP

13. Study on MEMS –device,structural modeling & analysis using CAD lab SUITE

14. PLC/SCADA/PCB study-develop one Case Study as Application with suitable platform.


ET5091 MEMS TECHNOLOGY L T P C

3 0 0 3

COURSE OBJECTIVES

- To teach the students properties of materials ,microstructure and fabrication methods.
- To teach the design and modeling of Electrostatic sensors and actuators.
- To teach the characterizing thermal sensors and actuators through design and modeling
- To teach the fundamentals of piezoelectric sensors and actuators through exposure to different MEMS and NEMS devices
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

UNIT I MICRO-FABRICATION, MATERIALS AND ELECTRO-MECHANICAL CONCEPTS 9
Overview of micro fabrication – Silicon and other material based fabrication processes – Concepts: Conductivity of semiconductors-Crystal planes and orientation-stress and strain-flexural beam bending analysis-torsional deflections-Intrinsic stress- resonant frequency and quality factor.

UNIT II ELECTROSTATIC SENSORS AND ACTUATION 9
Principle, material, design and fabrication of parallel plate capacitors as electrostatic sensors and actuators-Applications

UNIT III THERMAL SENSING AND ACTUATION 9
Principle, material, design and fabrication of thermal couples, thermal bimorph sensors, thermal resistor sensors-Applications

UNIT IV PIEZOELECTRIC SENSING AND ACTUATION 9
Piezoelectric effect-cantilever piezoelectric actuator model—properties of piezoelectric materials—Applications.

UNIT V CASE STUDIES
Piezoresistive sensors, Magnetic actuation, Micro fluidics applications, Medical applications, Optical MEMS.-NEMS Devices

Note: Class room discussions and tutorials can include the following guidelines for improved teaching/learning process: Discussions/Exercise/Practice on Workbench: on the basics/device model design aspects of thermal/peizo/resistive sensors etc.

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

- Understand basics of microfabrication, develop models and simulate electrostatic and electromagnetic sensors and actuators
- Understand material properties important for MEMS system performance, analyze dynamics of resonant micromechanical structures
- The learning process delivers insight onto design of micro sensors, embedded sensors & actuators in power aware systems like grid.
- Understand the design process and validation for MEMS devices and systems, and learn the state of the art in optical microsystems
- Improved Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded systems design.

REFERENCES

ET5001 ADVANCED COMPUTER ARCHITECTURE AND LT P C PARALLEL PROCESSING 3 0 0 3

COURSE OBJECTIVES
- To educate the students to the fundamentals of parallel processing
- To teach the fundamentals of network topologies for multiprocessors
- To introduce different pipeline designs
- To introduce features of parallel processors, memory technologies, OS for multiprogrammed computer
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

UNIT I THEORY OF PARALLELISM
Parallel Computer models – the state of computing-introduction to parallel processing-parallelism in uniprocessors & Multiprocessors, -parallel architectural classification schemes-speedup performance laws- Program and Network Properties-H/W-S/W Parallelism
UNIT II  SYSTEM INTERCONNECT ARCHITECTURES
System interconnect Architectures-Network Properties and routing-Static Interconnection Networks-Dynamic Interconnection Networks-Multiprocessor System Interconnects-interprocessor communication network-Structure of Parallel Computers; Hierarchical bus systems-Crossbar switch and multiport memory-multistage and combining network

UNIT III  PIPELINING AND SUPERSCALAR TECHNOLOGIES
Pipeline principle and implementation-classification of pipeline processor-introduction of arithmetic,instruction,processor pipelining-pipeline mechanisms-hazards

UNIT IV  HARDWARE TECHNOLOGIES
Introduction to features of advanced embedded processors through Basic Comparative study : of Architectures -addressing modes -instruction types-performance of- Parallel and scalable architectures, Multiprocessor and SIMD ,MIMD computers, RISC,CISC,Superscalar, VLIW , Vector, Systolic processors of their unique features -Scalable, Multithreaded and data flow Architectures-inter PE communication-interconnection networks- Array & vector processors, vector instruction types-performance modeling-design of vectorising compiler- case Architecture of Itanium processor, Pentium Processor, SPARC Processor.

UNIT V OS ISSUES FOR MULTI PROCESSOR
Introduction-Need for Preemptive OS – Synchronising and Scheduling in Multiprocessor OS- Usual Os scheduling Techniques, threads – Classification of multi processor OS – Software requirements of multiprocessor OS, Distributed scheduler – PVM – PT Threads in shared memory systems

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: :Discussions/Practice on Workbench : modelling of Computing Algorithms /ALU Functional Blocks

TOTAL : 45 PERIODS

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

- An ability to understand the operations of multiprocessor and multicomputer systems.
- To understand the various advanced processor technology, pipelining and scalable architectures.
- To know the working of superscalar pipeline, cache memory organization.
- To understand the principles of multithreading, multithread architecture, static and dynamic data flow.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

REFERENCES:
2. Advanced Computer architecture, By Rajiv Chopra, S Chand , 2010
IN5092 DIGITAL INSTRUMENTATION

UNIT I DATA ACQUISITION SYSTEMS
Overview of A/D converter, types and characteristics – Sampling, Errors. Objective – Building blocks of Automation systems -Calibration, Resolution, Data acquisition interface requirements.–Counters – Modes of operation- Frequency, Period, Time interval measurements, Prescaler, Heterodyne converter for frequency measurement, Single and Multi channel Data Acquisition systems-Digital storage Oscilloscope-digital display interface.

UNIT II INSTRUMENT COMMUNICATION
Introduction, Modem standards, Data transmission systems- Time Division Multiplexing (TDM) – Digital Modulation Basic requirements of Instrument Bus Communications standards, interrupt and data handshaking , serial bus- basics, Message transfer, - RS-232, USB, RS-422, Ethernet Bus- CAN standards interfaces .General considerations -advantages and disadvantages-Instrumentation network design ,advantages and limitations ,general considerations, architecture, model, and system configuration of : HART network, Mod Bus, Fieldbus

UNIT III VIRTUAL INSTRUMENTATION BASICS
Block diagram ,role,and Architecture for VI— tool bar,Graphical system design &programming usingGUI – Virtual Instrumentation for test, control design-modular programming-conceptual and prog approaches for creation of panels,icons-Loops-Arrays-clusters-plotting data-structures-strings and File I/O- Instrument Drivers

UNIT IV CONFIGURING PROGRAMMABLE INSTRUMENTATION
Microprocessor based system design –Peripheral Interfaces systems and instrument communication standards –Data acquisition with processor and with VI – Virtual Instrumentation Software and hardware simulation of I/O communication blocks-peripheral interface – ADC/DAC – Digital I/O – Counter , Timer-servo motor control-PID control.

UNIT V CASE STUDIES
Processor based DAS, Data loggers, VI based process measurements like temperature, pressure and level development system- DSO interface -digital controller for colour video display.
Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: Discussions/Exercise/Practice on Workbench for Digital Control of Relays/Solenoids, Digital I/O – Counter, Timer-servo motor control-PID control. / LCD graphics Interface/storage interface,

TOTAL : 45 PERIODS

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

- Use digital integrated circuit logic family chips.
- Perform computational and measurement activities using digital techniques, build sequential and combinational logic circuits.
- Analyse working of A/D and D/A converters, use display devices for digital circuits, use digital meters for measurements.
- Graduates will understand the fundamental principles of electrical and electronics circuits and instrumentation, enabling them to understand current technology and to adapt to new devices and technologies.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

REFERENCES:


ET5002 EMBEDDED LINUX

COURSE OBJECTIVES

- To expose the students to the fundamentals of Linux Operating system, its basic commands and shell programming
- To teach the history of embedded Linux, various distributions and basics of GNU Cross Platform Tool Chain.
- To study on different Host-Target setup, debug and various memory device, file systems and performance tuning.
- To introduce the concept of configuring kernel using the cross-platform tool chain.
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

UNIT I FUNDAMENTALS OF LINUX

Basic Linux System Concepts: Working with Files and Directories - Introduction to Linux File system - Working with Partitions and File systems - Understanding Linux Permissions; Using Command Line Tools: Executing Commands from the Command Line - Getting to a Shell - Popular Command-Line Commands - Working with the Bash Shell
UNIT II  VARIOUS DISTRIBUTIONS AND CROSS PLATFORM TOOL CHAIN

UNIT III  HOST-TARGET SETUP AND OVERALL ARCHITECTURE
Real Life Embedded Linux Systems - Design and Implementation Methodology - Types of Host/Target Development Setups - Types of Host/Target Debug Setups - Generic Architecture of an Embedded Linux System - System Startup - Types of Boot Configurations - System Memory Layout - Processor Architectures - Buses and Interfaces - I/O – Storage

UNIT IV  KERNEL CONFIGURATION

UNIT V  LINUX DRIVERS
Introduction in to basics on Linux drivers, introduction to GNU cross platform Toolchain- Case study on programming one serial driver for developing application using Linux Driver

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: Discussions/Practice on Workbench : on design of Algorithms for Practicing Shell Programming in Linux / Developing programs in GCC and Eclipse / Learning Debugging and Profiling/Linux Driver interface

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

- To use Linux desktop and GNU tool chain with Eclipse IDE
- Cross compile Linux kernel and port it to target board.
- Add applications and write customized application for the Linux kernel in the target board.
- Students will study about distributions and cross platform tool chain.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

REFERENCES:
COURSE OBJECTIVES

- To expose the students to the fundamentals of digital signal processing in frequency domain and its application
- To teach the fundamentals of digital signal processing in time-frequency domain and its application
- To compare Architectures & features of Programmable DSP processors & develop logical functions of DSP processors
- To discuss on Application development with commercial family of DSP processors
- To involve Discussions/ Practice/ Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

UNIT I FUNDAMENTALS OF DSP 12

UNIT II TRANSFORMS AND PROPERTIES 9

UNIT III ADAPTIVE FILTERS 9

UNIT IV ARCHITECTURE OF COMMERCIAL DIGITAL SIGNAL PROCESSORS 9
Introduction to commercial digital signal processors, Categorization of DSP processor – Fixed point and floating point, Architecture and instruction set of the TI TMS 320 C54xx and TMS 320 C6xxx DSP processors, On-chip and On-board peripherals – memory (Cache, Flash, SDRAM), codec, multichannel buffered I/O serial ports (McBSPs), interrupts, direct memory access (DMA), timers and general purpose I/Os.

UNIT V INTERFACING I/O PERIPHERALS FOR DSP BASED APPLICATIONS 6

TOTAL: 45 PERIODS

Note: Discussions / Exercise / practice on signal analysis, transforms, filter design concepts with simulation tools such as Matlab / Labview / CC studio will help the student understand signal processing concepts and DSP processors.
Overview of TMS320C54xx and TMS320C67xx /other DSP Starter Kits, Introduction to code composer studio (CCS), Board support library, Chip support library and Runtime support library, Generating basic signals, Digital filter design, Spectrum analysis, Adaptive filters, Speech and Audio processing applications.

OUTCOMES: After the completion of this course the student will be able to:
Students will learn the essential advanced topics in DSP that are necessary for successful Postgraduate level research.

Students will have the ability to solve various types of practical problems in DSP

Comprehend the DFTs and FFTs, design and Analyze the digital filters, comprehend the Finite word length effects in Fixed point DSP Systems.

The conceptual aspects of Signal processing Transforms are introduced.

The comparison on commercial available DSPprocessors helps to understand system design through processor interface.

Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

REFERENCES:

ET5003 PYTHON PROGRAMMING LT P C 3 0 0 3

COURSE OBJECTIVES:
- Students will learn the grammar of Python programming language.
- Students will understand and be able to use the basic programming principles such as data types, variable, conditionals, loops, recursion and function calls.
- Students will learn how to use basic data structures such as List, Dictionary and be able to manipulate text files and images.
- Students will understand the process and will acquire skills necessary to effectively attempt a programming problem and implement it with a specific programming language - Python.
- 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 PYTHON

UNIT II      PROGRAM ORGANIZATION AND FUNCTIONS
Organize Large programs into functions – Python functions including scoping rules and documentation strings – Modules and Libraries – Organize programs into modules – System administration, Text processing, Subprocesses, Binary data handling, XML parsing and Database Access – Installing third-party libraries.

UNIT III    CLASSES AND OBJECTS
Introduction to Object-oriented programming – Basic principles of Object-oriented programming in Python – Class definition, Inheritance, Composition, Operator overloading and Object creation – Python special modules – Python Object System – Object representation, Attribute binding, Memory management, and Special properties of classes including properties, slots and private attributes.

UNIT IV     TESTING, DEBUGGING, AND SOFTWARE DEVELOPMENT PRACTICE
Python Software development – Use of documentation string – Program testing using doctest and unittest modules – Effective use of assertions – Python debugger and profiler – Iterators and Generators to set up data processing pipelines – An effective technique for addressing common system programming problems (e.g. processing large datafiles, handling infinite data streams, etc.)

UNIT V      TEXT I/O HANDLING
Text generation, Template strings and Unicode-packages – Python Integration Primer – Network programming – Accessing C code – Survey on how Python interacts with other language programs.

TOTAL: 45 PERIODS

Note: Class Room Discussions and Tutorials can include the following Guidelines for improved Teaching /Learning Process: Practice through any of Case studies through Exercise/Discussions on Design , Development of embedded solutions with improved programming skill learnt through python that can be adopted while programming on other domains.

COURSE OUTCOMES:

- Students will be able to develop skill in system administration and network programming by learning Python.
- Students will also learn how to effectively use Python’s very powerful processing primitives, modeling etc.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

REFERENCES:
1. Mark Lutz, "Learning Python, Powerful OOPs, O’reilly, 2011
OBJECTIVE

- The course aims at providing the basic concepts of product design, product features and its architecture so that student can have a basic knowledge in the common features a product has and how to incorporate them suitably in product.

UNIT I  CONCEPTS OF PRODUCT DEVELOPMENT  

UNIT II  INTRODUCTION TO APPROACHES IN PRODUCT DEVELOPMENT

UNIT III  INDUSTRIAL DESIGN STRATEGIES

UNIT IV  ELECTRONIC PRODUCT DEVELOPMENT STAGES

UNIT V  EMBEDDED PRODUCTS DESIGN

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: Term Project/Presentation on specific product design can be given for Assessment

TOTAL: 45 PERIODS
OUTCOMES:
On completion of the course the student will be able to
- understand the integration of customer requirements in product design
- Apply structural approach to concept generation, creativity, selection and testing
- Understand various aspects of design such as industrial design, design of Consumer specific product, its Reverse Engineering manufacture, economic analysis and product architecture
- To involve Discussions/ Practice/ Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

REFERENCES

ET5005 AUTOMOTIVE EMBEDDED SYSTEM

COURSE OBJECTIVES
- To expose the students to the fundamentals and building of Electronic Engine Control systems.
- To teach on functional components and circuits for vehicles
- To discuss on programmable controllers for vehicles
- To teach logics of automation & commercial techniques for vehicle communication
- To involve Discussions/ Practice/ Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

UNIT I BASICS OF ELECTRONIC ENGINE CONTROL SYSTEMS
Motivation, concept for electronic engine controls and management-Standards; introduction to fuel economy- automobile sensors-volumetric, thermal, air-fuel ratio, solenoid, hall effect- exhaust gas oxygen sensors, Oxidizing catalytic efficiency, emission limits and vehicle performance; advantages of using Electronic engine controls – open and closed loop fuel control; Block diagram of Electronic ignition system and Architecture of a EMS with multi point fuel injection system, Direct injection; programmed ignition- actuators interface to the ECU; starter motors and circuits - sensors interface to the ECU; Actuators and their characteristics – exhaust gas recirculation.

UNIT II FUEL CELL FOR AUTOMOTIVE POWER
Fuel cell-Introduction-Proton exchange membrane FC (PEM), Solid oxide fuel cell (SOFC)-properties of fuel cells for vehicles-power system of an automobile with fuel cell based drive, and their characteristics
UNIT III VEHICLE MANAGEMENT SYSTEMS


UNIT IV AUTOMOTIVE TELEMATICS

Role of Bluetooth, CAN, LIN and flex ray communication protocols in automotive applications; Multiplexed vehicle system architecture for signal and data / parameter exchange between EMS, ECUs with other vehicle system components and other control systems; Realizing bus interfaces for diagnostics, dashboard display, multimedia electronics- Introduction to Society of Automotive Engineers(SAE). J1850 message with(IFR) in frame response in protocol-Local Interconnect n/w [LIN], Bluetooth.

UNIT V ELECTRONIC DIAGNOSTICS FOR VEHICLES

System diagnostic standards and regulation requirements – On board diagnosis of vehicles electronic units & electric units-Speedometer, oil and temperature gauges, and audio system.

Note: Class room discussions and tutorials can include the following guidelines for improved teaching/learning process: Discussions//Practice on Workbench/Exercise/ AUTOSAR/ Vehicle simulators: on the basics of interfacing sensors, actuators to special automobile-microcontrollers, role of Instrumentation software packages / special automobile-microcontrollers for i/o port communication applicable to vehicles

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

- Design and develop automotive embedded systems.
- Analyze various embedded products used in automotive industry.
- Evaluate the opportunities involving technology, a product or a service required for developing a startup idea used for automotive applications.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

REFERENCES


TOTAL: 45 PERIODS
COURSE OBJECTIVES

- To introduce the Reconfigurable Processor technologies
- To familiarize the need and role of Reconfigurable Processor for embedded system applications.
- 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 Codesign-FPAA Architecture overview- recent trends in Reconfigurable Processor & SoC.

UNIT II    PROGRAMMABLE LOGIC DEVICES CPLD
Introduction to Programmable logic devices, SPLDs, CPLD building blocks- Architectures and features of Altera:MAX 7000, MAX V- Xilinx XC 9500, CoolRunner-II.

UNIT III    PROGRAMMABLE LOGIC DEVICES FPGA
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 Xilinx Virtex II pro ,Zynq-7000, Altera Excalibur, Cyclone V -Triscend A7, E5- Atmel 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.

Note: Class Room Discussions and Tutorials can include the following Guidelines for improved Teaching /Learning Process: Practice through any of Case studies through Exercise/Discussions on Design , Development of embedded solutions using reconfigurable processor support

TOTAL:45 PERIODS

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

- Adaptability, in its complete strength, is present in reconfigurable processors, which makes it an important IP in modern System-on-Chips (SoCs).
- Reconfigurable processors have risen to prominence as a dominant computing platform across embedded, general-purpose, and high-performance application domains during the last decade
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

REFERENCES


ET5092  DIGITAL IMAGE PROCESSING  L T P C
3 0 0 3

COURSE OBJECTIVES:
The objectives of this course to impart knowledge in
- the fundamentals of image processing
- the techniques involved in image enhancement
- the low and high-level features for image analysis
- the fundamentals and significance of image compression
- the hardware for image processing applications

UNIT I  FUNDAMENTALS OF IMAGE PROCESSING  9
Introduction to image processing systems, sampling and quantization, color fundamentals and models, image operations – arithmetic, geometric and morphological. Multi-resolution analysis – image pyramids

UNIT II  IMAGE ENHANCEMENT  9

UNIT III  IMAGE SEGMENTATION AND FEATURE ANALYSIS  9

UNIT IV  IMAGE COMPRESSION  9

UNIT V  EMBEDDED IMAGE PROCESSING  9
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

TOTAL: 45 PERIODS

NOTE: Discussions / Exercise / practice on Image enhancement, segmentation and compression with simulation tools such as Matlab/ Raspberry pi (python programming) will help the student understand image processing concepts and hardware implementation using relevant processors.
COURSE OUTCOMES:
At the end of the course students will comprehend

- Fundamentals of image processing and techniques involved in image enhancement, segmentation and compression and their real-time applications
- The implementation of image processing applications using software and hardware.

REFERENCES:

ET5007 EMBEDDED NETWORKING AND AUTOMATION OF ELECTRICAL SYSTEM

COURSE OBJECTIVES
- To expose the students to the fundamentals of wired embedded networking techniques.
- To expose the students to the fundamentals of wireless embedded networking
- To study on design of automation in instrumentation
- To introduce design of Programmable measurement & control of electrical Devices & grid
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

UNIT I EMBEDDED PROCESS COMMUNICATION WITH INSTRUMENT BUS

UNIT II WIRELESS EMBEDDED NETWORKING

UNIT III BUILDING SYSTEM AUTOMATION
Concept of Uc Based & PC based data acquisition – Concept of Virtual Instrumentation - Programming Environment to build a Virtual Instrumentation, Building system automation with graphical user interface programming-Programmable Logic Controllers-introduction-Ladder & Functional Block programming-Case study on Temperature control, Valve sequencing control
UNIT IV  MEASUREMENT AND EMBEDDED CONTROL OF ELECTRICAL APPARATUS  9

UNIT V  COMMUNICATION FOR LARGE ELECTRICAL SYSTEM AUTOMATION  9

NOTE
Discussions/Exercise/Practice on Workbench /simulators: on the basics interface of sensors, actuators to microcontrollers, role of virtual Instrumentation software packages/ simulators/ special microcontrollers for i/o port communication with electrical loads.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
• The learning process delivers insight into categorizing various i/p-o/p configurations of computational processors with improved communication strategies
• Improved Employability and enterprenership capacity due to knowledge upgradation on recent trends in embedded systems design .

REFERENCES:  
1. Control and automation of electrical power distribution systems, James Northcote-Green, Robert Wilson, CRC, Taylor and Francis, 2006  
6. Jan Axelson ‘Embedded Ethernet and Internet Complete’, Penram publications  

ET5008 SMART SYSTEM DESIGN  LT P C  3 0 0 3

COURSE OBJECTIVES
• To underline about the smart system technologies and its role in real time applications  
• To expose students to different open source platforms and Attributes.  
• To familiarize the design and development of embedded system based system design.

UNIT I INTRODUCTION  9
Overview of smart system design and requirements- Hardware and software selection & co-design-Communications-smart sensors and actuators-Open-source resources for embedded system- android
for embedded system - Embedded system for Ecommerce- Embedded system for Smart card design and development – Recent trends.

UNIT II MOBILE EMBEDDED SYSTEM
Design requirements-Hardware platform- OS and Software development platform- Mobile Apps development- Applications: heart beat monitoring, blood pressure monitoring, mobile banking and appliances control.

UNIT III HOME AUTOMATION:

UNIT IV SMART APPLIANCEs AND ENERGY MANAGEMENT

UNIT V EMBEDDED SYSTEMS AND ROBOTICS

TOTAL : 45 PERIODS

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process :Discussions on integration of H/W & S/W technology in automation of system/process.

OUTCOMES
• Students will develop more understanding on the concepts of smart system design and its present developments.
• Students will study about different embedded open source and cost effective techniques for developing solution for real time applications.
• Students will acquire knowledge on different platforms and Infrastructure for Smart system design.
• Students will learn the art of implementing embedded system for smart applications and control.

REFERENCES:
COURSE OBJECTIVES

- To develop an understanding on business promotion process.
- To expose students on the skills required for success in business.
- To impart embedded system technology based entrepreneurship.

UNIT I   BASICS FOR ENTREPRENEURSHIP  9
The entrepreneurial culture and structure -theories of entrepreneurship -entrepreneurial traits - types -behavioural patterns of entrepreneurs -entrepreneurial motivation -establishing entrepreneurial systems -idea processing, personnel, financial information and intelligence, rewards and motivation - concept bank -Role of industrial Fairs.

UNIT II   CHALLENGES FOR ENTREPRENEURSHIP  9
Setting quality standards- recruitment strategies- time schedules- Financial analysis - credit facilities- Marketing channel – advertisement- institutions providing technical, financial and marketing assistance- factory design -design requirements -applicability of the Factories Act.

UNIT III   RESPONSIBILITIES IN ENTREPRENEURSHIP  9
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 IV   SCOPE IN EMBEDDED SYSTEM FIELD  9
Entrepreneurship opportunities in Embedded system technologies - embedded systems design, modeling, Feasibility study on embedded system products- Entrepreneurial skills for embedded system hardware and software architecture, software and hardware co-design and challenges; problems of entrepreneurship in Embedded system field.

UNIT V   SCOPE THROUGH EMBEDDED PRODUCTS  9

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process :Discussions with Case studies on establishing entrepreneurial development through Government supported schemes for utilizing technology.

TOTAL : 45 PERIODS

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

- Manage people, processes, and resources within a diverse organization.
- Apply knowledge of leadership concepts in an integrated manner.
- Analyze the internal/external factors affecting a business/organization to evaluate business opportunities.
- demonstrate extemporaneous speaking skills developed through in-class discussion of text materials, case study analyses, and current entrepreneurship-related issues.
• demonstrate basic computer proficiency, including the use of word processing, presentation, and spreadsheet software packages, as well as a basic facility with the internet and other research tools.
• Key concepts underpinning entrepreneurship and its application in the recognition and exploitation of product/service/process opportunities
• Improved Employability and entrepreneurship capacity due to knowledge upgrade on recent trends in embedded systems design.

REFERENCES
5. Gupta and Smivasan, Entrepreneurial Development, New Delhi, Sultan Chand, 1992

ET5010 NANO ELECTRONICS

COURSE OBJECTIVES
• To introduce the properties of electron and its implication for electronics
• To teach the importance and the issues of Nanoscale CMOS technology.
• To introduce the characteristics and applications of nano electronic devices, nano fabrication methods and techniques.
• To teach the circuits and architectural features of nano memory devices.
• 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
Particles, waves, Wave mechanics, Schrodinger equation, free and confined electrons, particle statistics and density of states. Electron transport in semiconductors and nanostructures, Quantum dots, Quantum Well, Quantum wire, materials and its properties, Ballistic electron transport, 1D transport, Spin electronics- Electrical and Electronics Applications of Nanotechnology.

UNIT II NANOSCALE CMOS
Survey of modern electronics and trends towards nanoelectronics CMOS scaling, challenges and limits, static power, device variability, interconnect - CNT-FET, HEMT, pHEMT FinFET, FerroFET-nanoscale CMOS circuit design and analysis

UNIT III NANOELECTRONIC STRUCTURE AND DEVICES.

UNIT IV NANOELECTRONIC MEMORIES
Nano tube for memories- Nano RAM- Nanoscale DRAM, SRAM, Tunnel magnetoresistance-Giant magnetoresistance- design and applications.

UNIT V FABRICATION TECHNIQUES

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process :Discussions/Practice on Workbench : on modelling of nano/micro analog &digital devices.

TOTAL : 45 PERIODS

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

- Students will understand the divers electronic device fabrication.
- The students should be able to understand basic and advanced concepts of nanoelectronic devices, sensors and transducers and their applications in nanotechnology
- The concepts of a quantum well, quantum transport and tunnelling effects.
- Understand the impact of nanoelectronics onto information technology, communication and computer science.
- Design integrated circuits (micro chip) using state-of-the-art CMOS technology
- The learning process delivers insight into categorizing various nano configurations of computational processors with improved design strategies.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

REFERENCES:
2. Rainer Waser, “Nanoelectronics and Information Technology”, Wiley 2005
6. George W. Hanson, Fundamental of nanoelectronics, Pearson education.

ET5011 DISTRIBUTED EMBEDDED COMPUTING

COURSE OBJECTIVES

- To expose the students to the fundamentals of Network communication technologies and distributed computing.
- To teach the fundamentals of Internet
- To study on Java based Networking and distributed computing
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills
UNIT I DISTRIBUTED SYSTEM
Introduction- Communication in distribution system-Client/Server Model- Synchronization in distributed system

UNIT II EMBEDDED JAVA
Overview of JAVA – Programs- Multithreaded programming- APPLET programming- I/O streaming- RMI- Introduction to Embedded JAVA

UNIT III DISTRIBUTED COMPUTING
Definition- Model of distributed computation- Distributed shared memory- Authentication in distributed system

UNIT IV SECURITY IN COMPUTING
Security meaning- Threads in networks- Network security control- Firewall- Authentication- E-mail security- Security in web services- Case studies

UNIT V WEB BASED HOME AUTOMATION
Components of Distributed Embedded - Protocols & Standards - Hardware/Software selection for Distributed Embedded – case study : Web based Home Automation

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: Discussions/Practice on Workbench : Program Development and practice in exercises with XML/HTML/Java Programming Environments.

TOTAL : 45 PERIODS

OUTCOMES : After the completion of this course the student will be able to:
- Able to apply knowledge from undergraduate engineering and other disciplines to identify, formulate, solve novel advanced electronics engineering along with soft computing problems that require advanced knowledge within the field.
- Able to understand and integrate new knowledge within the field and advanced technical knowledge in multiple contexts.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

REFERENCES:
1. Andrew S. Tanenbaum, “Distributed operating systems”, Pearson 2013

PS5091 SMART GRID LT P C 3 0 0 3

OBJECTIVES:
- To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure.
- To familiarize the power quality management issues in Smart Grid.
- To familiarize the high performance computing 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, National and International Initiatives in Smart Grid.

UNIT II  SMART GRID TECHNOLOGIES
Technology Drivers, Smart 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).

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), Intelligent Electronic Devices (IED) & their application for monitoring & protection.

UNIT IV  POWER QUALITY MANAGEMENT IN SMART GRID

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

TOTAL : 45 PERIODS

OUTCOMES:
- Learners will develop more understanding on the concepts of Smart Grid and its present developments.
- Learners will study about different Smart Grid technologies.
- Learners will acquire knowledge about different smart meters and advanced metering infrastructure.
- Learners will have knowledge on power quality management in Smart Grids
- Learners will develop more understanding on LAN, WAN and Cloud Computing for Smart Grid applications.

REFERENCES
1  Stuart Borlase “Smart Grid :Infrastructure, Technology and Solutions”, CRC Press 2012.
OBJECTIVES:
- To understand the concept of electrical vehicles and its operations
- 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 9
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 9
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 CONTROL OF DC AND AC DRIVES 9
DC/DC chopper based four quadrant operations of DC drives – Inverter based V/f Operation (motoring and braking) of induction motor drive system – Induction motor and permanent motor based vector control operation – Switched reluctance motor (SRM) drives

UNIT IV BATTERY ENERGY STORAGE SYSTEM 9
Battery Basics, Different types, Battery Parameters, Battery modeling, Traction Batteries.

UNIT V ALTERNATIVE ENERGY STORAGE SYSTEMS 9
Fuel cell – Characteristics- Types – hydrogen Storage Systems and Fuel cell EV – Ultra capacitors

TOTAL : 45 PERIODS

OUTCOMES:
Learners will understand the operation of Electric vehicles and various energy storage technologies for electrical vehicles

REFERENCES

ET5012 SOFT COMPUTING AND OPTIMIZATION TECHNIQUES LT P C 3 0 0 3
COURSE OBJECTIVES:
The main objectives of this course is to make the students
- Understand the fundamental concepts of soft computing, artificial neural networks and optimization techniques
- Familiarize with recent advancements in Artificial neural networks and optimization techniques
UNIT I  INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS
Introduction to soft computing: soft computing vs. hard computing – various types of soft computing techniques, from conventional AI to computational intelligence, applications of soft computing.

UNIT II  ARTIFICIAL NEURAL NETWORKS

UNIT III  FUZZY LOGIC AND NEURO FUZZY SYSTEMS

UNIT IV  INTRODUCTION TO OPTIMIZATION TECHNIQUES

UNIT V  ADVANCED OPTIMIZATION TECHNIQUES

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: Discussions/Practice on Workbench: on role of Fuzzy, Neural, Genetic algorithms and Concepts in design of intelligent systems.

TOTAL: 45 PERIODS

OUTCOMES:  
At the end of the course students will
- Comprehend the fundamentals of artificial neural network, fuzzy systems and optimization techniques
- Understand the significance of various optimization algorithms applied to engineering problems.
- Be capable of developing ANN-based models
- Be capable of choosing appropriate optimization techniques for engineering applications.

REFERENCES:  
ET5013 WIRELESS AND MOBILE COMMUNICATION

COURSE OBJECTIVES
- To expose the students to the fundamentals of wireless communication technologies.
- To teach the fundamentals of wireless mobile network protocols
- To study on wireless network topologies
- To introduce network routing protocols
- To study the basis for classification of commercial family of wireless communication technologies

UNIT I INTRODUCTION

UNIT II MOBILE NETWORKS

UNIT III WIRELESS NETWORKS
Wireless LAN – IEEE 802.11 Standard-Architecture – Services – Hiper LAN, Bluetooth

UNIT IV ROUTING

UNIT V TRANSPORT AND APPLICATION LAYERS

TOTAL : 45 PERIODS

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process:
Discussions on wireless technology , its integration for multi system by networked communication.

OUTCOMES : After the completion of this course the student will be able to:
- Knowledge of basic and advanced theories on wireless communications systems in physical, link and network layer.
- Ability to understand, model, and design mobile networks.
- Ability to understand and apply mathematically model in wireless communications.
- Wireless communication transceiver algorithm design
- Mobile system design methodology, link level simulation for wireless communications.
- Fundamentals of mobile communication including various propagation path loss models under different operating conditions and their impact on received signal strength
- The learning process delivers insight into categorizing various embedded & communication protocols for networking of distributed static & mobile systems.
REFERENCES
2. C. Siva Ram Murthy and B.S. Manoj, AdHoc Wireless Networks: Architectures and protocols, Prentice Hall PTR, 2004

COURSE OBJECTIVES
- To expose the students to the fundamentals of data security.
- To teach the fundamentals of mathematical aspects in creating Encryption keys.
- To teach the fundamentals of Security in data& wireless communication.
- To teach the fundamentals of Secured system operation.
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.

UNIT I SYMMETRIC CIPHERS

UNIT II PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS

UNIT III NETWORK SECURITY PRACTICE

UNIT IV SYSTEM SECURITY

UNIT V WIRELESS SECURITY

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process : Discussions/Exercise/Practice on Workbench : on the basics /numerical design aspects of encryption,decryption keys/password creation etc

TOTAL : 45 PERIODS
OUTCOMES: After the completion of this course the student will be able to:

- Identify the major types of threats to information security and the associated attacks, understand how security policies, standards and practices are developed.
- Describe the major types of cryptographic algorithms and typical applications, write code to encrypt and decrypt information using some of the standard algorithms.
- To be exposed to original research in network security and master information security governance, and related legal and regulatory issues.
- The learning process delivers insight onto role of security aspects during data transfer and communication in systems like grid.
- Improved Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded systems design.

REFERENCES:

IN5079 ROBOTICS AND CONTROL L T P C

COURSE OBJECTIVES
- To introduce robot terminologies and robotic sensors
- To educate direct and inverse kinematic relations
- To educate on formulation of manipulator Jacobians and introduce path planning techniques
- To educate on robot dynamics
- To introduce robot control techniques

UNIT I INTRODUCTION AND TERMINOLOGIES
- Definition-Classification-History- Robots components-Degrees of freedom-Robot joints-coordinates-Reference frames-workspace-Robot languages-actuators-sensors-Position, velocity and acceleration sensors-Torque sensors-tactile and touch sensors-proximity and range sensors-vision system-social issues.

UNIT II KINEMATICS
- Mechanism-matrix representation-homogenous transformation-DH representation-Inverse kinematics solution and programming-degeneracy and dexterity

UNIT III DIFFERENTIAL MOTION AND PATH PLANNING
- Jacobian-differential motion of frames-interpretation-calculation of Jacobian-Inverse Jacobian- Robot Path planning
UNIT IV    DYNAMIC MODELLING
Lagrangian mechanics- Two-DOF manipulator- Lagrange-Euler formulation – Newton- Euler formulation – Inverse dynamics

UNIT V    ROBOT CONTROL SYSTEM
- Linear control schemes- joint actuators- decentralized PID control- computed torque control – force control- hybrid position force control- Impedance/ Torque control

TOTAL : 45 PERIODS

OUTCOMES:
• Ability to understand the components and basic terminology of Robotics
• Ability to model the motion of Robots and analyze the workspace and trajectory panning of robots
• Ability to develop application based Robots
• Ability to formulate models for the control of mobile robots in various industrial applications

REFERENCES