ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
REGULATIONS – 2015
CHOICE BASED CREDIT SYSTEM
M.E. EMBEDDED SYSTEM TECHNOLOGIES

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):
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 of societal importance.
3) To provide opportunity for students to work as part of teams on multi disciplinary projects.
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.

PROGRAMME OUTCOMES (POs):

a) To Offer the P.G Program in Embedded System Technology with imparting domain knowledge in Electrical circuits, electronic devices ; computer science 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 as 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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# M.E. Embedded System Technologies
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- **Syllabi:**
  - The syllabi includes courses that cover various aspects of embedded systems technology, including applied mathematics, design of embedded systems, advanced digital principles and design, microcontroller based systems, and electives.
  - Each course is allocated contact periods that consist of theory and practical components.

- **Contact Periods:**
  - Theory sections are typically of 4 periods, while practical sessions are usually of 3 periods.
  - Elective courses are also included, offering students the flexibility to tailor their learning according to their interests.

- **TOTAL Contact Periods:**
  - The total contact periods for each semester are calculated to ensure a well-rounded educational experience.

- **Annexures:**
  - Annexures for the courses are not specified in the table, indicating that additional resources or materials may be provided separately.

This syllabus is designed to provide a comprehensive understanding of embedded systems technology, equipping students with the necessary skills and knowledge to excel in this field.
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TOTAL NO. OF CREDITS: 69
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### UNIVERSITY DEPARTMENTS
### REGULATIONS – 2015
### CHOICE BASED CREDIT SYSTEM
### M.E. EMBEDDED SYSTEM TECHNOLOGIES (PART TIME)
### CURRICULA AND SYLLABI I TO VI SEMESTERS

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### PROFESSIONAL CORE (PC)

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## PROFESSIONAL ELECTIVES (PE)

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EMPLOYABILITY ENHANCEMENT COURSES (EEC)

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OBJECTIVES:

- To develop the ability to apply the concepts of Matrix theory and Linear programming in Electrical Engineering problems.
- To achieve an understanding of the basic concepts of one dimensional random variables and apply in electrical engineering problems.
- To familiarize the students in calculus of variations and solve problems using Fourier transforms associated with engineering applications..

UNIT I  MATRIX THEORY  12
The Cholesky decomposition - Generalized Eigen vectors, Canonical basis - QR factorization - Least squares method - Singular value decomposition

UNIT II  CALCULUS OF VARIATIONS  12
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 – problems with constraints - Direct methods: Ritz and Kantorovich methods

UNIT III  ONE DIMENSIONAL RANDOM VARIABLES  12
Random variables - Probability function – moments – moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a Random Variable

UNIT IV  LINEAR PROGRAMMING  12
Formulation – Graphical solution – Simplex method – Two phase method - Transportation and Assignment Models

UNIT V  FOURIER SERIES  12

TOTAL: 60 PERIODS

BOOKS FOR STUDY:
REFERENCES

ET7101 DESIGN OF EMBEDDED SYSTEMS L T P C 3 0 0 3

COURSE OBJECTIVE
- 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 12

UNIT II EMBEDDED NETWORKING AND INTERRUPTS SERVICE MECHANISM 6

UNIT III RTOS BASED EMBEDDED SYSTEM DESIGN 9
Introduction to basic concepts of RTOS- Need, 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 Real time Operating systems: VxWorks, μC/OS-II, RT Linux
UNIT IV  FUNDAMENTALS OF UML


UNIT V  EMBEDDED SYSTEM APPLICATION DEVELOPMENT

Objective, Need, different Phases & Modeling 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.

NOTE
Practice through any of Case studies through Exercise/Discussions on Design, Development & Product Manufacturing Processes’ of embedded Products like : Digital Camera /Adaptive Cruise control in a Car /Mobile Phone / Automated Robonoid

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- The learning process delivers insight into design & development of computational processors & automated process with improved design strategies.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

REFERENCES
6. MichaelBlaha and James Rambaugh,” Oriented Modeling and Design with UML”
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 Vending Machine Controller.

UNIT III FAULT DIAGNOSIS AND TESTABILITY ALGORITHMS  12

UNIT IV SYNCHRONOUS DESIGN USING PROGRAMMABLE DEVICES  12
Programming Techniques - Re-Programmable Devices Architecture- Function blocks, I/Oblocks, Interconnects, Realize combinational, Arithmetic, Sequential Circuit with Programmable Array Logic; Architecture and application of Field Programmable Logic Sequence.

UNIT V ARCHITECTURES AND PROGRAMMING PROGRAMMABLE LOGIC DEVICES  12

NOTE
Discussions/Practice on Workbench: Logic Synthesis And Simulation for digital design with VHDL, hierarchical modeling concepts, modules and port definitions, gate level modeling, data flow modeling, behavioral modeling task & functions, logic synthesis-simulation-Design examples, Ripple carry Adders, Carry Look ahead adders, Design of Arithmetic circuits for Fast adder, Array Multiplier, ALU, Shift Registers, Multiplexer, Comparator/other examples on Test Bench.

COURSE OUTCOMES:

- The learning process delivers insight into incorporating switching logics, with improved design strategies. Error free circuitry design of computation logics of processors.
- Improved Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in digital design for embedded systems.

TOTAL : 60 PERIODS
REFERENCES

ET7152 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

TOTAL : 60 PERIODS

COURSE OUTCOMES:
- The learning process delivers insight into involving the capacities of a programmable microcontroller for system interface & automation of processes with improved design strategies.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

REFERENCES

ET7201  RISC PROCESSOR ARCHITECTURE AND PROGRAMMING  L T P C
4 0 0 4

COURSE OBJECTIVES
- To teach the architecture of RISC processor
- To compare the architecture and programming of 8,16,32 bit (NUVOTON, ARM Cortex M Series) RISC processor
- To teach the implementation of DSP in ARM processor
- To discuss on memory management, application development in RISC processor
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills
UNIT I ARM MICROCONTROLLER ARCHITECTURE

UNIT II ARM ARCHITECTURE AND PROGRAMMING


UNIT III ARM APPLICATION DEVELOPMENT


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 Discussions/Exercice/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

COURSE OUTCOMES:
- The learning process delivers insight into various embedded processors of RISC architecture / computational processors with improved design strategies.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

REFERENCES
3. Trevor Martin, ‘The Insider’s Guide To The Philips ARM7-Based Microcontrollers, An Engineer's Introduction To The LPC2100 Series’ Hitex (UK) Ltd.,
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, network routing protocols
- To introduce the basis for classification of commercial family of wireless communication technologies
- 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  12


UNIT II  MOBILE NETWORKS  12


UNIT III  WIRELESS NETWORKS  12

Wireless LAN  –  IEEE 802.11 Standard-Architecture – Services – Hiper LAN, Bluetooth

UNIT IV  ROUTING  12


UNIT V  TRANSPORT AND APPLICATION LAYERS  12


NOTE

Discussions/Practice on Workbench : Sessions in NS2 / Glomosim / Open Source packages.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

- The learning process delivers insight into categorizing various embedded & communication protocols for networking of distributed static & mobile systems.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

REFERENCES


ET7251 REAL TIME OPERATING SYSTEM L T 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 processes 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 I REVIEW OF OPERATING SYSTEMS 12

UNIT II OVERVIEW OF RTOS 9

UNIT III REAL TIME MODELS AND LANGUAGES 6
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 6
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 USING 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
Discussions/Practice on Workbench: on understanding the scheduling techniques, timing circuitry, memory allotment scheme, overview of commercial Embedded OS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- The learning process delivers insight into scheduling, disciplining various embedded & computational processes with improved design strategies.
- Improved Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded systems design.

REFERENCES:

ET7252  SOFTWARE FOR EMBEDDED SYSTEMS  L T P C 4 0 0 4

COURSE OBJECTIVES
- To expose the students to the fundamentals of embedded Programming.
- To Introduce the GNU C Programming Tool Chain in Linux.
- To study the basic concepts of embedded C and Embedded OS
- 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 TOOLCHAIN 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  
Discussions/Practice on Workbench : Program Development and practice in exercises with C, C++ and Python Programming Environments.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

- The learning process delivers insight into various programming languages/softwares compatible to embedded process development with improved design & programming skills.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

REFERENCES  

ET7211  EMBEDDED SYSTEM TECHNOLOGY LABORATORY  L T P C  0 0 4 2

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 micro Controllers with peripheral interfaces.
- Practicing through atleast one of the subdivisions covered within experiments listed below to expose the students into the revising the concepts acquired from theory subjects.
<table>
<thead>
<tr>
<th>Sl.No</th>
<th>EXPERIMENT DETAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Programming with 8 bit Microcontroller /PIC /AVR /other special Microcontrollers: Assembly /C program Study with peripherals; ;IDE, Board Support Software Tools /UcOS-II/C Compiler/others with simulators/practice with incircuit Emulators, crosscompilers, debuggers</td>
</tr>
<tr>
<td>2</td>
<td>I/O Programming with 8 bit Microcontrollers/PIC Microcontrollers / other special Microcontrollers I/O Interfacing : Timers/ Interrupts/ Serial port programming/PWM Generation/ Motor Control/ADC/DAC/ LCD/ RTC Interfacing/ Sensor Interfacing</td>
</tr>
<tr>
<td>3</td>
<td>Programming in Higher Level Languages as C/C++/Java/Embedded C/Embedded Java/ Compilers&amp; Platforms /Linux Support Platforms/Special Embedded Design Programming Suites</td>
</tr>
<tr>
<td>4</td>
<td>Programming with 16 bit /ARM family/special Embedded processors on Assembly / C programming Study with peripherals; IDE, Board Support Software Tools /OS/ C Compiler/others</td>
</tr>
<tr>
<td>5</td>
<td>I/O Interfacing with Nuvoton ARM cortex series /ARM series Embedded processors I/O Programming/ Timers/ Interrupts/ Serial port programming/PWM Generation/ Motor Control/ADC/DAC/ LCD/ RTC Interfacing/ Sensor/communication modules Interfacing Study with peripherals; IDE, Board Support Software Tools /OS/C Compiler/Matlab/Labview support/others with in circuit Emulators, crosscompilers, debuggers</td>
</tr>
<tr>
<td>6</td>
<td>Design and Implementation of Combinational and Sequential Circuits on Simulation Tools as VLSI Suite/pspice/MentorGraphics/any CAD Suite/others Experimenting on Xilinx/Altera CPLD/FPGA/Cortex series processors</td>
</tr>
<tr>
<td>7</td>
<td>Study of one type of Real Time Operating Systems (RTOS) with VXWorks/Keil/Android/Tiny OS/ Linux Support RTOS</td>
</tr>
<tr>
<td>8</td>
<td>Simulation &amp; Programming on System Modelling with using programming environments (MATLAB/LabVIEW/Processor Modeling/ MEMS Suites:Intellisuite/Comsol/other Simulation Tools)</td>
</tr>
<tr>
<td>9</td>
<td>Programming with wired/wireless communication protocol/Network Simulators Study with Networking processors &amp; its peripherals; IDE, Board Support Software Tools /OS/C Compiler/others on in circuit Emulators, crosscompilers, debuggers</td>
</tr>
</tbody>
</table>
UNIT I  INTERNET INFRASTRUCTURE 9

UNIT II  INTERNET CONCEPTS 9
Capabilities and limitations of the internet — Interfacing Internet server applications to corporate databases HTML and XML Web page design through programming and the use of active components.

UNIT III  EMBEDDED JAVA 9

UNIT IV  EMBEDDED AGENT 9

UNIT V  EMBEDDED COMPUTING ARCHITECTURE 9
Synthesis of the information technologies of distributed embedded systems – analog/digital co-design – optimizing functional distribution in complex system design – validation and fast prototyping of

TOTAL : 60 PERIODS

ET7351  DISTRIBUTED EMBEDDED COMPUTING  L T P C
3 0 0 3

COURSE OBJECTIVES
- To expose the students to the fundamentals of Network communication technologies.
- To teach the fundamentals of Internet
- To study on Java based Networking
- To introduce network routing Agents
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills
multiprocessor system-on-chip – a new dynamic scheduling algorithm for real-time multiprocessor systems.

NOTE

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- The learning process delivers insight into involving JAVA concepts & internet based communication to establish decentralized control mechanism of system
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

REFERENCES:
5. Wigglesworth,”Java Programming Advanced Topics, Cengage, 2010

ET7311
PROJECT WORK PHASE I

PROJECT PHASE I - LAB Assignment (20 % of Marks in Sessional Evaluation)

Pre-requisites: choice of project title/broad domain of research topic for project

Course objectives and outcomes

<table>
<thead>
<tr>
<th>Course objectives</th>
<th>Training outcomes</th>
<th>Related programme outcomes</th>
</tr>
</thead>
</table>
| 1.0 | ✓ Programming in C/ Embedded C / C++ / JAVA  
✓ Network Simulators  
✓ Python Programming  
✓ Programming on Pervasive Computing  
✓ Java for Wireless Devices | 1.1 | Skill development in software programming/working in simulators, emulators, learn using the commercial packages for wired, wireless communications |
<p>| | | a,b,c,d |
| 2.0 | Embedded Processors with Programming | 2.1 | The students will learn design with  |
| | | 2,3,4,a,c,d |</p>
<table>
<thead>
<tr>
<th>Evaluation Scheme:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two Assignment submissions based on project domain work as listed below =20 % of Mark of Sessionals and End Semester examination as per university norms.</td>
</tr>
</tbody>
</table>

**Design / development through simulation/ experimental analysis with report submission as one appendix chapter on any two of the following topics (relevant to the candidates project area)**

1. **Network Simulators**- Design and Implement a GUI or text based network monitoring tool to record network statistics like packets sent and received, percentage errors, desktop grabbing, remote monitoring etc.

2. **Embedded Processors**- Implement an IO peripheral interface ARM family/ PIC / MSP 430 /any advanced embedded Processor through Study of CAN / I2C / Ethernet/any serial bus 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 controller scheme.

| 3.0 | ✓ Android / LINUX OS Internals/VxWorks/Keil Os |
| 3.1 | The students will skill through OS programming through API, libraries |

| 4.0 | ✓ Virtual Instrumentation programming |
| 4.1 | The students will apply programming logic for modeling/simulating embedded application development |

| 5.0 | ✓ Entrepreneurship development |
| 5.1 | The students will know to pickup skills for Embedded product development/establish consultancy services with an outlook into selecting commercially viable market for technical demands |

- uc,ARM processors/NW Processors
- DSP / Image / Video Processors
- VHDL Programming in processors
- simulators/experiments, in programming processor boards, processor interfacing/designing reprogrammable system

- Android / LINUX OS Internals/VxWorks/Keil Os
- The students will skill through OS programming through API, libraries

- Virtual Instrumentation programming
- The students will apply programming logic for modeling/simulating embedded application development

- Entrepreneurship development
- The students will know to pickup skills for Embedded product development/establish consultancy services with an outlook into selecting commercially viable market for technical demands
4. **Study on process Controller modelling** - with math lab suite with modeling, analysis for Embedded control of Machines

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

7. **DSP / Image / Video Processing** - Simulation / Implementation of any one its algorithm


9. **Programming in C/ Embedded C / C++ / JAVA** - 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

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.

15. **Entrepreneurship Skill development through Product Design with Cost Estimation** – Learn through survey on: project/product identification, development plan and execution, the Activity planning, schedule development, Integration Management configuration management, Time management, Cost estimation, Quality Management planning, Human Resource Management, Organizational planning, staff acquisition, Communication Management, Information distribution, reporting, Risk Management, Procurement Management, contract, Legal & Government rules on administration.
COURSE OBJECTIVES

- To expose the students to the fundamentals of wireless communication technologies.
- To teach the fundamentals of wireless mobile network routing protocols.
- To study on network OSI Layers.
- To introduce on concepts for network deployment, Network performance & Analysis.
- 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 LAN, PAN, WAN AND MAN

UNIT II MAC, ROUTING AND MULTICAST ROUTING PROTOCOLS

UNIT III TRANSPORT LAYER AND SECURITY PROTOCOLS

UNIT IV ENERGY MANAGEMENT
Need, classification of battery management schemes, Transmission power management schemes, System power management schemes. Wireless Sensor Networks: Architecture, Data dissemination, Date gathering, MAC protocols, location discovery, Quality of a sensor network.

UNIT V PERFORMANCE ANALYSIS
ABR beaconing, Performance parameters, Route-discovery time, End-to-end delay performance, Communication throughput performance, Packet loss performance, Route reconfiguration/repair time, TCP/IP based applications.

NOTE
Discussions/Practice on Workbench: on Zigbee /other Protocols with respect to understanding the importance of network components, networking Layers.

TOTAL: 45 PERIODS
COURSE OUTCOMES:
- The learning process delivers insight onto role of various communication standards applicable in building automation during data transfer and communication in systems.
- Improved Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded systems design.

REFERENCES
1. C. Siva Ram Murthy and B.S. Manoj, AdHoc Wireless Networks: Architectures and protocols, Prentice Hall PTR, 2004

ET7002 ADVANCED COMPUTER ARCHITECTURE AND PARALLEL PROCESSING

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
9
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
9
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  6
Pipeline principle and implementation-classification of pipeline processor-introduction of arithmetic, instruction, processor pipelining-pipeline mechanisms-hazards

UNIT IV  HARDWARE TECHNOLOGIES  15

UNIT V  OS ISSUES FOR MULTI PROCESSOR  6
Introduction-Need for Pre emptive OS – Synchronizing 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
Discussions/Practice on Workbench : modelling/ Computing Algorithms /ALU Functional Blocks  TOTAL : 45 PERIODS

COURSE OUTCOMES:
• The learning process delivers insight into familiarizing onto commercial processor technology that involves multicore processors with improved design strategies.
• 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
ET7005  EMBEDDED LINUX  L T P C  3 0 0 3

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 devices, 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  9
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  9

UNIT III  HOST-TARGET SETUP AND OVERALL ARCHITECTURE  9
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  9

UNIT V  LINUX DRIVERS  9
Introduction into basics on Linux drivers, introduction to GNU cross platform Tool chain- Case study on programming one serial driver for developing application using Linux Driver

NOTE
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

TOTAL : 45 PERIODS

COURSE OUTCOMES:
- The learning process delivers insight onto role of freeware/open source Linux for building own Embedded Applications
• Improved Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded systems design.

REFERENCES:

ET7004    DESIGN OF AUTOMOBILE EMBEDDED SYSTEM    L T P C
                                      3 0 0 3

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    9
Motivation, concept for electronic engine controls and management-Standards; Control objectives linked to fuel economy-volumetric, thermal, air-fuel ratio, Oxidizing catalytic efficiency, emission limits and vehicle performance; advantages of using Electronic engine controls – open and closed loop fuel control; Electronic ignition-Block diagram of ignition system and fuel injection system, multi point fuel injection, Direct injection; Architecture of a EMS with multi point injection, programmed ignition-recent trend in hybrid vehicles

UNIT II    SENSORS, ACTUATORS, CONTROLLERS FOR VEHICLES    9
sensors used and their characteristics- airflow rate –crank shaft and throttle position-hall effect-exhaust gas oxygen sensors, sensors interface to the ECU; Actuators and their characteristics – exhaust gas recirculation-solenoid, actuators interface to the ECU; Electrical fuel pump, speedometer, oil and temperature gauges, horn, wiper system, starter motors and circuits –batteries-types-rating-performance characteristics-programmable power supply.

UNIT III    SOFTWARE FOR ENGINE MANAGEMENT SYSTEMS    9
Development methodologies for system software and superposed application software related to specific engines and vehicles; System diagnostic standards and control software for compliance for meeting diagnostic and regulation requirements- cruise control- speed response-anti-locking braking
system-electronic suspension with control system- electronic steering; Vehicle system schematic for interfacing with EMS

UNIT IV  AUTOMOTIVE TELEMATICS
Role of Bluetooth, CAN, LIN and flexray 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 and for control-automatic transmission-electronic clutch.

UNIT V  AUTOMOTIVE INFOTAINMENT SYSTEMS
Types of AI-Features-electronic dash board instruments-Parking Aid Control-Touch Screen Displays-Diagnostics-Network Management

NOTE
Discussions/Exercice/ AUTOSAR/ simulator /Practice on Workbench/: on the basics of interfacing sensors, actuators to microcontrollers, role of Instrumentation software packages / special microcontrollers for i/o port communication applicable to vehicles

TOTAL:45 PERIODS

COURSE OUTCOMES:
- The learning process delivers insight onto role of automation, communication systems in vehicles
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

REFERENCES
1. William B. Ribbens ,"Understanding Automotive Electronics", sixth edition,
COURSE OBJECTIVES

- To review the fundamentals of ANN and fuzzy set theory.
- To make the students understand the use of ANN for modeling and control of non-linear system and to get familiarized with the ANN tool box.
- To impart knowledge of using Fuzzy logic for modeling and control of non-linear systems and get familiarized with the FLC tool box.
- To make the students to understand the use of optimization techniques.
- To familiarize the students on various hybrid control schemes, P.S.O and get familiarized with the ANFIS tool box.

UNIT I  OVERVIEW OF ARTIFICIAL NEURAL NETWORK (ANN) & FUZZY LOGIC  9


UNIT II  NEURAL NETWORKS FOR MODELLING AND CONTROL  9

Generation of training data - optimal architecture – Model validation- Control of non linear system using ANN- Direct and Indirect neuro control schemes- Adaptive neuro controller – Case study - Familiarization of Neural Network Control Tool Box.

UNIT III  FUZZY LOGIC FOR MODELLING AND CONTROL  9


UNIT IV  GENETIC ALGORITHM  9

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

UNIT V  HYBRID CONTROL SCHEMES  9

Fuzzification and rule base using ANN–Neuro fuzzy systems-ANFIS –Optimization of membership function and rule base using Genetic Algorithm and Particle Swarm Optimization - Case study– Familiarization of ANFIS Tool Box.

TOTAL : 45 PERIODS

COURSE OUTCOMES

Students,
- Will be able to know the basic ANN architectures, algorithms and their limitations.
- Also will be able to know the different operations on the fuzzy sets.
- Will be capable of developing ANN based models and control schemes for non-linear system.
- Will get expertise in the use of different ANN structures and online training algorithm.
- Will be knowledgeable to use Fuzzy logic for modeling and control of non-linear systems.
- Will be competent to use hybrid control schemes and P.S.O.
REFERENCES

ET7074 MEMS TECHNOLOGY

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
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
Principle, material, design and fabrication of parallel plate capacitors as electrostatic sensors and actuators-Applications

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

UNIT IV PIEZOELECTRIC SENSING AND ACTUATION
Piezoelectric effect-cantilever piezo electric 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
Discussions/Exercise/Practice on Workbench: on the basics /device model design aspects of thermal/peizo/resistive sensors etc.

TOTAL : 45 PERIODS

COURSE OUTCOME:

- The learning process delivers insight onto design of micro sensors, embedded sensors & actuators in power aware systems like grid
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

REFERENCES

ET7003 ADVANCED EMBEDDED SYSTEMS

COURSE OBJECTIVES

- To expose the students to the concepts of HARDWARE/SOFTWARE Modelling, partitioning, co-simulation.
- To expose the students to the fundamentals of the internals of a router and hardware architecture for protocol processing,
- To study on Fundamentals on design attributes of functional units of Network processors their architecture, through the classification of commercial Network in processors
- To introduce aspects in Protocols: Design issues, goals in Network 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 MODELLING WITH HARDWARE/SOFTWARE PARTITIONING 15

UNIT II EMBEDDED PROCESSOR FOR NETWORK PROTOCOL PROCESSING 9
Introduction and overview, basic terminology and example systems, review of protocols and packet format, Conventional computer hardware architecture, basic packet processing, packet processing functions, protocol software on a conventional processor, hardware architecture for protocol
processing, classification and forwarding, switching fabrics, Hardware/Software Traffic management implementation

UNIT III INTRODUCTION TO ADVANCED ARCHITECTURE: NETWORK PROCESSOR 6
Network processors, the complexity of network processor design, network processor architectural
Overview and comparison of commercial network processors: the Intel network processor, RISC
processor, packet processor hardware.

UNIT IV SCALING IN NETWORK PROCESSORS 6
Scalability With Parallelism And Pipelining issues in scaling a network processor-Complexity
Of Network Processor Design (packet processing, ingress & egress processing, Macrosopic
Data Pipelining And Heterogeneity etc) - Network Processor fun : Packet Flow, Clock Rates,
software architecture, Assigning Functionality To The Processor Hierarchy.

UNIT V CLASSIFICATION OF NETWORK PROCESSORS 9
Basis in Classification of network processors- Multichip pipeline, configurable instruction set
processors, packet processor-Issues In Scaling A Network Processor (processing hierarchy and
scaling)--functional configurations in commercial Network Processors : Multi-Chip Pipeline,
Augmented RISC Processor, Embedded Processor Plus Coprocessors- Design Tradeoffs and
consequences (Programmability Vs. Processing Speed , speed vs functionality. etc).

NOTE
Discussions/Exercise/Practice on Workbench : on commercial processor technology through
comparisons on to the design strategies used in multicore processors

TOTAL : 45 PERIODS

COURSE OUTCOMES:
- The learning process delivers insight onto role of multicore processors specifically designed for
  networking during data transfer and communication systems like electrical grid
- Improved Employability and enterprenership capacity due to knowledge upgradation on recent
trends in embedded systems design.

REFERENCES:
5. UYLESS black,’computer NETWORKS-Protocols,STANDARDS INTERFACES’,2"ed
   ED,PHI,2007
8. Giovanni De Micheli, Rolf Ernst Morgon, “Reading in Hardware/Software Co-Design” Kaufmann
COURSE OBJECTIVES

- To discuss to the students on the fundamentals building blocks of a digital instrument
- To teach digital data communication techniques
- To study on bus communication standards and working principles
- To teach Graphical programming using GUI for instrument building
- To involve Discussions/Practice onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

UNIT I  DATA ACQUISITION SYSTEMS  9
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 Modulation - Digital Displays for Instrumentation.

UNIT II  INSTRUMENT COMMUNICATION  15

UNIT III PROGRAMMABLE LOGIC CONTROLLERS,  6
Need for PLC, Ladder Diagram, role of PLC for Industrial instrumentation and automation.

UNIT IV VIRTUAL INSTRUMENTATION:  10

UNIT V CASE STUDIES  5
PC based DAS, Data loggers, PC based process measurements using sensors, actuators, CRT interface and controller with monochrome and colour video display.

NOTE
Discussions/Exercise/Practice on Workbench : on Digital Control of sensors, Relays,Solenoids, DC/STEPPER motor, LCD graphics Interface, SD Card storage interface

TOTAL : 45 PERIODS

COURSE OUTCOMES:

- The learning process delivers insight onto role of various communication standards applicable in building instrument based automation during data transfer and communication in systems like large industrial processes.
• Improved Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded systems design.

REFERENCES:

ET7006 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
Data Acquisition, Monitoring, Communication, Event Processing, and Polling Principles, SCADA system principles - outage management - Decision support application for substation automation, extended control feeder automation, Performance measure and response time, SCADA Data Models, need, sources, interface

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 etc

TOTAL : 45 PERIODS

COURSE OUTCOMES:
• The learning process delivers insight onto design of automation, communication systems through wired, wireless technology for monitoring and control of grid.
• Improved Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded systems design.

REFERENCE:
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
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, Schrödinger 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
Discussions/Practice on Workbench : on modelling of analog & digital devices.

TOTAL = 45 PERIODS

COURSE OUTCOMES:
- 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.

ET7010  PERVERSIVE DEVICES AND TECHNOLOGY  L T P C
3 0 0 3

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

UNIT I  OVERVIEW OF WIRELESS SENSOR NETWORKS  12
Challenges for Wireless Sensor Networks- Characteristic requirements for WSN - Challenges for WSNs - WSN vs Adhoc Networks - Physical layer and transceiver design considerations in WSNs, introduction to fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts - Contention-based protocols - Schedule-based protocols - the IEEE 802.15.4 MAC protocol- Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations- Applications of sensor networks

UNIT II  ISSUES IN PERVERSIVE SENSOR NETWORK  9

UNIT III  PERVERSIVE FOR SMART GRID APPLICATION  12
Introduction, Networking Infrastructure and Architecture of PERV NET, Mobility management, service discovery, disconnected operation, Smart Grid structure-metering-standards-Data Management Principles
UNIT IV PERVASIVE DEVICES
Introduction to use of special uC for networking with Case study of Sensor node architecture – compare Commercially available sensor nodes – Imote, IRIS, Mica Mote - Communication Standards - Zigbee, Z-Wave.

UNIT V EMERGING WIRELESS TECHNOLOGIES

NOTE
Discussions/Exercise/Practice on Workbench : on the basics of Zigbee protocols, sensor motes, role of special microcontrollers for Zigbee communication etc

TOTAL : 45 PERIODS

COURSE OUTCOMES:
- The learning process delivers insight onto building of automation, communication with microcontrollers into systems like grid
- Improved Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded systems design

REFERENCES
3. Mullet,”Introduction to wireless telecommunications systems and networks”, cengage learning, 2010 (unit 5)
OBJECTIVE

- Aims at providing the basic concepts of product design, product features & its architecture
- Clarity in creative thinking in developing automation into consumer products of market value
- To know the techniques & procedures as are adopted in Industry for Product manufacture
- Elaborate understanding for developing an embedded product by choice of functional blocks, HW/SW parameters.
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability & entrepreneurship skills

UNIT I CONCEPTS OF PRODUCT DEVELOPMENT


UNIT II INTRODUCTION TO APPROACHES IN PRODUCT DEVELOPMENT


UNIT III INDUSTRIAL DESIGN

Integrate process design - Managing costs - Robust design – need for Involving CAE, CAD, CAM, IDE tools – Simulating product performance and manufacturing processes electronically - Estimation of Manufacturing cost-reducing the component costs and assembly costs – Minimize system complexity - Prototype basics - Principles of prototyping - Planning for prototypes - Economic & Cost Analysis - Understanding and representing tasks-baseline project planning - accelerating the project-project execution.

UNIT IV DEVELOPMENT BASED ON REVERSE ENGINEERING


UNIT V DEVELOPING EMBEDDED PRODUCT DESIGN

Discussions on Creating Embedded System Architecture(with at least one Case study example: Mobile Phone / Adaptive Cruise Controller/ Robonoid about ) - Architectural Structures- Criteria in
selection of Hardware & Software Components, product design by Performance Testing, Costing, Benchmarking ,Documentation

NOTE
Term Project/Presentation on specific product design can be given for Assessment – 3 (Optional)

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- Improved knowledge upgradation on recent trends in embedded systems design with understand the integration of customer requirements in product design
- apply structural approach to concept generation, creativity, selection and testing so that student can have a basic knowledge in the common features a product through industrial design, design of Consumer specific product , its Reverse Engineering manufacture , economic analysis and product architecture.
- Improved Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded systems design.

REFERENCES
COURSE OBJECTIVE:
- To understand about the SCADA system components and SCADA communication protocols
- To provide knowledge about SCADA applications in power system

UNIT I  INTRODUCTION TO SCADA
Evolution of SCADA, SCADA definitions, SCADA Functional requirements and Components, SCADA Hierarchical concept, SCADA architecture, General features, SCADA Applications, Benefits

UNIT II  SCADA SYSTEM COMPONENTS
Remote Terminal Unit (RTU), Interface units, Human- Machine Interface Units (HMI), Display Monitors/Data Logger Systems, Intelligent Electronic Devices (IED), Communication Network, SCADA Server, SCADA Control systems and Control panels

UNIT III  SCADA COMMUNICATION
SCADA Communication requirements, Communication protocols: Past, Present and Future, Structure of a SCADA Communications Protocol, Comparison of various communication protocols, IEC61850 based communication architecture, Communication media like Fiber optic, PLCC etc. Interface provisions and communication extensions, synchronization with NCC, DCC.

UNIT IV  SCADA MONITORING AND CONTROL
Online monitoring the event and alarm system, trends and reports, Blocking list, Event disturbance recording. Control function: Station control, bay control, breaker control and disconnector control.

UNIT V  SCADA APPLICATIONS IN POWER SYSTEM
Applications in Generation, Transmission and Distribution sector, Substation SCADA system Functional description, System specification, System selection such as Substation configuration, IEC61850 ring configuration, SAS cubicle concepts, gateway interoperability list, signal naming concept. System Installation, Testing and Commissioning.

CASE STUDIES:
SCADA Design for 66/11KV and 132/66/11KV or 132/66 KV any utility Substation and IEC 61850 based SCADA Implementation issues in utility Substations,

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- This course gives knowledge about various system components and communication protocols of SCADA system and its applications.
REFERENCE:
1. Stuart A. Boyer: SCADA-Supervisory Control and Data Acquisition, Instrument Society of America Publications, USA, 2004
4. David Bailey, Edwin Wright, Practical SCADA for industry, Newnes, 2003

HV7072 DESIGN OF SUBSTATIONS

**OBJECTIVE:**
- To provide in-depth knowledge on design criteria of Air Insulated Substation (AIS) and Gas Insulated Substation (GIS).
- To study the substation insulation co-ordination and protection scheme.
- To study the source and effect of fast transients in AIS and GIS.

**UNIT I INTRODUCTION TO AIS AND GIS**
Introduction – characteristics – comparison of Air Insulated Substation (AIS) and Gas Insulated Substation (GIS) – main features of substations, Environmental considerations, Planning and installation- GIB / GIL

**UNIT II MAJOR EQUIPMENT AND LAYOUT OF AIS AND GIS**
Major equipment – design features – equipment specification, types of electrical stresses, mechanical aspects of substation design- substation switching schemes- single feeder circuits; single or main bus and sectionalized single bus- double main bus-main and transfer bus- main, reserve and transfer bus- breaker-and-a- half scheme-ring bus

**UNIT III INSULATION COORDINATION OF AIS AND GIS**

**UNIT IV GROUNDING AND SHIELDING**
Definitions – soil resistivity measurement – ground fault currents – ground conductor – design of substation grounding system – shielding of substations – Shielding by wires and masts.

**UNIT V FAST TRANSIENTS PHENOMENON IN AIS AND GIS**

**TOTAL : 45 PERIODS**
COURSE OUTCOMES:

- Awareness towards substation equipment and their arrangements.
- Ability to design the substation for present requirement with proper insulation coordination and protection against fast transients.

REFERENCES


PS7071 DISTRIBUTED GENERATION AND MICRO GRID L T P C

3 0 0 3

OBJECTIVES

- To illustrate the concept of distributed generation
- To analyze the impact of grid integration.
- To study concept of Microgrid and its configuration

UNIT I INTRODUCTION


UNIT II DISTRIBUTED GENERATIONS (DG)

Concept of distributed generations, topologies, selection of sources, regulatory standards/framework, Standards for interconnecting Distributed resources to electric power systems: IEEE 1547. DG installation classes, security issues in DG implementations. Energy storage elements: Batteries, ultra-capacitors, flywheels. Captive power plants

UNIT III IMPACT OF GRID INTEGRATION

Requirements for grid interconnection, limits on operational parameters.: voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality issues.
UNIT IV  BASICS OF A MICROGRID  
Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids.

UNIT V  CONTROL AND OPERATION OF MICROGRID  
Modes of operation and control of microgrid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes: passive, active and communication based techniques, microgrid communication infrastructure, Power quality issues in microgrids, regulatory standards, Microgrid economics, Introduction to smart microgrids.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
- Students will attain knowledge on the various schemes of conventional and non-conventional power generation.
- Students will have knowledge on the topologies and energy sources of distributed generation.
- Students will learn about the requirements for grid interconnection and its impact with NCE sources.
- Students will understand the fundamental concept of Microgrid.

REFERENCES

PW7351  ENERGY MANAGEMENT AND AUDITING  L T P C
3 0 0 3

COURSE OBJECTIVES
- To study the concepts behind economic analysis and Load management.
- To emphasize the energy management on various electrical equipments and metering.
- To illustrate the concept of lighting systems and cogeneration.

UNIT I  INTRODUCTION
Need for energy management - energy basics- designing and starting an energy management program – energy accounting -energy monitoring, targeting and reporting- energy audit process.

UNIT II  ENERGY COST AND LOAD MANAGEMENT
Important concepts in an economic analysis - Economic models-Time value of money- Utility rate structures- cost of electricity-Loss evaluation Load management: Demand control techniques-Utility monitoring and control system- HVAC and energy management-Economic justification
UNIT III ENERGY MANAGEMENT FOR MOTORS, SYSTEMS, AND ELECTRICAL EQUIPMENT

Systems and equipment: Electric motors - Transformers and reactors - Capacitors and synchronous machines

UNIT IV METERING FOR ENERGY MANAGEMENT

Relationships between parameters: Units of measure - Typical cost factors - Utility meters - Timing of meter disc for kilowatt measurement - Demand meters - Paralleling of current transformers - Instrument transformer burdens - Multitasking solid-state meters - Metering location vs. requirements - Metering techniques and practical examples

UNIT V LIGHTING SYSTEMS & COGENERATION

Concept of lighting systems - The task and the working space - Light sources - Ballasts - Luminaries - Lighting controls - Optimizing lighting energy - Power factor and effect of harmonics on power quality - Cost analysis techniques - Lighting and energy standards - Cogeneration: Forms of cogeneration - feasibility of cogeneration - Electrical interconnection.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- Students will develop the ability to learn about the need for energy management and auditing process.
- Learners will learn about basic concepts of economic analysis and load management.
- Students will understand the energy management on various electrical equipments.
- Students will have knowledge on the concepts of metering and factors influencing cost function.
- Students will be able to learn about the concept of lighting systems, light sources and various forms of cogeneration.

TEXT BOOKS

REFERENCES
COURSE OBJECTIVES

- To expose the students to the fundamentals of digital signal processing in frequency domain & its application
- To teach the fundamentals of digital signal processing in time-frequency domain & its application
- To compare Architectures & features of Programmable DSP Processors & develop logical functions of DSP Processors with Re-Programmable logics & Devices
- 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 INTRODUCTION TO DIGITAL SIGNAL PROCESSING 12

UNIT II WAVELET TRANSFORM 6
Introduction to continuous wavelet transform - discrete wavelet transform - orthogonal wavelet decomposition - Multiresolution Analysis-Wavelet function-DWT, bases, orthogonal Basis-Scaling function, Wavelet coefficients - orthogonal wavelets and their relationship to filter banks - Digital filtering interpolation (i) Decomposition filters, (ii) reconstruction, the signal- Example MRA- Haar & Daubechies wavelet.

UNIT III ARCHITECTURES OF COMMERCIAL DIGITAL SIGNAL PROCESSORS 12
Introduction, categorization of DSP Processors, Fixed Point (Blackfin), Floating Point (SHARC), TI TMS 320c6xxx & OMAP processors TMS320C54X & 54xx on Basic Architecture – study : of functional variations of Computational building blocks (with comparison onto their MAC, Bus Architecture and memory, Interrupt- I/O interface, Memory Interface, DMA through one example Architecture in each of these case studies).

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

UNIT V VLSI IMPLEMENTATION 9
Low power Design-need for Low power VLSI chips-Basics of DSP system architecture design of functional units, Filter using VHDL programming, Mapping of DSP algorithm onto hardware.

NOTE
Discussions/Exercise/Practice on Workbench : Signal analysis transforms, Filter design concepts with simulation tools as Matlab /Labview/ CCS suites to understand the commercial DSP processor technology.

TOTAL : 45 PERIODS
COURSE OUTCOMES:
- The conceptual aspects of Signal processing Transforms are introduced.
- The comparison on commercial available DSPProcessors helps to understand system design through processor interface
- The possibility to develop system on chip design will be explored.

REFERENCES:

PS7073 OPTIMISATION TECHNIQUES
L T P C 3 0 0 3

COURSE OBJECTIVES
- To introduce the different optimization problems and techniques
- To study the fundamentals of the linear and non-linear programming problem.
- To understand the concept of dynamic programming and genetic algorithm technique

UNIT I INTRODUCTION
Definition, Classification of optimization problems, Classical Optimization Techniques, Single and Multiple Optimization with and without inequality constraints.
UNIT II  LINEAR PROGRAMMING (LP)  9
Simplex method of solving LPP, revised simplex method, duality, Constrained optimization, Theorems and procedure, Linear programming, mathematical model, solution technique, duality.

UNIT III NON LINEAR PROGRAMMING  9

UNIT IV  DYNAMIC PROGRAMMING (DP)  9
Multistage decision processes, concept of sub-optimization and principle of optimality, Recursive relations, Integer Linear programming, Branch and bound algorithm

UNIT V  GENETIC ALGORITHM  9
Introduction to genetic Algorithm, working principle, coding of variables, fitness function, GA operators; Similarities and differences between Gas and traditional methods; Unconstrained and constrained optimization using genetic Algorithm, real coded gas, Advanced Gas, global optimization using GA, Applications to power system.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
- Students will learn about different classifications of optimization problems and techniques.
- Students will attain knowledge on linear programming concepts
- Students will understand the application of non-linear programming in optimization techniques
- Students will understand the fundamental concepts of dynamic programming
- Students will have knowledge about Genetic algorithm and its application to optimization in power system.

TEXT BOOKS

REFERENCE BOOKS:
COURSE OBJECTIVES

- To Study about solar modules and PV system design and their applications
- To Deal with grid connected PV systems
- To Discuss about different energy storage systems

UNIT I INTRODUCTION

Characteristics of sunlight – semiconductors and P-N junctions – behavior of solar cells – cell properties – PV cell interconnection

UNIT II STAND ALONE PV SYSTEM

Solar modules – storage systems – power conditioning and regulation - protection – stand alone PV systems design – sizing

UNIT III GRID CONNECTED PV SYSTEMS

PV systems in buildings – design issues for central power stations – safety – Economic aspect – Efficiency and performance - International PV programs

UNIT IV ENERGY STORAGE SYSTEMS

Impact of intermittent generation – Battery energy storage – solar thermal energy storage – pumped hydroelectric energy storage

UNIT V APPLICATIONS


TOTAL : 45 PERIODS

COURSE OUTCOMES:

- Students will develop more understanding on solar energy storage systems
- Students will develop basic knowledge on standalone PV system
- Students will understand the issues in grid connected PV systems
- Students will study about the modelling of different energy storage systems and their performances
- Students will attain more on different applications of solar energy

TEXT BOOKS


REFERENCES:

COURSE OBJECTIVES

- To learn the design and control principles of Wind turbine.
- To understand the concepts of fixed speed and variable speed, wind energy conversion systems.
- To analyze the grid integration issues.

UNIT I  INTRODUCTION  9
Components of WECS-WECS schemes-Power obtained from wind-simple momentum theory-Power coefficient-Sabinin’s theory-Aerodynamics of Wind turbine

UNIT II  WIND TURBINES  9
HAWT-VAWT-Power developed-Thrust-Efficiency-Rotor selection-Rotor design considerations-Tip speed ratio-No. of Blades-Blade profile-Power Regulation-yaw control-Pitch angle control-stall control-Schemes for maximum power extraction.

UNIT III  FIXED SPEED SYSTEMS  9
Generating Systems- Constant speed constant frequency systems -Choice of Generators-Deciding factors-Synchronous Generator-Squirrel Cage Induction Generator- Model of Wind Speed- Model wind turbine rotor - Drive Train model- Generator model for Steady state and Transient stability analysis.

UNIT IV  VARIABLE SPEED SYSTEMS  9
Need of variable speed systems-Power-wind speed characteristics-Variable speed constant frequency systems synchronous generator- DFIG- PMSG -Variable speed generators modelling - Variable speed variable frequency schemes.

UNIT V  GRID CONNECTED SYSTEMS  9
Wind interconnection requirements, low-voltage ride through (LVRT), ramp rate limitations, and supply of ancillary services for frequency and voltage control, current practices and industry trends wind interconnection impact on steady-state and dynamic performance of the power system including modelling issue.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- Students will attain knowledge on the basic concepts of Wind energy conversion system.
- Students will have the knowledge of the mathematical modelling and control of the Wind turbine
- Students will develop more understanding on the design of Fixed speed system
- Students will study about the need of Variable speed system and its modelling.
- Students will learn about Grid integration issues and current practices of wind interconnections with power system.

TEXT BOOKS
REFERENCES

PS7255 SMART GRIDS L T P C
3 0 0 3

COURSE 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 (Transmission)
Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control

UNIT III SMART GRID TECHNOLOGIES (Distribution)
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 IV 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 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

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

**TEXT BOOKS**


**REFERENCES:**

2. Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang “Smart Grid – The New and Improved Power Grid: A Survey”, IEEE Transaction on Smart Grids,

**COURSE OBJECTIVE:**

- 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**

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**

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**

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**

Battery Basics, Different types, Battery Parameters, Battery modeling, Traction Batteries

**UNIT V ALTERNATIVE ENERGY STORAGE SYSTEMS**

Fuel cell – Characteristics- Types – hydrogen Storage Systems and Fuel cell EV – Ultra capacitors
COURSE OUTCOME:

- This course equips the student to understand the operation of Electric vehicles and various energy storage technologies for electrical vehicles.

REFERENCES
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 9

UNIT II PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS 9

UNIT III NETWORK SECURITY PRACTICE 9

UNIT IV SYSTEM SECURITY 9

UNIT V WIRELESS SECURITY 9

NOTE
Discussions/Exercice/Practice on Workbench: on the basics/numerical design aspects of encryption, decryption keys/password creation etc

TOTAL : 45 PERIODS

COURSE OUTCOME:
- 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.
REFERENCE:

ET7072 DIGITAL IMAGE PROCESSING L T P C 3 0 0 3

COURSE OBJECTIVES
- To understand the techniques for image enhancement; image segmentation; the techniques for compression etc for Grey scale & Color Images

UNIT I IMAGE REPRESENTATION 9
Image representation-Image Basis Functions- Two dimensional DFT- Discrete Cosine TransformWalsh- Hadamard transform-Wavelet transform- Principal component analysis.

UNIT II IMAGE ENHANCEMENT AND RESTORATION 9
Gray level transformation techniques- Spatial domain techniques - Half toning, Median filtering, contrast stretching, Histogram Equalization- Frequency domain techniques - Weiner filteringHomomorphic filtering- PSFs for different forms of blur - noise models- color image processing.

UNIT III IMAGE SEGMENTATION 9
Segmentation - Similarity and dissimilarity methods- Thresholding - Edge based and Region based methods- Hough transform- Morphological operations - Clustering methods.

UNIT IV IMAGE COMPRESSION 9

UNIT V COLOR IMAGE PROCESSING 9
Percepection of color, color model, chromaticity diagram, color image - quantization, filtering, gamma correction, pseudo color, segmentation.

TOTAL: 45 PERIODS
COURSE OUTCOMES:

- To be able to design and implement image enhancement schemes; compression schemes; restoration schemes; segmentation schemes

REFERENCES:


CO7073 ROBOTICS AND CONTROL L T P C 3 0 0 3

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

COURSE 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

ET7012  REAL TIME SYSTEMS  L T P C  3 0 0 3

OBJECTIVES
- To teach the fundamentals of Real Time systems
- To introduce the concepts related to Scheduling and Programming Languages
- To make them understand the process of real-time system design
- To have an understanding about fault tolerance and reliability

UNIT I  INTRODUCTION

UNIT II  SCHEDULING IN REAL-TIME SYSTEMS
Scheduling of Dependent Tasks: Tasks with precedence relationships - Tasks sharing critical resources. Scheduling schemes for handling overload: Scheduling techniques in overload conditions - Handling real-time tasks with varying timing parameters - Handling overload conditions for hybrid task sets. Multiprocessor scheduling: Introduction - First results and comparison with uniprocessor scheduling - schedulability conditions - Scheduling algorithms.

UNIT III  PROGRAMMING LANGUAGE AND TOOLS
Programming Languages and Tools – Desired language characteristics – Data typing – Control

UNIT IV REAL-TIME SYSTEM DESIGN


UNIT V FAULT TOLERANCE AND RELIABILITY EVALUATION TECHNIQUES


TOTAL : 45 PERIODS

COURSE OUTCOMES:
- The learning process delivers insight into incorporating schedulers into various embedded & computational processes with improved design strategies.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

REFERENCE BOOKS
7. NPTEL Videos: http://nptel.ac.in/courses/106105036/2
COURSE OBJECTIVES

- To give an insight to the students about the significance of CMOS technology and fabrication process.
- To teach the importance and architectural features of programmable logic devices.
- To introduce the ASIC construction and design algorithms.
- To teach the basic analog VLSI design techniques, Logic synthesis and simulation of digital system with Verilog HDL.
- To involve Discussions/Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.

UNIT I CMOS DESIGN 9
Overview of VLSI design Methodologies- Logic design with CMOS-transmission gate circuits- Clocked CMOS-dynamic CMOS circuits, Bi-CMOS circuits- Layout diagram, Stick diagram-IC fabrications – Low Power VLSI techniques-Trends in IC technology.

UNIT II PROGRAMABLE LOGIC DEVICES 9

UNIT III ASIC CONSTRUCTION, FLOOR PLANNING, PLACEMENT AND ROUTING 9

UNIT IV ANALOG VLSI DESIGN 9
Introduction to analog VLSI- Design of CMOS 2stage-3 stage Op-Amp –High Speed and High frequency op-amps-Super MOS- Analog primitive cells-realization of neural networks- Introduction to FPAA.

UNIT V LOGIC SYNTHESIS AND SIMULATION 9
Overview of digital design with Verilog HDL, hierarchical modelling concepts, modules and port definitions, gate level modelling, data flow modelling, behavioural modelling, task & functions, Verilog and logic synthesis-simulation-Design examples,Ripple carry Adders, Carry Look ahead adders, Multiplier, ALU, Shift Registers, Multiplexer, Comparator, Test Bench.

NOTE Discussions/Practice on Workbench : Practice Digital design with Verilog HDL, gate level modelling, -simulation-Design examples like say Ripple carry Adders, Carry Look ahead adders, Multiplier, ALU, Shift Registers, Multiplexer, Comparator, on Xilinx Platform/Processor Supported Test Bench

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- The learning process delivers insight into developing design logic/arithmetic functionalities of various embedded & computational arithmetic/logic functionalities evolvable in processors with improved design strategies.
- Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.
REFERENCES:

CO7072       MULTI SENSOR DATA FUSION       L T P C
            3 0 0 3

COURSE OBJECTIVES
- To educate on sensor data inference hierarchy and fusion models.
- To educate on the algorithms used for data fusion.
- To educate on Kalman filter and its application to decision identity fusion.
- To educate on advanced filtering and sensor fusion concepts.
- To introduce various high performance data structures.

UNIT I       MULTISENSOR DATA FUSION INTRODUCTION

UNIT II      ALGORITHMS FOR DATA FUSION
Taxonomy of algorithms for multisensor data fusion. Data association. Identity declaration.

UNIT III     ESTIMATION:

UNIT IV      ADVANCED FILTERING

UNIT V       HIGH PERFORMANCE DATA STRUCTURES:
Tessellated, trees, graphs and function. Representing ranges and uncertainty in data structures. Designing optimal sensor systems with in dependability bounds. Implementing data fusion system.

COURSE OUTCOMES:
- Ability to explain and use multiple sensor data in data fusion model.
- Capable to use algorithms for data fusion.

TOTAL : 45 PERIODS
• Ability to estimate using kalman filter.
• Ability to estimate using advance filtering such as data, extended information filtering.
• Ability to handle various high performance data structures.

REFERENCES:

ET7009 OPEN SOURCE SOFTWARE

COURSE OBJECTIVES:
• Define open source software
• Identify and discuss various software licensing models
• Understand the motivation, theory, strengths and weaknesses of open source software.
• Become familiar with Linux, MySQL, PHP, Python, Apache and other Tools and technologies
• 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

UNIT II OPEN SOURCE DATABASE

UNIT III OPEN SOURCE PROGRAMMING LANGUAGES
UNIT IV        PYTHON
Syntax and Style - Python Objects - Numbers - Sequences - Strings - Lists and Tuples - Dictionaries - Conditionals and Loops - Files - Input and Output - Errors and Exceptions - Functions - Modules - Classes and OOP - Execution Environment.

UNIT V        OPEN SOURCE WEB SERVER, TOOLS AND TECHNOLOGIES

TOTAL: 45 PERIODS

COURSE OUTCOMES:
• The student will have a clear understanding about the terms, tools & programming Languages in the open source category for application development
• Improved Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded systems design.

REFERENCES:
8. Vivek Chopra, Sing Li, Jeff genender, “Professional Apache Tomcat 6”, Wiley India, 2007

ET7011        PYTHON PROGRAMMING
L T 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

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
COURSE OBJECTIVES
- To teach the fundamentals of Internet Technology.
- To teach on functional components Web services, data management
- To discuss on significance of SOA in embedded networking
- To teach the need of Cloud Computing, its services for embedded applications
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

UNIT I WEB ESSENTIALS

UNIT II WEB DATA

UNIT III SERVICE ORIENTED ARCHITECTURE

UNIT IV INTRODUCTION TO CLOUD COMPUTING

UNIT V USING CLOUD SERVICES

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- The learning process delivers insight onto role of Web enabled communication systems in networking for large scale systems like the grid
- Improved Employability and entrepreneurship capacity with knowledge up gradation on recent trends in embedded systems design.

REFERENCES:
5. Anthony t. velte,'Cloud computing a practical approach',TATA McGRAW-HILL,2011.