VEL TECH MULTI TECH Dr.RANGARAJAN Dr.SAKUNTHALA ENGINEERING COLLEGE

CHOICE BASED CREDIT SYSTEM

M.E EMBEDDED SYSTEM TECHNOLOGIES

I TO IV SEMESTERS CURRICULUM (FULL TIME)

Regulation - 2019

SEMESTER I

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	192MA102	Advanced Applied Mathematics	FC	4	4	0	0	4
2.	192ES121	Fundamentals of Embedded Software	PC	3	3	0	0	3
3.	192ES122	Microcontrollers and Applications	PC	3	3	0	0	3
4.	192ES123	Real-Time Concepts for Embedded Systems	PC	3	3	0	0	3
5.	192ES124	Design of Embedded Systems	PC	3	3	0	0	3
6.		Elective I	PE	3	3	0	0	3
PRACTICALS								
7.	192ET12A	Embedded System Lab I	PC	2	0	0	2	1
8.	192HS10A	English for Research paper Writing	MC	0	0	0	0	0
			TOTAL		**19**	**0**	**6**	**20**

SEMESTER II

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	192ES221	Real Time Operating System	PC	3	3	0	0	3
2.	192ES222	Embedded System Networks	PC	3	3	0	0	3
3.	192ES223	Object Computing and Data Structures	PC	4	3	2	0	4
4.	192ES224	Embedded Processors	PC	3	3	0	0	3
5.	192ES225	Digital System Design and Testing	PC	3	3	2	0	4
6.		Elective II	PE	3	3	0	0	3
PRACTICALS								
7.	192ET22A	Embedded System Lab II	PC	2	0	0	2	1
			TOTAL		18	4	6	21

SEMESTER III

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.		Elective III	PE	3	3	0	0	3
2.		Elective IV	PE	3	3	0	0	3
3.		Elective V	PE	3	3	0	0	3
4.	192MC36A	Research Methodology and Intellectual property rights	MC	0	0	0	0	**
PROJECT								
5.	192ET35A	Project Phase -I	PROJ	12	0	0	12	6
			TOTAL		**9**	**0**	**12**	**15**

SEMESTER IV

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PROJECT								
1.	192ET45A	Project Phase-II	PROJ	20	0	0	20	12
			TOTAL				**20**	**12**

TOTAL NO. OF CREDITS: 68

CURRICULUM BREAKUPS

Sl.No	Category	Proposed Breakup of Credits
1	Foundation courses (FC)	4
2	Professional core courses (PC)	31
3	Professional Elective courses relevant to chosen specialization/branch (PE)	15
4	Project work, seminar and internship in industry or elsewhere(PROJ)	18
5	Mandatory Courses (MC)	Non credit
	TOTAL CREDITS	**68**

PROFESSIONAL ELECTIVES (PE)*

SEMESTER I

ELECTIVE I

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	192ES131	Digital Instrumentation	PE	3	3	0	0	3
2.	192ES132	Embedded System Architecture	PE	3	3	0	0	3
3.	192ES133	Real Time Systems	PE	3	3	0	0	3
4	192ES134	Soft Computing and Optimization Techniques	PE	3	3	0	0	3

SEMESTER II

ELECTIVE II

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	192ES231	Automotive Embedded Systems	PE	3	3	0	0	3
2.	192ES232	Embedded Networking	PE	3	3	0	0	3
3.	192ES233	Embedded Product Development	PE	3	3	0	0	3
4.	192ES234	Python Programming	PE	3	3	0	0	3

SEMESTER III
ELECTIVE III

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	192ES331	Advanced Embedded Controllers	PE	3	3	0	0	3
2.	192ES332	Cryptography And Network Security	PE	3	3	0	0	3
3.	192ES335	Industrial Networking And Standards	PE	3	3	0	0	3
4.	192ES337	Medical Instrumentation Systems	PE	3	3	0	0	3

ELECTIVE IV

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	192ES333	Digital Image Processing	PE	3	3	0	0	3
2.	192ES3310	Smart Grid Communications	PE	3	3	0	0	3
3.	192ES3311	System On Chip	PE	3	3	0	0	3
4.	192ES3312	Wireless And Mobile Communication	PE	3	3	0	0	3

ELECTIVE V

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	192ES334	Embedded Linux	PE	3	3	0	0	3
2.	192ES336	Internet of Things	PE	3	3	0	0	3
3.	192ES338	Personal Computer Systems	PE	3	3	0	0	3
4.	192ES339	Robotics And Factory Automation	PE	3	3	0	0	3

** - No Credits
PC – Professional Core.
PE- Professional Elective
MC- Mandatory Course.
FC – Foundation Core

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M.E. EMBEDDED SYSTEM TECHNOLOGIES
REGULATION – 2019
SEMESTER 1

192MA102 ADVANCED APPLIED MATHEMATICS LTPC
4004

COURSE 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 (12)
Cholesky decomposition - Generalized Eigenvectors - 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 – Functional dependant on functions of several independent variables –Variation problems with moving boundaries – Isoperimetric problems - Direct methods : Ritz andKantorovich.

UNIT III PROBABILITY AND RANDOM VARIABLES (12)
Probability – Axioms of probability – Conditional probability – Baye's theorem - Random variables - Probability function – Moments – Moment generating functions and their properties –Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.

UNIT IV LINEAR PROGRAMMING (12)
Formulation – Graphical solution – Simplex method – Big M method - Two phase method -

Transportation and Assignment models.

UNIT V FOURIER SERIES (12)

Fourier trigonometric series : Periodic function as power signals – Convergence of series – Even and odd function : Cosine and sine series – Non periodic function : Extension to other intervals –Power signals : Exponential Fourier series – Parseval's theorem and power spectrum
– Eigen value problems and orthogonal functions – Regular Sturm - Liouville systems – Generalized Fourier series.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

After completing this course, students will be able to:

- 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.

TEXT BOOKS:

1. Elsgolts.L,—Differential Equation and Calculus of Variation ‖, MIRPublication,Moscow,1977.
2. Howard Anton and Chris Rorres,—Elementary Linear Algebra: Applications Version ‖, WileyIndia,NewDelhi,2010.

REFERENCES:

1. Saeed Ghahramani, —Fundamentals of Probability with Stochastic processes ‖,Pearson, Prentice Hall,NewJersey,2012.
2. Curtis F,Gerald & Patrick O Wheatly,—Applied Numerical Analysis ‖, PearsonEducation, NewDelhi,2011.
3. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice Hall, New Delhi,2005.
4. Yellen J and Gross J,—Graph Theory and its Applications ‖, Chapman & Hall, Boca Raton,2006.

192ES121 FUNDAMENTALS OF EMBEDDED SOFTWARE LTPC 3003

COURSE OBJECTIVES:

- To learn C language and assembly programming.
- To learn Object orientation for programming and C++.
- To learn software modeling fundamentals.
- To involve Discussions/ Practice/Exercise the programming knowledge in real timeapplications.

UNIT I EMBEDDED SYSTEMS (5)

Definition and examples of Embedded Systems, Embedded Systems versus General Computing Systems- Characteristics of Embedded Computing Applications, Components of a typical Embedded Systems- Design metrics- Challenges in Embedded Computing Design - Embedded System Design Approach.

UNIT II MIXING C AND ASSEMBLY (10)

Programming in Assembly – Register Usage Conventions – Typical Use of Addressing Options
– Instruction Sequencing – Procedure Call and Return – Parameter Passing – RetrievingParameters – pass by-value - Temporary Variables – I/O Programming: Interrupt Driven I/O.

UNIT III PROGRAM DESIGN AND ANALYSIS (11)

Models for Programs- State Machines – Data Flow Graphs – Control/Data Flow Graphs – Assembly and Linking Process– Basic Compilation Techniques – Cross Platform Development - Analysis and Optimization of Execution Time, Energy, Power and ProgramSize –Debugging Techniques.

UNIT IV OBJECT-ORIENTED ANALYSIS, DESIGN AND MODELLING (11)

OOAD Concepts – Development activities – Managing software development - UML overview – Modeling concepts – Dealing with complexity – Requirement elicitation – Analysis activities – System design activities – overview of Object design.

UNIT V OPEN-SOURCE IDE (8)

Installing Eclipse –Setting up GCC tool chain – Creating a simple program using multiple sourcefiles – Build- Run-Debug. DESIGN CASE STUDIES: Alarm Clock- Software MODEM - Elevator system – Automatic Teller Machine.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After completing this course, students will be able to**:**

- Explain the concepts of assembly level programming.
- Describe the various software modeling techniques.
- Analysis real time applications and debug them.
- Illustrate how a open source IDE will work.
- Design an application using embedded software.

TEXTBOOKS:

1. Wayne Wolf,―Computer as Components–Principles of Embedded Computing SystemDesign‖, Har court India Pvt.Ltd., 2001.
2. Daniel Lewis,―Fundamentals of Embedded Software where C and Assembly Meet‖,Prentice HallInc, USA, 2002.

REFERENCES:

1. Williamvon Hagen,―TheDefinitiveGuideto GCC‖,Apress, USA, 2006.
2. Arthur Griffith,―GCC:The Complete Reference‖,McGraw-Hill,USA,2002.
3. Bernd Bruegge, AllenDutoit,―Object-orientedSoftware Engineering– Using UML,PatternsandJava‖,Prentice Hall,USA, 2010.

192ES122 MICROCONTROLLERS AND APPLICATIONS LTPC 3003

COURSE OBJECTIVES:

- To introduce the fundamentals of microcontroller based system design.
- To learn the concept of I/O and RTOS role on microcontroller.
- To know Microcontroller based system design, applications.
- To understand 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 INTEL 8051 (9)

Architecture of 8051 - Memory organization - Register Banks - Bit addressable area - SFR area – Addressing modes– Instruction set –Programming examples.

UNIT II INTERRUPT OF 8051 (7)

8051 Interrupt structure -Timer modules - Serial features - Port structure - Power saving modes - MCS51 Family features: 8031/8051/8751.

UNIT III TYPICAL APPLICATIONS (10)

Stepper Motor Control - DC Motor Control – Servo motor control – AC Power Control.

UNIT IV ARM PROCESSORS (12)

ARM Programmer's Model – Registers – Processor Modes – State of the processor – Condition Flags – ARM Pipelines – Exception Vector Table – ARM Processor Families – Typical 3 stage pipelined ARM organization–Introduction to ARM Memory Management Unit. ARM Addressing Modes – ARM Instruction Set Overview – Thumb Instruction Set Overview – LPC210X ARM Processor Features.

UNIT V MICROCONTROLLER DEVELOPMENT TOOLS (7)

Compiler – Assembler – Linker/Locator – Intel Hex file format – Emulators: ROM Emulators –In-circuit Emulators –Logic Analyzer.

TOTAL : 45 PERIODS

COURSE OUTCOMES :

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

- Understand assembly and C-programming of 8051.
- Interface peripheral with Microcontroller.
- Explain about ARM microcontroller and system design.
- Enrich their knowledge with hands on experiments and project based learning.
- Effectively utilize microcontroller software development tools such as a compiler, makefiles, or compile scripts.

TEXTBOOKS:

1. "8-bit Embedded Controllers", Intel Corporation,1990.
2. William Hohl ―ARM Assembly Language Fundamental and Techniques ‖CRC PressTaylor & Francis, 2009.

REFERENCES:

1. AndrewSloss,―ARMSystemDeveloper'sGuide‖,Morgan Kaufmann Publishers,2005.
2. Steve Furber,―ARMSystem-on-Chip Architecture‖,PearsonEducation,2009.
3. ―ARM7TDMITechnicalReferenceManual‖,ARM Ltd.,UK,2004.
4. David ESimon―AnEmbeddedSoftware Primer‖,PearsonEducation, 2007.

192ES123 REAL-TIME CONCEPTS FOR EMBEDDED SYSTEMS LTPC 3003

COURSE OBJECTIVES:

- To learn fundamentals of operating system.
- To study implementation aspects of real time concepts.
- To study example RTOSs and applications.

UNIT I INTRODUCTION (9)

Introduction to Embedded Systems and Real-Time Embedded Systems – Embedded System Software Development Process–Make Utility- Mapping Executable Images into Target Embedded Systems – Embedded System Initialization- Concept of Super loop Design Approach and Operating System based Approach.

UNIT II REAL-TIME OPERATING SYSTEMS (8)

RTOS Definition – Structure of a Typical RTOS - Key Characteristics of an RTOS – Task Definition – Types of Real-time Tasks- Task States and Scheduling– Typical Task Structure and Operations.

UNIT III SYNCHRONIZATION AND COMMUNICATION (9)

Critical Sections – Atomic Operation – Concept of Re-entrancy – Semaphores- Intertask Communication Methods – Shared Memory Technique - Mutex – Mail Box - Message Queues –Pipes – Event Registers, Signals and Condition Variables.

UNIT IV EXCEPTIONS AND INTERRUPTS (11)

Introduction to Exceptions and Interrupts – Applications –Processing General Exceptions – Real-Time Clocks and System Clocks – Programmable Interval Timer – Timer Interrupt Service Routines Basic I/O Concepts – The I/O Sub-system – Memory Management – Dynamic Memory Allocation and Fixed- size Memory Allocation in Embedded Systems – Blocking and Non- Blocking Memory Functions – Hardware Memory Management Units.

UNIT V APPLICATION MODULARIZATION FOR CONCURRENCY (8)

Resource Synchronization Problems – Premature Task Deletion – CPU Starvation – Deadlocks Priority Inversion Need for Concurrency – Pseudo Concurrency and True Concurrency Outside- In Approach – Guidelines for Identifying Concurrency – Design Example: Mobile Phone.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- Explain the concepts of Real time operating systems.
- Understand about Interrupts and their functionality.
- Solve design problems like Resource Synchronization Problems and deadlockconditions.
- Design application modules using concurrent and exception concepts.
- Illustrate real time application models.

TEXTBOOKS:

1. Qing Li, ―Real-Time Concepts for Embedded Systems‖,CMP Books,2003.
2. AlbertCheng,―Real-TimeSystems:Scheduling,AnalysisandVerification‖, WileyInterscience,2002.

REFERENCES:

1. Hermann Kopetz,―Real-Time Systems: Design Principles for Distributed Embedded Applications‖,Kluwer,1997.
2. InsupLee, Joseph Leung, and Sang Son,―Handbook of Real-Time Systems‖, Chapman and Hall,2008.
3. Krishna and Kang G Shin,―Real-Time Systems‖, Mc Graw Hill, 2001.

192ES124 DESIGN OF EMBEDDED SYSTEMS LTPC 3003

COURSE OBJECTIVES:

- To provide a clear understanding on the basic concepts, Building Blocks of EmbeddedSystem.
- To learn 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 develop and anayze a new embedded processor, different Phases & Modeling of embedded system.
- To involve Discussions/ Practice/Exercise onto revising &familiarizing the conceptsacquired over the 5 Units of the subject for improved employability skills.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS (9)

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 (9)

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols - RS232 standard – RS485 –USB – Inter Integrated Circuits (I2C) – interrupt sources , Programmed-I/O busy-wait approach without interrupt service mechanism- ISR concept-– multiple interrupts – context and periods for context switching, interrupt latency and deadline -

Introduction to Basic Concept Device Drivers.

UNIT III RTOS BASED EMBEDDED SYSTEM DESIGN (9)

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 (9)

Software Development environment-IDE, assembler, compiler, linker, simulator, debugger, In circuit emulator, Target Hardware Debugging, need for Hardware-Software Partitioning and Co- Design. Overview of UML, Scope of UML modeling, Conceptual model of UML, Architectural, UML basic elements-Diagram- Modeling techniques - structural, Behavioral, Activity Diagrams.

UNIT V EMBEDDED SYSTEM APPLICATION DEVELOPMENT (9)

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.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After the completion of this course the student will be able 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 embeddedsystem.
- 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.

TEXTBOOKS:

1. Rajkamal, ‘Embedded system-Architecture, Programming, Design’, TMH,2011.
2. Peckol, “Embedded system Design”,JohnWiley&Sons,2010.
3. Shibu.K.V, “Introduction to Embedded Systems”, TataMcgraw Hill,2009.
4. Lyla B Das,” Embedded Systems-An Integrated Approach”,Pearson2013.

REFERENCES:

1. Elicia White,”Making Embedded Systems”,O’Reilly Series,SPD,2011.
2. Bruce Powel Douglass, ”Real-Time UML Workshop for Embedded Systems,Elsevier,2011.
3. Simon Monk, “Make: Action, Movement, Light and Sound with Arduino andRaspberry Pi”, O’Reilly Series ,SPD,2016.
4. Tammy Noergaard, ”Embedded System Architecture, A comprehensive Guide for Engineers and Programmers”, Elsevier, 2006.
5. Jonathan W.Valvano,”Embedded Microcomputer Systems ,Real Time Interfacing”,Cengage Learning,3rd edition,2012.
6. Michael Margolis,”Arduino Cookbook, O’Reilly Series ,SPD, 2013.

192ET12A EMBEDDED SYSTEM LABORATORY- I **LTPC 0021**

LIST OF EXPERIMENTS:

1. Programming with 8051
2. Programming with PIC Microcontroller.
3. Programming with Arduino Microcontroller Board.
4. Programmingwith AVR Microcontrollers.
5. VHDL Programming in FPGA processors.
6. Verilog Programming in FPGA processors.
7. Programming with Simulators tools.
8. Study on in-circuit Emulators, cross compilers.
9. Programming using EDWin XP PCB design software
10. Programming using MATLAB software.

TOTAL : 60 PERIODS

TEXTBOOKS:

1. Mohamammad Ali Mazidi&Mazidi ‘ 8051 Microcontroller and Embedded Systems’,Pearson Education.
2. Mohammad Ali Mazidi, RolindMckinley and Danny Causey, ‘PIC Microcontroller and Embedded Systems’ Pearson Education.
3. Simon Monk,” Make Action-with Arduino and Raspberry Pi,SPD ,2016.

REFERENCE:

1. Wesley J.Chun,”Core Python Applications Programming,3rd ed,Pearson,2016.
2. KraigMitzner, ‘Complete PCB Design using ORCAD Capture and Layout’, Elsevier.
3. VinayK.Ingle,John G.Proakis,”DSP-A Matlab Based Approach”,Cengage Learning,2010.
4. Taan S.Elali,”Discrete Systems and Digital Signal Processing with Matlab”,CRCPress2009.
5. JovithaJerome,”Virtual Instrumentation using Labview”PHI,2010.
6. Woon-SengGan, Sen M. Kuo, ‘Embedded Signal Processing with the Micro Signal Architecture’, John Wiley & Sons, Inc., Hoboken, New Jersey 2007.
7. Dogan Ibrahim, ‘Advanced PIC microcontroller projects in C’, Elsevier 2008.

192ES131 DIGITAL INSTRUMENTATION **LTPC 3003**

COURSE OBJECTIVES:

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

UNIT I DATA ACQUISITION SYSTEMS (10)

Overview of A/D converter, types and characteristics – Sampling, Errors. Objective – Building blocks of Automation systems -Calibration, Resolution, Data acquisition interfacerequirements.–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 (10)

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, Field bus.

UNIT III VIRTUAL INSTRUMENTATION BASICS (12)

Block diagram ,role and Architecture for VI— tool bar, Graphical system design &programming using GUI – Virtual Instrumentation for test, control design-modular programming-conceptual and program approaches for creation of panels, icons-Loops-Arrays-clusters-plotting data- structures-strings and File I/O- Instrument Drivers.

UNIT IV CONFIGURING PROGRAMMABLE INSTRUMENTATION (7)

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 (6)

Processor based DAS, Data loggers, VI based process measurements like temperature, pressure and level development system - DSO interface -digital controller for colour video display.

TOTAL : 45 PERIODS

COURSE 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.
- Analyze 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.

TEXTBOOKS:

1. Mathivanan, “PC based Instrumentation Concepts and practice”, Prentice-Hall India,2009.
2. JovithaJerome,”Virtual Instrumentation using Labview”PHI,2010.
3. Gregory J. Pottie / William J. Kaiser, Principles Of Embedded Networked Systems Design, CAMBRIDGE UNIVERSITY PRESS (CUP),2016.

REFERENCES:

1. Jonathan W Valvano, “Embedded Microcomputer systems”, Brooks/Cole, Thomson,2010.
2. Cory L.Clark,”Labview Digital Signal Processing & Digital Communication,TMcH,2005.
3. Lisa K. wells & Jeffrey Travis, Lab VIEW for everyone, Prentice Hall, New Jersey,1997.
4. H S Kalsi, “Electronic Instrumentation” Second Edition, Tata McGraw-Hill,2006.
5. K.Padmanabhan, S.Ananthi A Treatiseon Instrumentation Engineering ,I K Publish,2011.
6. Gary Johnson, LabVIEW Graphical Programming, Second edition, McGHill, Newyork,1997.

192ES132 EMBEDDED SYSTEM ARCHITECTURE LTPC 3003

COURSE OBJECTIVES:

- To learn the architecture of ISA models.

- To analyze the Hardware Architecture of 8/16 bit processor.
- To study about middleware and middleware applications.
- To discuss above interfacing peripherals and memory devices.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS (9)

Embedded system model – embedded standards – block diagrams – powering the hardware EMBEDDED processors: ISA architecture models– general purpose ISA models – instruction level parallelism.

UNIT II PROCESSOR HARDWARE (9)

Internal processor design: ALU – registers – control unit - clock – on chip memory – processori/o – interrupts – processor buses – processor performance.

UNIT III SUPPORT HARDWARE (9)

Board memory: ROM – RAM – cache – auxiliary memory – memory management – memory performance – board buses: arbitration and timing – integrating bus with components – bus performance.

UNIT IV SOFTWARE (9)

Middleware and applications: PPP – IP middleware – UDP – Java .application layer: FTP client – HTTP server and client.

UNIT V ENGINEERING ISSUES OF SOFTWARE (9)

Design and development: architectural patterns and reference models – creating the architectural structures –analyzing and evaluating the architecture – debugging testing, and maintaining.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- Explain the architecture of ISA models.
- Distinguish the Hardware Architecture of 8/16 bit processor.
- Summarize above issues faced in developing a software.
- Demonstrate an application in middleware and middleware applications.
- Illustrate above interfacing peripherals and memory devices.

TEXTBOOKS:

1. Rajkamal, 'Embedded system-Architecture, Programming, Design', TMH,2011.
2. KEVIN OTTO & KRISTIN WOOD, "Product Design and Development", 4th Edition,2009, Product Design Techniques in Reverse Engineering and New Product Development, , Pearson Education(LPE),2001./ISBN 9788177588217.

REFERENCES:

1. Tammy Noergaard, "Embedded system architecture", Elsevier, 2006.
2. Jean J. Labrosse, "Embedded Systems Building Blocks: Complete and Ready-To-Use.

192ES133 REAL TIME SYSTEMS LTPC 3003

COURSE OBJECTIVES:

- To understand the fundamentals of Real Time systems.
- To analyze the fundamentals of Scheduling and features of programming languages.
- To study the data management system for real time.
- To learn the fundamentals of real time communication.

- To discuss and examine the different algorithms and techniques used for real time systems.

UNIT I INTRODUCTION TO TASK SCHEDULING (9)

Introduction - Issues in Real Time Computing, Structure of a Real Time System, Task classes, Performance Measures for Real Time Systems, Task Assignment and Scheduling – Classical Uni processor scheduling algorithms, RM algorithm with different cases-Priority ceiling- precedence constraints- using of primary and alternative tasks.

UNIT II UNI AND MULTI PROCESSOR SCHEDULING (9)

Uniprocessor scheduling of IRIS tasks, Task assignment, Utilization balancing – Next fit- Bin packing- Myopic off-line - Focused addressing and bidding- Buddy strategy- Fault Tolerant Scheduling.-Aperiodic scheduling - Spring algorithm, Horn algorithm- Bratley. – Sporadic scheduling.

UNIT III REAL TIME COMMUNICATION (9)

Introduction – VTCSMA – PB CSMA- Deterministic collision resolution protocol- DCR for multi packet messages- dynamic planning based- Communication with periodic and aperiodic messages.

UNIT IV REAL TIME DATABASES (9)

Basic Definition, Real time Vs General purpose databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Two-phase Approach to improve Predictability, Maintaining Serialization Consistency, Databases for Hard Real Time System.

UNIT V REAL-TIME MODELING AND CASE STUDIES (9)

Petrinets and applications in real-time modeling, Air traffic controller system – Distributed air defense system.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- Explain students to the fundamentals of Real Time systems.
- Recall fundamentals of Scheduling and features of programming languages.
- Analyze data management system for real time.
- Illustrate fundamentals of real time communication.
- Determine different algorithms and techniques used for real time systems.

TEXTBOOKS:

1. C.M. Krishna, Kang, G.Shin, “Real Time Systems”, McGraw Hill, 1997.
2. MarkoGargenta,”Learning Android “,O’reilly 2011.
3. Herma K., “Real Time Systems – Design for distributed Embedded Applications”, Kluwer Academic, 1997.

REFERENCES:

1. Giorgio C. Buttazzo , “Hard real-time computing systems: predictable scheduling algorithms and applications” , Springer, 2008.
2. Corbet Rubini, Kroah-Hartman, “Linux Device Drivers”, O’reilly, 2016.
3. MukeshSighal and N G Shi “Advanced Concepts in Operating System”, McGraw Hill,2000.
4. D.M.Dhamdhere,” Operating Systems, A Concept-Based Approch,TMH,2008.

192ES134 SOFT COMPUTING AND OPTIMIZATION TECHNIQUES LTPC 3003

COURSE OBJECTIVES:

- 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 (9)

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. Fundamentals of neural network: biological neuron, artificial neuron, activation function, single layer perceptron – limitations. Multi-layer perceptron – back propagation algorithm.

UNIT II ARTIFICIAL NEURAL NETWORKS (9)

Radial basis function networks – reinforcement learning. Hopfield / recurrent network – configuration – stability constraints, associative memory and characteristics, limitations and applications. Hopfield vs. Boltzmann machine. Advances in neural networks – convolution neural networks. Familiarization of Neural network toolbox.

UNIT III FUZZY LOGIC AND NEURO FUZZY SYSTEMS (9)

Fundamentals of fuzzy set theory: fuzzy sets, operations on fuzzy sets, scalar cardinality, union and intersection, complement, equilibrium points, aggregation, projection, composition. Fuzzy membership functions. Fundamentals of neuro-fuzzy systems – ANFIS. Familiarization of ANFIS Toolbox.

UNIT IV INTRODUCTION TO OPTIMIZATION TECHNIQUES (9)

Classification of optimization problems – classical optimization techniques. Linear programming – simplex algorithm. Non-linear programming – steepest descent method, augmented Lagrangemultiplier method – equality constrained problems.

UNIT V ADVANCED OPTIMIZATION TECHNIQUES (9)

Simple hill climbing algorithm, Steepest ascent hill climbing – algorithm and features. Simulated annealing – algorithm and features. Genetic algorithm: working principle, fitness function. Familiarization with Optimization Toolbox.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- Comprehend the fundamentals of artificial neural network.
- Realize fuzzy systems and optimization techniques.
- Recognize the significance of various optimization algorithms applied to engineering problems.
- Develop an ANN-based models.
- Be capable of choosing appropriate optimization techniques for engineering applications.

TEXTBOOKS:

1. Singiresu S. Rao, “Engineering Optimization – Theory and Practice”, 4th edition, John Wiley &Sons, 2009.
2. Thomas Weise, “Global Optimization algorithms – Theory and applications”, self- published, 2009.

REFERENCES:

1. Laurene V. Fausett, “Fundamentals of neural networks, architecture, algorithms and applications, Pearson Education, 2008.
2. Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, “Neuro-Fuzzy and soft computing”,Prentice Hall of India, 2003.
3. Simon Haykin, “Neural Networks – A comprehensive foundation”, Pearson Education, 2005.
4. David E. Goldberg, “Genetic algorithms in search, optimization and machine learning”, Pearson Education, 2009.

5. Singiresu S. Rao, “Engineering Optimization – Theory and Practice”, 4th edition, John Wiley &

Sons, 2009.
6. Thomas Weise, “Global Optimization algorithms – Theory and applications”, self- published, 2009.

SEMESTER II

192ES225 DIGITAL SYSTEM DESIGN AND TESTING LTPC 3204

COURSE OBJECTIVES:

- To learn the fundamentals of sequential system design, Asynchronouscircuits, switching errors.
- To analyze the fundamentals of modeling through comparative study on the classificationof commercial family of Programmable Device.
- To study on Fault identification in digital switching circuits.
- To analyze the logics to design a Programmable Devices.
- To involve Discussions/ Practice/Exercise onto revising &familiarizing the conceptsacquired over the 5 Units of the subject for improved employability skills

UNIT I REVIEW OF DIGITAL SYSTEM DESIGN (3)

Designing combinational circuit using multiplexer, decoder – Finite State Machines – Mealy Machine-Moore Machine – State Diagram –State table

UNIT II SYSTEM DESIGN USING PLDS (6)

Basic concepts – Programming technologies - Programmable Logic Element (PLE) – Programmable Array Logic (PLA)-ProgrammableArrayLogic(PAL)– ProgrammableLogicArchitectures–16L8–16R4–22V10– Design of combinational and sequential circuits using PLDs – Complex PLDs (CPLDs) –Xilinx cool runner architecture - Design of state machines using Algorithmic State Machines (ASM) chart as a design tool.

UNIT III FIELD PROGRAMMABLE GATE ARRAYS (7)

Types of FPGA - Xilinx XC3000 series - Logic Cell Array (LCA) – Configurable Logic Blocks (CLB) - Input/Output Blocks (IOB) - Programmable Interconnection Points (PIP) - Xilinx XC4000 Series – FPGA – Design examples.

UNIT IV INTRODUCTION TO VHDL (10)

Design process flow - Software tools – Hardware Description Languages – VHDL : Data Objects - Data types - Operators – Entities and Architectures – Components and Configurations – Concurrent signal assignment – Conditional signal assignment - Selected signal assignment – Concurrent statements – Sequential statements – Transport and Inertial delays – Delta delays – Behavioral, Data flow and Structural modeling – Attributes – Generics – Packages and Libraries
– Multivalued logic and Signal resolution – IEEE 1164 std logic – Subprograms: Functions and Procedures –Design examples.

UNIT V FAULT MODELING (12)

Defects, errors, faults, Levels of Fault models, Types, Fault Detection in Combinational Logic circuits: Path sensitization method, Boolean difference method. Fault Detection in sequential logic circuit, Design for Testability: Scan path Testing, Boundary Scan Test, Built in Self Test.

UNIT VI FAULT - TOLERANT SYSTEMS (7)

Fault avoidance and fault - tolerance - Techniques of fault - tolerance - Hardware fault - tolerance : Static, Dynamic and Hybrid redundancy - Fault - tolerance in memories. Software Fault - tolerance : Design of fault tolerant software - N-version programming - Recovery block - Reliability models for fault tolerant software.

TOTAL : 45 PERIODS

COURSE 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 givenapplication.
- Learners can acquire knowledge about HDL programming.
- Improved Employability and entrepreneurship capacity due to knowledge up gradationon recent trends in digital design for embedded systems.

TEXTBOOKS:

1. Palmer, J.E., Perlman, D.E., "Introduction to Digital Systems", Tata McGraw Hill, New
2. Delhi,Reprint1996.
3. Nelson, V.P., Nagale, H.T., Carroll, B.D., and Irwin, J.D., "Digital Logic Circuit Analysis and Design", Prentice Hall International, Inc., NewJersey,1995.

REFERENCES:

1. BhaskarJ.,―AVHDL Primer‖,PrenticeHallofIndialearinng,2012.
2. CharlesHRothandLizyKurianJohn―DigitalSystemsDesignUsingVHDL,‖CengageLe arning,2013.
3. MichaelLBushnell,VishwaniDAgrawal,―EssentialsofElectronicTestingFordigitalme moryandmixed signal VLSI circuits‖,Springer, 2002.
4. Pradhan, D K., "Fault - Tolerant Computing - Theory and Techniques", Vol. I & II, PrenticeHall,1986.

192ES224 EMBEDDED PROCESSORS LTPC 3003

COURSE OBJECTIVES:

- To learn about hardware for embedded system application based on the processors.
- To know about ARM Family of processors.
- To Define Incorporate suitable microcontroller along with appropriate interfacing circuits.
- To develop an application with software programs.
- To analyze microcontrollers and provide apt solutions for any embedded Application.

UNIT I MSP430 MICROCONTROLLER ARCHITECTURE (9)

Low Power 16-bit MSP430x5xx microcontroller architecture, address space, on-chip peripherals(analog and digital), and Register sets. Instruction set, instruction formats, and various addressing modes of MSP430 devices; Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, System clocks.

UNIT II REAL WORLD INTERFACING (9)

GPIO programming and I/O multiplexing; Interrupts and interrupt programming. Watchdog timer.Timers & Real Time Clock (RTC), PWM control. Analog interfacing and data acquisition: ADC and Comparator in MSP430, data transfer using DMA. Serial communication basics, Synchronous/Asynchronous interfaces (like UART, USB, SPI, and I2C). UART protocol, I2C protocol, SPI protocol. Implementing and programming UART, I2C, SPI interface using

MSP430, Interfacing external devices.

UNIT III ARM7 (9)

Introduction to ARM processors and its versions. ARM7, ARM9 & ARM11 comparison, advantages & suitability in embedded application. ARM7 data flow model, programmer's model, modes of operations, Instruction set.

UNIT IV REAL WORLD INTERFACING WITH ARM7 BASED MICROCONTROLLER (9)
Interfacing the peripherals to LPC2148: GSM and GPS using UART, on-chip ADC using interrupt (VIC), EEPROM using I2C, SD card interface using SPI, on-chip DAC for waveform generation.

UNIT V ARM CORTEX PROCESSORS (9)
Introduction to ARM CORTEX series, improvement over classical series and advantages for embedded system design. CORTEX A, CORTEX M, CORTEX R processors series, versions, features and applications. Need of operating system in developing complex applications in embedded system, desired features of operating system & hardware support from processor.

TOTAL : 45 PERIODS

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

- Develop the hardware for embedded system application based on the processors.
- Explain about ARM Family of processors.
- Incorporate suitable microcontroller along with appropriate interfacing circuits.
- Implement the same for an application with software programs.
- Explore the features of the microcontrollers and provide apt solutions for any embedded Application.

TEXTBOOKS:

1. The Definitive Guide to the ARM Cortex-M3, Joseph Yiu, Second Edition, Elsevier Inc.2010.
2. AndrewNSloss,DominicSymes,ChrisWright,"ARMSystemDeveloper'sGuide-Designing and Optimizing System Software", 2006, Elsevier.

REFERENCES:

1. Steve Furber, "ARM System-on-Chip Architecture", 2nd Edition, Pearson Education.
2. Cortex-M series-ARM Reference Manual.
3. Cortex-M3 Technical Reference Manual(TRM.)
4. Embedded/Real Time Systems Concepts, Design and Programming Black Book, Prasad, KVK.
5. DavidSeal"ARMArchitectureReferenceManual",2001AddisonWesley,England;MorganKaufmannPublishers6.STM32L152xx ARM Cortex M3 Microcontroller Reference Manual.

192ES222 EMBEDDED SYSTEM NETWORKS LTPC 3003

COURSE OBJECTIVES:

- To understand the fundamentals of Bus architecture.
- To learn the GNU C Programming.
- To study basic concepts of embedded C ,CAN.
- To analyze the concept of USB and Network security.
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.

UNIT I THE CAN BUS (5)
Introduction – Concepts of Bus Access and Arbitration – Error Processing and Management – Definition of the CAN Protocol ISO 11898-1 – Error Properties, Detection and Processing– Framing.

UNIT II THE CAN PHYSICAL LAYER (10)
Introduction – Signal Propagation – Bit Synchronisation – Network Speed and Range – High Speed CAN – Low Speed CAN – CAN Components – Event-Triggered and Time-Triggered Protocols - CAN Applications: Application Layers and Development ToolsforCAN - Introduction of Communication

Protocols used in Automobiles : LIN, MOST Flex ray.

UNIT III USB (10)

Introduction – Types of USB Transfers: Control Transfer – Bulk Transfer – Interrupt Transfer – Isochronous Transfer – Introduction to the Enumeration Process – Introduction to USB Development Tools.

UNIT IV NETWORK SECURITY (11)

Introduction – Confidentiality – Message Integrity - Message Authentication - Digital Signature - Entry Authentication - Key management – Internet Security–Firewalls.

UNIT V TCP/IP FOR EMBEDDED SYSTEM (9)

Introduction – Embedded SMTP Client – Embedded SMTP Server – Case Studies: IP Security Camera – Vending Machine – Internet Radio –Ethernet Gateway.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- Explain the fundamentals of Bus architecture.
- Design GNU C Programming.
- Understands basic concepts of embedded C, CAN.
- Analyze USB and Network security concepts.
- Develop an Embedded systems with the help of TCP/IP approach.

TEXTBOOKS:

1. Dominique Paret,―Multiplexed Networks for EmbeddedSystems‖,Wiley,2007.
2. John Hyde,―USB Design by Example ‖,Intel University Press, 2001.

REFERENCES:

1. Jan,Axelson,―USBComplete‖,LakeViewResearch,2005.
2. Behrouz A Forouzan and Firouz Mosharraf,‖ Computer Network– a Top Down
3. Approach‖, Tata Mc Graw Hill Education Pvt .Ltd., NewDelhi,2012.
4. Edward Insam,―TCP/IPEmbeddedInternetApplications‖,Elsevier,2003.
5. Tim Jones,―TCP/IP Application Layer Protocols fo rEmbedded Systems ‖, Charles River Media,2002.

192ES223 OBJECT COMPUTING AND DATASTRUCTURES LTPC 3204

COURSE OBJECTIVES:

- To understand Object Oriented Programming concepts.
- To know the principles of packages, inheritance and interfaces.
- To define exceptions and use I/O streams.
- To learn linear data structures List, Stack and Queue.
- Analyze the concept of sorting, searching and hashing algorithms.

UNIT I PRINCIPLES OF OBJECT ORIENTED PROGRAMMING (4+1)

Software Crisis - Software Evolution - Procedure Oriented Programming, Object Oriented Programming paradigm - Basic concepts and benefits of OOP - Object Oriented Language - Application of OOP - Structure of C++ - Applications of C++ - Operators in C++-Manipulators.

UNIT II FUNCTIONS IN C++ (5+2)

Call by Reference - Return by reference - Inline functions - Default, Const Arguments - Function Overloading - Friend Functions - Classes and Objects - Member functions - Nesting of Member functions -Private member functions - Memory allocation for Objects - Static data members - Static Member

Functions - Arrays of Objects -Objects as Function Arguments - Friend Functions
– Pointers to Members.

UNIT III CONSTRUCTORS (4+1)
Parameterized Constructor-Copy constructor - Multiple Constructors in a Class–Destructors.

UNIT IV INHERITANCE (4+2)
Defining Derived Classes - Single Inheritance - Making a Private Member Inheritable - Multiple Inheritance - Hierarchical Inheritance –Hybrid Inheritance.

UNIT V POLYMORPHISM (4+2)
Compile and Run Time Polymorphism – Operator Overloading –Virtual function.

UNIT VI DATA STRUCTURES (4+0)
Abstract data Types - Primitive data structures - Analysis of algorithms - Best, worst and average case time complexities–Notation.

UNIT VII ARRAYS (4+2)
Operations - Implementation of one, two, three and multi dimensioned arrays - Sparse and dense matrices -Applications.

UNIT VIII STACKS (4+1)
Primitive operations - Sequential implementation - Applications: Subroutine handling, Recursion.

UNIT IX QUEUES (4+1)
Primitive operations - Sequential implementation – Dequeues – Applications: Job Scheduling.

UNIT X LISTS (5+1)
Primitive Operations - Singly linked lists, Doubly linked lists, Circular lists – Applications: Addition of Polynomials, Sparse Matrix representation and Operations - Linked Stacks –Linked queues.

UNIT XI SORTING (3+2)
Insertion sort - Selection sort - Bubble sort - Radix sort - Algorithms and their time complexities.

TOTAL : 60 PERIODS

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

- Recognize Object Oriented Programming concepts.
- Explain principles of packages, inheritance and interfaces.
- Summarize exceptions and use I/O streams.
- Illustrate linear data structures List, Stack and Queue.
- Demonstrate sorting, searching and hashing algorithms.

TEXTBOOKS:

1. StanleyBLippman,JoseeLajoieandBarbaraEMoo,―The C++Primer‖,PearsonEducation,NewDelhi,2009.
2. SahniSartaj, "Data Structures, Algorithms and Applications in C++", Universities Press,Hyderabad,2005.

REFERENCES:

1. AaronMTanenbaum,MosheJAugensteinandYedidyahLangsam,"Data structures using C and C++", Pearson Education, NewDelhi,2009.
2. HarveyMDeitel,andPaulJDeitel,―C++ HowtoProgram‖,PrenticeHall,NewDelhi,2010.
3. HerbertSchildt,―C++-The CompleteReference",TataMcGrawHill,NewDelhi,2012.
4. NellDale,―C++PlusDataStructures‖,Jones&Bartlett,Massachusetts, 2011.

192ES221 REAL-TIME OPERATING SYSTEMS LTPC
3003

COURSE OBJECTIVES:

- To learn the fundamentals of interaction of OS with a computer andUser computation.
- To understand fundamental concepts of how process are created and controlled with OS.
- To study the programming logic of modeling Process based on range of OS features.
- To study the different types and Functionalities of commercial OS, application development usingRTOS.
- To involve Discussions/Practice/Exercise onto revising &familiarizing the conceptsacquired over the 5 Units of the subject for improved employability skills.

UNIT I REAL-TIME SYSTEMS (7)

Introduction - The concept of time - Limits of current real-time systems - Desirable features of real-time systems - Achieving predictability – DMA – Cache – Interrupts - System calls – Semaphores - Memory management - Programming language - Types of task constraints - Timing constraints - Precedence constraints - Resource constraints - Definition of scheduling problems - Classification of scheduling algorithms - Guarantee-based algorithms - Best-effort algorithms - Metrics for performance evaluation – Scheduling anomalies.

UNIT II PERIODIC TASK SCHEDULING (7)

Introduction - Processor utilisation factor - Timeline scheduling - Rate monotonic scheduling - Earliest deadline first algorithm - Deadline monotonic algorithm - EDF with constrained deadlines - Comparison between RM and EDF algorithms.

UNIT III APERIODIC TASK SCHEDULING (6)

Jackson‟s algorithm - Horn‟s algorithm - Non-preemptive scheduling - Bratley‟s algorithm - The spring algorithm - Scheduling with precedence constraints.

UNIT IV FIXED -PRIORITY SERVERS (8)

Background scheduling – Polling server – Deferrable server – Priority exchange algorithm – sporadic server- Slack stealing – Performance evaluation – Introduction to dynamic priority server – Dynamic priority exchange server.

UNIT V RESOURCE ACCESS PROTOCOLS (6)

Priority inversion – Non-preemptive protocol – Highest locker priority protocol – Priority inheritance protocol – Priority ceiling protocol.

UNIT VI MICRIUM OS (6)

Structure of Micrium Real-Time Kernel - Process states – Data structures – Time management – Task classes and scheduling algorithm – List management – Task management – Resource Management - Task Synchronization – Inter-task Communication.

UNIT VII APPLICATION DESIGN ISSUES (5)

Introduction – Time constraints definition – Obstacle avoidance – Robot deburring – Examplesof real-time robotics applications – Standards for real-time operating systems – RS-POSIX – OSEK/VDK – Commercial real-time systems –Development tools.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- Analyze Real-time scheduling and schedulability analysis, including clock-driven and priority-driven scheduling
- Understand Theoretical background (specification/verification) and practical knowledgeof real-time operating systems.

- Develop multitasking techniques in real- times ystems.
- Recognize the fundamental concepts of real-time operating systems.
- Improve their entrepreneurship capacity due to knowledge up gradation on recent trendsin embedded systems design.

TEXTBOOKS:

1. Silberschatz,Galvin,Gagne" Operating System Concepts,6th ed,John Wiley,2003.
2. Charles Crowley, "Operating Systems-A Design Oriented approach" McGraw Hill,1997.
3. Raj Kamal, "Embedded Systems- Architecture, Programming and Design" Tata McGrawHill,2006.

REFERENCES:

1. Giorgio C.Buttazzo,―Hard Real-TimeComputingSystems‖,Springer,NewYork, 2011.
2. Jean J. Labrosse, ― µC/OS-III, The Real-Time Kernel‖, MicriumPress,2009. JaneW.Liu,―Real-TimeSystems‖,Pearson, NewDelhi,2006.

192ET22A EMBEDDED SYSTEM LABORATORY- II LTPC 0021

LIST OF EXPERIMENTS:

1. Programming ARM Processor
2. Programming with Rasberry Pi Microcontroller Board.
3. Programming with DSP Processors.
4. Programming with free software's /Platforms.
5. Programming & Simulation in Python Simulators and Others.
6. Programming with Arduino boards.
7. Programming with EDWinXP Tool.

TOTAL : 60 PERIODS

REFERENCES:

1. MohamammadAli Mazidi&Mazidi ' 8051 Microcontroller and Embedded Systems', Pearson Education.
2. Mohammad Ali Mazidi, RolindMckinley and Danny Causey, 'PIC Microcontroller and Embedded Systems' Pearson Education.
3. Simon Monk," Make Action-with Arduino and Raspberry Pi,SPD,2016.
4. Wesley J.Chun,"Core Python Applications Programming,3rded,Pearson,2016.
5. KraigMitzner, 'Complete PCB Design using ORCAD Capture and Layout', Elsevier.
6. VinayK.Ingle,John G.Proakis,"DSP-A Matlab Based Approach",CengageLearning,2010
7. Taan S.Elali,"Discrete Systems and Digital Signal Processing with Matlab",CRCPress2009.
8. JovithaJerome,"Virtual Instrumentation usingLabview"PHI,2010.
9. Woon-senggan, SenM.Kuo,'Embedded signal processing with the Micro signal Architecture', John Wiley&Son s,Inc.,Hoboken, New Jersey 2007.
10. Dogan Ibrahim, 'Advanced PIC microcontroller projects in C', Elsevier 2008.

ELECTIVE 2

192ES231 AUTOMOTIVE EMBEDDED SYSTEMS LTPC 3003

COURSE OBJECTIVES:

- To understand the fundamentals and building of Electronic Engine Control

systems.

- To learn the concept of functional components and circuits for vehicles.
- To discuss on programmable controllers for vehicles.
- To learn the 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 INTRODUCTION (7)

Current trends in modern automobiles – Drive by wire Systems -Vehicle functional domains and their requirements - Components of an Automobile Electronic system and their functions:Sensors, Actuators, Control Units and Software structure of Control units.

UNIT II POWER TRAIN, BODY AND CHASSIS DOMAIN (9)

Power Train Domain: Gasoline engine management -Body Electronics: Vehicle power supply controllers – Lighting technology– Adaptive lighting system – Automatic wiper system – Door control modules – Vehicle to vehicle communication-Chassis Domain: Antilock Braking System (ABS) –Electronic Stability Program (ESP)

UNIT III AUTOMOTIVE INFOTRONICS (8)

Automotive Vision System - Advanced Driver Assistant Systems (ADAS) – Multimedia systems-Intelligent Automotive Systems: Navigation Systems – Adaptive Cruise Control (ACC)

UNIT IV SAFETY AND SECURITY SYSTEMS (8)

Active and Passive safety- Airbag System – Seat belt tightening system - Electronic Brake Force Distribution (EBD) - Lane Departure Warning System - Anti-theft technologies – Electronic Immobilizers – Remote Keyless entry.

UNIT V AUTOMOTIVE NETWORKING (9)

Cross-system functions - Bus systems: Requirements, classification and applications – coupling of networks- CAN – LIN – MOST – Flex Ray – Diagnostic Interfaces – examples of networked vehicles.

UNIT VI DIAGNOSTICS (4)

Introduction – Diagnostics Theory – On-Board Diagnostics – Off-board diagnostics – Diagnostics Link Connector – Vehicle Condition Monitoring.

TOTAL : 45 PERIODS

COURSE 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,
- Develop a product or a service required for developing a startup idea used forautomotive applications.
- Improved Employability and entrepreneurship capacity due to knowledge up gradationon recent trends in embedded systems design.

TEXTBOOKS:

1. NicolasNavetand Francoise Simonot-Lion,―AutomotiveEmbedded Systems Handbook‖,CRCPress,USA,2008.
2. RobertBosch,‖Automotive lectricsAutomotiveElectronics‖,Wiley(5THEdition),2010.

REFERENCES:

1. LjuboVlacic,MichelParent&FurnioHarshima,―IntelligentVehicleTechnologies:Theoryand Applications‖,Butterworth- Heinemann publications, 2001.

2. RobertBosch,―AutomotiveHandBook‖,SAE(5THEdition),2000.
3. Bechhold,―UnderstandingAutomotive Electronics‖,SAE1998.

192ES232 EMBEDDED NETWORKING LTPC 3003

COURSE OBJECTIVES:

- To study the Serial and parallel communication protocols.
- To develop an application using USB and CAN bus for PIC microcontrollers.
- To develop an application using Embedded Ethernet for Rabbit processors.
- To understand the concept of Wireless sensor network communication protocols.

UNIT I EMBEDDED COMMUNICATION PROTOCOLS (9)

Embedded Networking: Introduction – Serial/Parallel Communication – Serial communication protocols - RS232 standard – RS485 – Synchronous Serial Protocols -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) – PC Parallel port programming - ISA/PCI Bus protocols – Firewire.

UNIT II USB AND CAN BUS (9)

USB bus – Introduction – Speed Identification on the bus – USB States – USB bus communication: Packets –Data flow types – Enumeration –Descriptors –PIC 18 Microcontroller USB Interface – C Programs –CAN Bus – Introduction - Frames –Bit stuffing – Types of errors –Nominal Bit Timing – PIC microcontroller CAN Interface –A simple application with CAN.

UNIT III ETHERNET BASICS (9)

Elements of a network – Inside Ethernet – Building a Network: Hardware options – Cables, Connections and network speed – Design choices: Selecting components –Ethernet Controllers
– Using the internet in local and internet communications – Inside the Internet protocol.

UNIT IV EMBEDDED ETHERNET (9)

Exchanging messages using UDP and TCP – Serving web pages with Dynamic Data – Serving web pages that respond to user Input – Email for Embedded Systems – Using FTP – Keeping Devices and Network secure.

UNIT V WIRELESS EMBEDDED NETWORKING (9)

Wireless sensor networks – Introduction – Applications – Network Topology – Localization – Time Synchronization - Energy efficient MAC protocols –SMAC – Energy efficient and robust routing – Data Centric routing.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- Elucidate Serial and parallel communication protocols
- Develop Application using USB
- Outline about CAN bus for PIC microcontrollers.
- Demonstrate Application using Embedded Ethernet for Rabbit processors.
- Summarize Wireless sensor network communication protocols.

TEXTBOOKS:

1. Krzysztof Iniewski,"Smart Grid ,Infrastructure & Networking",TMcGH,2012.
2. Shih-Lin Wu,Yu-Chee Tseng,{"Wireless Ad Hoc Networking, PAN, LAN, SAN, Aurebach Pub,2012

REFERENCES:

1. Embedded Systems Design: A Unified Hardware/Software Introduction - Frank Vahid, Tony

Givargis, John & Wiley Publications, 2002
2. Parallel Port Complete: Programming, interfacing and using the PCs parallel printer port - Jan Axelson, Penram Publications, 1996.

192ES233 EMBEDDED PRODUCT DEVELOPMENT LTPC
3003

COURSE OBJECTIVE:

- The understand the basic concepts of product design, product features andits architecture.

UNIT I CONCEPTS OF PRODUCT DEVELOPMENT (12)

Need for PD- Generic product Development Process Phases- Product Development Process Flows- Product Development organization structures-Strategic importance of Product Planning process – Product Specifications-Target Specifications-Plan and establish product specifications - integration of customer, designer, material supplier and process planner, Competitor and customer Understanding customer and behavior analysis. Concept Generation, Five Step Method-Basics of Concept selection- Creative thinking –creativity and problem solving- creative thinking methods- generating design concepts-systematic methods for designing – functional decomposition – physical decomposition.

UNIT II INTRODUCTION TO APPROACHES IN PRODUCT DEVELOPMENT (12)

Product development management - establishing the architecture - creation - Product Architecture changes - variety – component standardization , clustering -geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems - architecture of the chunks - creating detailed interface specifications- Portfolio Architecture competitive benchmarking- Approach for the benchmarking process- Design for manufacturing - Industrial Design-Robust Design – Prototype basics - Principles of prototyping - Planning for prototypes- Economic & Cost Analysis - Testing Methodologies- Product Branding.

UNIT III INDUSTRIAL DESIGN STRATEGIES (6)

Role of Integrating CAE, CAD, CAM tools for Simulating product performance and manufacturing processes electronically- Basics on reverse engineering – Reverse engineering strategies – Finding reusable software components – Recycling real-time embedded software based approach and its logical basics- Incorporating reverse engineering for consumer product

development –case study on DeskJet Printer.

UNIT IV ELECTRONIC PRODUCT DEVELOPMENT STAGES (6)

Product Development Stages-Embedded product modeling- Linear, Iterative, Prototyping, Spiral
- Selection of Sensor, Voltage Supply, Power supply protection, Grounding and noise elimination methods, Thermal protection with heat management – PCB design steps – Software design and testing method – documentation.

UNIT V EMBEDDED PRODUCTS DESIGN (9)

Creating general Embedded System Architecture(with Case study example: Mobile Phone / DeskJet Printer./ Robonoid as a product) -Architectural Structures- Criteria in selection of Hardware & Software Components, processors, input/output interfaces & connectors, ADC System ,Memory ,choosing Bus Communication Standards, Criteria in selection of Embedded OS/Device Drivers, Need for Developing with IDE, Translation & Debugging Tools & Application Software, Performance Testing, Costing, Benchmarking ,Documentation.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On completion of the course the student will be able to

- Realize the integration of customer requirements in product design.
- Apply structural approach to concept generation, creativity, selection and testing.
- Comprehend various aspects of design such as industrial design.

- Design a Consumer specific product , Reverse Engineering manufacture ,economicanalysis 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.

TEXTBOOKS:

1. "Product Design and Development", Anita Goyal, Karl T Ulrich, Steven D Eppinger, McGraw – Hill International Edns.1999/ Tata McGrawEducation,ISBN-10-007- 14679-9.
2. R.G. Kaduskar and V.B. Baru, " Electronic Product Design", Wiley,2014.
3. George E.Dieter, Linda C.Schmidt, "Engineering Design", McGraw-Hill International Edition,4th Edition, 2009, ISBN978-007-127189-9.

REFERENCES:

1. Stephen Armstrong, Engineering and Product Development Management ; The Holistic Approach, CAMBRIDGE UNIVERSITY PRESS (CUP),2014.
2. Rajkamal, „Embedded system-Architecture, Programming, Design",TMH,2011.
3. KEVIN OTTO & KRISTIN WOOD, "Product Design and Development", 4th Edition,2009,Product.
4. Design Techniques in Reverse Engineering and New Product Development, , Pearson Education (LPE),2001./ISBN 9788177588217.
5. YousefHaik, T. M. M. Shahin, "Engineering Design Process", 2nd Edition Reprint, Cengage Learning, 2010, ISBN0495668141.
6. Clive L.Dym, Patrick Little, "Engineering Design: A Project-based Introduction", 3rd Edition,John Wiley& Sons, 2009, ISBN 978-0-470-22596-7.

192ES234 PYTHON PROGRAMMING LTPC 3003

COURSE OBJECTIVES:

- Students will learn the grammar of Python programming language.
- Students will understand and be able to use the basic programming principles such asdata types, variable, conditionals, loops, recursion and function calls.
- Students will learn how to use basic data structures such as List, Dictionary and be ableto manipulate text files and images.
- Students will understand the process and will acquire skills necessary to effectivelyattempt 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 (9)

Introduction to Python language – Using the interpreter – Python data types and functions – Working with Data – List, Dictionary and Set – Processing Primitives – List comprehensions – File Handling – Object model including Variables, Reference counting, Copying, and Type checking – Error handling.

UNIT II PROGRAM ORGANIZATION AND FUNCTIONS (9)

Organize Large programs into functions – Python functions including scoping rules and documentation strings – Modules and Libraries – Organize programs into modules – System administration, Text rocessing, Subprocesses, Binary data handling, XML parsing and DatabaseAccess – Installing third-party libraries.

UNIT III CLASSES AND OBJECTS (9)

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 (9)

Python Software development – Use of documentation string – Program testing using doc test and unit test 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.

UNIT V TEXT I/O HANDLING (9)

Text generation, Template strings and Unicode-packages – Python Integration Primer – Network programming – Accessing C code Survey on how Python interacts with other languageprograms.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- Explain the grammar of Python programming language.
- Summarize basic programming principles such as data types, variable, conditionals,loops, recursion and function calls.
- Recall basic data structures such as List, Dictionary and be able to manipulate text filesand images.
- Examine a process and will acquire skills necessary to effectively attempt aprogramming problem and implement it with a specific programming language -Python.
- Demonstrate an application using Python Integration Primer.

TEXTBOOKS:

1. Mark Lutz,"LearningPython,PowerfulOOPs,O"reilly,2011.
2. Robert Sedgewick, Kevin Wayne ,RobertDondero, Intr Programming in Python,Pearson,2016.

REFERENCES:

1. MarkJ.Guzdial,BarbaraEricson,"IntroductiontoComputing&ProgramminginPython,4th Edition Pearson,2015.
2. Budd, Timothy. Exploring Python. McGraw-Hillscience,2009.
3. Guttag, John. Introduction to Computation and Programming Using Python. MIT Press,2013.
4. Zelle,JohnM.Python Programming: An Introduction to Computer Science.1sted.Franklin Beedle & Associates,2003.

SEMESTER III

192ES331 ADVANCED EMBEDDED CONTROLLERS LTPC 3003

COURSE OBJECTIVES:

- To familiarize about the features, specification and features of modern microprocessors.
- To gain knowledge about the architecture of Intel 32 and 64 bit microprocessors andsalient features associated with them.
- To familiarize about the features, specification and features of modern microcontrollers.
- To gain knowledge about the 32 bit microcontrollers based on ARM.

UNIT I ARCHITECTURE OF MIXED SIGNAL PROCESSOR (10)

Introduction to 16-bit Mixed Signal Controller- Important aspects of Mixed Signal Controller's Hardware – CPU – Functional Block Diagram - Memory Mapping – Clock System - Addressing Modes - Register Mode – Indexed Mode – Introduction to functions – Interrupts - Low Power Modes - Development Environment - Programming and Debugging.

UNIT II PERIPERALS OF MIXED SIGNAL PROCESSOR (10)

Parallel ports - Digital Inputs/ Outputs – Timers - Watchdog Timer- Capture/Compare module – Generation of Periodic Signal – Generation of PWM Signal - Operation of the ADC Peripheral (ADC10) - Internal Temperature Sensor – Serial Communication Protocols.

UNIT III ARCHITECTURE OF ARM CORTEX – M4 (10)

ARM Cortex-M4 Processor Core overview - Programmers Model - Memory Model - Exception and Fault Handling - Power Management - Instruction Set Summary - CMSIS Functions - Hardware-Software Synchronization - Interrupt Synchronization - Multithreading - Register Map
- System Timer - Nested Vectored Interrupt Controller - Floating Point Unit (FPU)-Optional Memory Protection Unit.

UNIT IV PERIPHERALS OF ARM CORTEX – M4 CONTROLLER (10)

Cortex-M4 Peripherals - Parallel I/O Ports - Timer Interfacing - Pulse Width Modulation - Frequency Measurement - Binary Actuators - Integral Control of a DC Motor – DAC - ADC - Serial Communication Protocols.

UNIT V PROCESSOR AND CONTROLLER (5)

Design and Development of Embedded Systems Using MSP430 Processor and Arm Cortex Controllers.

TOTAL : 45 PERIODS

OUTCOMES:

After completion of the course, the students should be able

- To explain the features and important specifications of modern microprocessors.
- To explain the salient features CISC microprocessors based on IA-32 bit and IA-64 bit architectures.
- To explain the salient features RISC processors based on ARM architecture anddifferent application profiles of ARM core.
- To explain the features and important specifications of modern microcontrollers.
- To explain about ARM – M3 architecture and its salient features.

TEXTBOOKS:

1. Steven F.Barret, Daniel J Pack, ―Microcontroller Programming and Interfacing: Texas Instruments MSP430‖ , Morgan & Claypool Publishers, ISBN: 9781608457137.
2. John H. Davies, ―MSP430 Microcontroller Basics‖, First Edition, NewnesPublication , ISBN: 978-93-80501-85-7, 2010.

REFERENCES:

1. C.P.Ravikumar. ―MSP430 Microcontroller in Embedded System Project‖, First Edition, Elite Publishing House Private Ltd, Dec ,ISBN:978-81-88901-46-3, 2011.
2. J. W. Valvano, ―Embedded Systems: Introduction to ARM Cortex -M Microcontrollers‖, Fourth edition, Volume 1, ISBN: 9781477508992, 2013.
3. J. W. Valvano, ―Embedded Systems: Real-Time Interfacing ARM Cortex – Microcontrollers‖, Fourth edition, Volume 2, ISBN: 978-1477508992, 2014 6. Cortex-M4 Devices, Generic User Guide By ARM.

192ES332 CRYPTOGRAPHY AND NETWORK SECURITY LTPC 3003

COURSE OBJECTIVES:

- To understand the fundamentals of data security.
- To learn the fundamentals of mathematical aspects in creating Encryption keys
- To learn the fundamentals of Security in data& wireless communication.
- To understand 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)

Overview – classical Encryption Techniques – Block Ciphers and the Data Encryption standard –Introduction to Finite Fields – Advanced Encryption standard – Contemporary, Symmetric Ciphers – Confidentiality using Symmetric Encryption.

UNIT II PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS (9)

Introduction to Number Theory – Public-Key Cryptography and RSA – Key Management – Diffie-Hellman Key Exchange – Elliptic Curve Cryptography – Message Authentication and Hash Functions– Hash Algorithms – Digital Signatures and Authentication Protocols.

UNIT III NETWORK SECURITY PRACTICE (9)

Authentication Applications – Kerberos – X.509 Authentication Service – Electronic mail Security – Pretty Good Privacy – S/MIME – IP Security architecture – Authentication Header – Encapsulating Security Payload – Key Management.

UNIT IV SYSTEM SECURITY (9)

Intruders – Intrusion Detection – Password Management – Malicious Software – Firewalls – Firewall Design Principles – Trusted Systems.

UNIT V WIRELESS SECURITY (9)

Introduction to Wireless LAN Security Standards – Wireless LAN Security Factors and Issues.

TOTAL : 45 PERIODS

COURSE 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 codeto 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 transferand communication in systems like grid.
- Improved Employability and entrepreneurship capacity due to knowledge up gradationon recent trends in embedded systems design.

TEXTBOOK:

1. William Stallings, “Cryptography And Network Security – Principles And Practices”,Pearson Education, 3rd Edition, 2003.
2. AtulKahate, “Cryptography and Network Security”, Tata McGraw Hill, 2003.

REFERENCES:

1. Natalia Olifer and Victor Olifer,”Computer Networks principles.technologies andprotocols fornetwork design”, Wiley, 2015
2. Bruce Schneier, “Applied Cryptography”, John Wiley and Sons Inc, 2001.
3. Stewart S. Miller, “Wi-Fi Security”, McGraw Hill, 2003.
4. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security In Computing”, 3rd Edition, Pearson Education, 2003.
5. Mai, “Modern Cryptography: Theory and Practice”, First Edition, Pearson Education,2003.

192ES335 INDUSTRIAL NETWORKING AND STANDARDS LTPC 3003

COURSE OBJECTIVES:

On Completion of the course the students will be able to:

- Understand various automation components and systems.
- Draw block diagram of Device net.
- Analyze the architecture of Field Bus systems.

UNIT I INTRODUCTION (4)

Modern Instrumentation and Control Systems – Open Systems Interconnection Model – Introduction to Protocols and Standards – Introduction to Noise and Ground/Shielding.

UNIT II SERIAL INTERFACE STANDARDS (8)

EIA-232 Interface Standard – Major Elements of EIA-232 – Half-Duplex and Full-Duplex operation of EIA-232 Interface –Overview of EIA-422 and EIA-423 Interface Standards- EIA-485Interface Standard – Comparison of Serial Interface Standards–Noise problems in serial communication and troubleshooting.

UNIT III HART PROTOCO (4)

Overview- Physical Layer, Data link Layer, Application Layer: HART Commands- applications.

UNIT IV MODBUS (6)

Overview – Modbus Protocol Structure: Data types, Transmission modes, messaging structure–Modbus Function Codes- Fault Handling Mechanisms of Modbus Protocol – Applications of Modbus Protocol.

UNIT V DEVICE NET (4)

Physical Layer Topology – Device Taps – Data link Layer: Frame Format – Medium Access – Fragmentation.

UNIT VI ACTUATOR-SENSOR INTERFACE (4)

Introduction to Actuator-Sensor Interface (AS-i) – Structure of AS-i slave ICs – AS-i messages – AS-i modulation technique – Troubleshooting.

UNIT VII FIELDBUS SYSTEMS (10)

Controller Area Network: Overview-Simulation of CAN using CANoe software - Smart Distributed Systems (SDS): Overview- Physical Layer, Data Link Layer and Application Layer – Special Features of SDS Network- Process Field Bus (PROFIBUS) - Foundation Fieldbus: Physical Layer and Wiring Rules – Data link Layer – Application Layer – Error Detection and Diagnostics.

UNIT VIII INDUSTRIAL ETHERNET (5)

Overview – Ethernet Hardware Basics – Ethernet Protocol and Addressing – Introductionto10Mbps, 100Mbps and Gigabit Ethernet.

COURSE OUTCOME:

After learning the course the students should be able to:

- Understand various automation components and systems.
- Draw block diagram of Device net.
- Explain architecture of Field Bus systems.
- Explain fundamentals of process control.
- List basic devices used in Networking.

TEXTBOOKS:

1. Fieldbus Technology: Industrial Network Standards for Real-Time Distributed ... editedby Nitaigour P. Mahalik.
2. John Park, Steve Mackey and Edwin Wright, ―Data Communications for Instrumentation and Control‖, Elsevier, 2003.

REFERENCES:

1. Perry Marshall and John Rinaldi, ―Industrial Ethernet‖, The Instrumentation, Systemsand Automation Society, 2005
2. Richard Zurawski, ―Industrial Communications Technology Handbook‖, CRC Press,2005

192ES337 MEDICAL INSTRUMENTATION SYSTEMS LTPC 3003

COURSE OBJECTIVES:

- To study about the different bio potential and its propagation.
- To understand the different types of electrodes and its placement for various recording.
- To study the design of bio amplifier for various physiological recording.

UNIT I MEDICAL INSTRUMENTATION BASICS (7)

Generalized Systems, Constraints. Classification of Biomedical Instruments, Bio statistics, Generalized static and Dynamic Characteristics, Regulation of Medical Devices.

UNIT II SENSORS, TRANSDUCERS AND AMPLIFIERS (7)

Resistive, Capacitive, Inductive, Piezoelectric, Thermocouple, Thermistors, Fiber, Optic Sensors, Radiation Sensors, Smart Sensors, Electro Chemical Sensors, Electrical Fibrosensors, Blood-Glucose Sensors. Operational Amplifiers, Inverting, Noninverting, Differential, Instrumentation Amplifiers, Pre amplifiers, Isolation Amplifiers, Active Filters.

UNIT III BIOELECTRIC SIGNALS AND ELECTRODES (7)

Origin of Bioelectric Signals, Electrical Activity, Volume Conductor Fields, ECG, EEG, EMG, MEG. Electrode- Electrolyte Interface, Polarizable and Nonpolarizable Electrodes, Electrode Model, Recording Electrodes, Internal Electrodes, Micro Electrodes.

UNIT IV MEASUREMENT SYSTEMS (7)

Patient Monitoring Systems, Measurement of Blood Pressure, Heart Rate, Pulse Rate, Temperature, Heart Sounds, Blood Flow and Volume, Respiratory Systems, Measurements, Cardiac Output Measurement, Blood pH, pO2 Measurement, Oximeters, Audiometers, Spectrophotometers.

UNIT V MEDICAL IMAGING SYSTEMS (6)

Information content of an Image, Radiography, Computed Radiography, Computed Tomography, Magnetic Resonance Imaging, Nuclear Medicine, Single Photon Emission Computed Tomography, Positron Emission Tomography, Ultrasonagraphy.

UNIT VI THERAPEUTIC AND PROSTHETIC DEVICES (5)

Cardiac Pacemakers, Defibrillators, Hemo dialysis, Lithotripsy, Ventilators, Incubators, Drug Delivery devices, Artificial Heart Valves, Heart Lung Machine, Applications of Laser.

UNIT VII ELECTRICAL SAFETY (3)

Physiological Effects of Electricity, Important susceptibility parameters, Distribution of Electric Power. Macroshock Hazards, Microshock Hazards, Electrical safety codes and Standards, Basic Approaches to Protection against shock, Equipment Design, Electrical Safety Analyzers, Testing.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- To Learn the different bio potential and its propagation.
- To get Familiarize the different electrode placement for various physiological recording.
- Students will be able design bio amplifier for various physiological recording.
- Students will understand various technique non electrical physiological measurements

- Understand the different biochemical measurements.

TEXTBOOKS:

1. Medical Instrumentation: Application And Design, 3Rd Ed By John Webster.
2. Design and Development of Medical Electronic Instrumentation: A Practical By David Prutchi, Michael Norris

REFERENCES:

1. John G.Webster, Editor, ―Medical Instrumentation application and Design‖, John Wiley& Sons, Inc Noida. 4th Edition, Feb 2009.
2. R.S.Khandpur, ―Handbook of Biomedical Instrumentation,‖, Tata McGraw Hill, New Delhi, 3rd Edition, June 2014.
3. Joseph J. Carr and John M. Brown, ―Introduction to Biomedical Equipmentechnology,‖ Pearson Education, 2003.

192ES333 DIGITAL IMAGE PROCESSING LTPC 3003

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)

Spatial domain; Gray-level transformations – histogram processing – spatial filtering, smoothing and sharpening. Frequency domain: filtering in frequency domain – DFT, FFT, DCT – smoothing and sharpening filters – Homomorphic filtering. Image enhancement for remote sensing images and medical images.

UNIT III IMAGE SEGMENTATION AND FEATURE ANALYSIS (9)

Detection of discontinuities – edge operators – edge linking and boundary detection, thresholding – feature analysis and extraction – region based segmentation – morphological watersheds – shape skeletonization, phase congruency. Number plate detection using segmentation algorithm.

UNIT IV IMAGE COMPRESSION (9)

Image compression: fundamentals – models – elements of information theory – error free compression – lossy compression – compression standards. Applications of image compressiontechniques in video and image transmission.

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 algorithmsinterfacing. Hardware implementation of image processing algorithms: Segmentation and compression.

TOTAL : 45 PERIODS

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.

TEXTBOOKS:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image processing", 2nd edition, Pearson education, 2003.
2. Anil K. Jain, "Fundamentals of digital image processing", Pearson education, 2003.

REFERENCES:

1. Milan Sonka, ValclavHalavac and Roger Boyle, "Image processing, analysis and machine vision", 2nd Edition, Thomson learning, 2001.
2. Mark Nixon and Alberto Aguado,"Feature extraction & Image processing for computer vision",3rd Edition, Academic press, 2012.
3. Donald G. Bailey, "Design for Embedded Image processing on FPGAs" John Wiley and Sons, 2011.

192ES3310 SMART GRID COMMUNICATIONS LTPC 3003

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 (9)

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 (9)

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 (9)

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 (9)

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS (9)

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:

- 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 forSmart Grid applications.

TEXTBOOKS:

1. Stuart Borlase "Smart Grid :Infrastructure, Technology and Solutions", CRC Press 2012.
2. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley 2012.

REFERENCES:

1. Vehbi C. Güngör, DilanSahin, TaskinKocak, SalihErgüt, ConcettinaBuccella, Carlo Cecati, and Gerhard P. Hancke, "Smart Grid Technologies: Communication Technologies and Standards" IEEE Transactions On Industrial Informatics, Vol. 7, No.
2. 2, November 2011. 4 Xi Fang, SatyajayantMisra, GuoliangXue, and Dejun Yang "Smart Grid – The New and Improved Power Grid: A Survey" , IEEE Transaction on Smart Grids, vol. 14, 2012.

192ES3311 SYSTEM ON CHIP LTPC 3003

COURSE OBJECTIVES:

- Understanding of the concepts, issues, and process of designing highly integrated SoCsfollowing systematic hardware/software co-design & co-verification principles.

UNIT I INTRODUCTION (5)

System tradeoffs and evolution of ASIC Technology – System on chip concepts and methodology – SoC design issues – SoC challenges and components.

UNIT II DESIGN METHODOLOGIC FOR LOGIC CORES (10)

SoC Design Flow – On-chip buses – Design process for hard cores – Soft and firm cores – Designing with hard cores, soft cores – Core and SoC design examples.

UNIT III DESIGN METHODOLOGY FOR MEMORY AND ANALOG CORES (10)

Embedded memories – Simulation modes – Specification of analog circuits – A to D converter –D to A converter – Phase-located loops – High speed I/O.

UNIT IV DESIGN VALIDATION (10)

Core level validation – Test benches- SoC design validation – Cosimulation – Hardware/software co verification.

UNIT V SOC TESTING (10)

SoC Test issues – Testing of digital logic cores – Cores with boundary scan – Test methodologyfor design re-use – Testing of microprocessor cores – Built in self test method – Testing of embedded memories.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

- Analyze algorithms and architecture of hardware software inorder to optimise thesystem based on requirements and implementation constraints.
- Model and specify systems at high level of abstraction.
- Appreciate the co-design approach and virtual platform models.

- Understand hardware, software and interface synthesis.

TEXTBOOKS:

1. P. Marwedel, Embedded System Design: Embedded Systems Foundations of Cyber-Physical Systems, Third Edition, Springer, 2018.
2. D. C. Black, J. Donovan, B. Bunton, A. Keist, SystemC: From the Ground Up, Second Edition, Springer, 2010.
3. G. De Micheli, Synthesis and Optimization of Digital Circuits, McGraw-Hill, 1994

REFERENCES:

1. 1. RochitRajsuman, ―System-on-a-chip: Design and Test‖, Artech House, London,2000.
2. Laung-Terng Wang, Charles E Stroud and Nur A Toubq, ―System on Chip Test Architectures: Nanometer Design for Testability‖, Morgan Kaufmann, 2008.
3. WgelBadawy, Graham A Jullien, ―System-on-Chip for Real-Time Applications‖,Kluwer Academic Press, 2003.
4. Rajanish K Kamat, Santosh A Shinde, Vinod G Shelake, ―Unleesh the System-on-Chip using FPGAs and Handle C, Spinger 2009.

192ES3312 WIRELESS AND MOBILE COMMUNICATION LTPC 3003

COURSE OBJECTIVES:

- To understand the fundamentals of wireless communication technologies.
- To learn the fundamentals of wireless mobile network protocols.
- To study on wireless network topologies.
- To study the network routing protocols.
- To study the basis for classification of commercial family of wireless communication technologies.

UNIT I INTRODUCTION (9)

Wireless Transmission – signal propagation – Free space and two ray models – spreadspectrum – Satellite Networks – Capacity Allocation – FDMA –TDMA- SDMA – DAMA.

UNIT II MOBILE NETWORKS (9)

Cellular Wireless Networks – GSM – Architecture – Protocols – Connection Establishment – Frequency Allocation – Handover – Security – GPRA.

UNIT III WIRELESS NETWORKS (9)

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

UNIT IV ROUTING (9)

Mobile IP- SIP – DHCP – AdHoc Networks – Proactive and Reactive Routing Protocols –Multicast Routing -WSN routing –LEACH- SPIN- PEGASIS

UNIT V TRANSPORT AND APPLICATION LAYERS (9)

TCP over Adhoc Networks – WAP – Architecture – WWW Programming Model – WDP –WTLS – WTP–WSP –WAE –WTA Architecture –WML–WML scripts.

TOTAL : 45 PERIODS

COURSE OUTCOMES :

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

- Knowledge of basic and advanced theories on wireless communications systems inphysical,

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 modelsunder 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.

TEXTBOOKS:

1. KavehPahlavan, PrasanthKrishnamoorthy, " Principles of Wireless Networks' PHI/Pearson Education, 2003.
2. C. Siva Ram Murthy and B.S. Manoj, AdHoc Wireless Networks: Architectures and protocols, Prentice Hall PTR, 2004.

REFERENCES :

1. UweHansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, " Principles of Mobile computing", Springer, New york, 2003.
2. C.K.Toh, " AdHoc mobile wireless networks", Prentice Hall, Inc, 2002.
3. Charles E. Perkins, " Adhoc Networking", Addison-Wesley, 2001.
4. Jochen Schiller, " Mobile communications", PHI/Pearson Education, Second Edition, 2003.
5. William Stallings, " Wireless communications and Networks", PHI/Pearson Education, 2002.

192ES334 EMBEDDED LINUX LTPC 3003

COURSE OBJECTIVES:

- To learn the fundamentals of Linux Operating system, its basiccommands and shell programming.
- To learn 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 systemsand performance tuning.
- To understand the concept of configuring kernel using the cross-platform tool chain.
- To involve Discussions/ Practice/Exercise onto revising & familiarizing the conceptsacquired 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)

Introduction - History of Embedded Linux - Embedded Linux versus Desktop Linux - Commercial Embedded Linux Distribution - Choosing a distribution - Embedded Linux Distributions - Architecture of Embedded Linux - Linux Kernel Architecture -Porting Roadmap -

GNU Cross Platform Tool chain.

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)

A Practical Project Workspace - GNU Cross-Platform Development Tool chain - C Library Alternatives - Other Programming Languages - Eclipse: An Integrated Development Environment - Terminal Emulators - Selecting a Kernel - Configuring the Kernel - Compiling the Kernel - Installing the Kernel Basic Root File system Structure - Libraries - Kernel Modules and Kernel Images - Device Files - Main System Applications - System Initialization.

UNIT V LINUX DRIVERS (9)

Introduction in to basics on Linux drivers, introduction to GNU cross platform Tool chain- Case study on programming one serial driver for developing application using Linux Driver.

TOTAL : 45 PERIODS

COURSE 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 targetboard.
- Students will study about distributions and cross platform tool chain.
- Improved Employability and entrepreneurship capacity due to knowledge up gradationon recent trends in embedded systems design.

TEXTBOOKS:

1. KarimYaghmour, Jon Masters, Gilad Ben-Yossef, and Philippe Gerum, 'Building Embedded Linux Systems 2nd Edition', SPD -O'Reilly Publications, 2008.
2. P.Raghavan,AmolLad,SriramNeelakandan,"EmbeddedLinux System Design &Development,Auerbach Publications, 2012.

REFERENCES:

1. William von Hagen, 'Ubuntu Linux Bible 3rd Edition', Wiley Publishing Inc., 2010.
2. Jonathan Corbet, Alessandro Rubini& Greg Kroah-Hartman, 'Linux Device Drivers 3rd Edition', SPD -O'Reilly Publications, 2011.
3. Robert Love,"Linux System Programming, SPD -O'Reilly Publications, 2010.

192ES336 INTERNET OF THINGS LTPC 3003

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 (6)

Overview, Technology drivers , Business drivers, Typical IoT applications , Trends and implications.

UNIT II IOT ARCHITECTURE (12)

Node Structure - Sensing, Processing, Communication, Powering, Networking - Topologies, Layer/Stack architecture ,IoTstandards,Cloud computing for IoT,Bluetooth, Bluetooth Low Energy, beacons.

UNIT III PROTOCOLS AND WIRELESS TECHNOLOGY FOR IOT (9)

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 ANALYSTICS FOR IOT (9)

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 (9)

Home Automation, smart cities, Smart Grid, Electric vehicle charging, Environment, Agriculture, Productivity Applications.

TOTAL : 45 PERIODS

COURSE 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.

TEXTBOOKS:

1. ArshdeepBahgaand VijaiMadisetti : A Hands-on Approach "Internet of Things",Universities Press 2015.
2. Oliver Hersent , David Boswarthick and Omar Elloumi " The Internet of Things", Wiley,2016.
3. Samuel Greengard, " The Internet of Things", The MIT press, 2015.

REFERENCES:

1. ArshdeepBahgaand VijaiMadisetti : A Hands-on Approach "Internet of Things",Universities Press 2015.
2. Oliver Hersent , David Boswarthick and Omar Elloumi " The Internet of Things", Wiley,2016.
3. Samuel Greengard, " The Internet of Things", The MIT press, 2015
4. Adrian McEwen and Hakim Cassimally "Designing the Internet of Things "Wiley,2014.
5. Jean- Philippe Vasseur, Adam Dunkels, "Interconnecting Smart Objects with IP: The Next Internet" Morgan Kuffmann Publishers, 2010.
6. Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", John Wiley and sons, 2014.
7. Lingyang Song/DusitNiyato/ Zhu Han/ EkramHossain," Wireless Device-to-Device Communications and Networks, CAMBRIDGE UNIVERSITY PRESS,2015.
8. OvidiuVermesan and Peter Friess (Editors), "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers Series in Communication, 2013.
9. Vijay Madisetti ,ArshdeepBahga, "Internet of Things (A Hands on-Approach)", 2014.

192ES338 PERSONAL COMPUTER SYSTEMS LTPC 3003

COURSE OBJECTIVES:

- Understand the layered and modular nature of computer system.
- Design the core component of a computer from basic components.
- Understand and apply knowledge of how computers represent programs and data.

UNIT I ARCHITECTURE (6)

AT architecture - DMAC - Interrupt controllers - Timers -Memory map - I/O map - AT BUS (ISA BUS) specifications –Extended and expanded memory - PCI Bus concepts.

UNIT II PERIPHERAL ADAPTERS (6)

Keyboard Interfacing - Functional description of keyboard processing - Display Adapters: VGA and SVGA adapter – Functional configurations – AGP basics.

UNIT III SECONDARY STORAGE (9)

Hard disk structure - IDE Bus-SATA - CD-ROM structure – Printers - Centronics parallel interface - Features of EPP and ECP modes of printers - USB Bus.

UNIT IV ASSEMBLY LANGUAGE PROGRAMMING (9)

Program development stages -Macro assembler: Directives - Macros - Linker - Debugger in real mode of the processor.

UNIT V STRUCTURE OF MS-DOS (7)

BIOS - DOS Kernel - Command processor – Boot record - File allocation table - File directory - Booting process of DOS-COM and EXE files - BIOS and DOS interrupts - Structure of device drivers.

UNIT VI MULTIUSER/ MULTI-TASKING OPERATING SYSTEM CONCEPTS (8)

Scheduling - Protection - Memory management – Windows system architecture: Virtual hardware and device drivers - Windows virtual address space memory map - Comparison of WIN 16 and WIN 32 applications structure.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

On successful completion of this course students will be able to:

- Demonstrate an understanding of the layered and modular nature of computer systems.
- Design the core component of a computer from basic components.
- Understand and apply knowledge of how computers represent programs and data.
- Explain how a computer execute a program.
- Write assembler and machine code.

TEXTBOOKS:

1. Mathivanan N., ―Microprocessors, PC Hardware Interfacing‖, Prentice Hall of India, Reprint 2007.186
2. Douglas V Hall, "Microprocessors and Interfacing: Programming and Hardware", McGraw Hill, 2006.
3. Barry B Brey, "The Intel Microprocessor 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium Pro Processor, Pentium II ,III and IV Architecture, Programming and Interfacing", Prentice Hall of India, 2005.

REFERENCES:

1. Ray Duncan, "Advanced MSDOS Programming", Microsoft Press, USA, 2002.
2. Walter Oney, ‖Systems Programming for Windows 95‖, Microsoft Press, USA, 1996.
3. IBM PC/AT Technical Reference Manual,1985.
4. Walter Oney, ‖Programming the Microsoft Windows Driver Model‖, South Asian, 2003.

192ES339 ROBOTICS AND FACTORY AUTOMATION LTPC 3003

COURSE OBJECTIVES:

Student will be able to:

- To understand the basic principles of Robotic technology, configurations, control and programming of Robots.
- Design an industrial robot which can meet kinematic and dynamic constraints.
- To describe the concept of Robot kinematics and dynamics, latest algorithms &analytical approaches.

UNIT I FUNDAMENTAL CONCEPTS OF ROBOTICS (4)

History, Present status and future trends in Robotics and automation - Laws of Robotics - Robot definitions - Robotics systems and robot anatomy - Specification of Robots - resolution, repeatability and accuracy of a manipulator. Robotic applications.

UNIT II ROBOT DRIVES AND POWER TRANSMISSION SYSTEMS (8)

Robot drive mechanisms, hydraulic – electric – servomotor- stepper motor - pneumatic drives, Mechanical transmission method - Gear transmission, Belt drives, cables, Roller chains, Link – Rod systems - Rotary-to-Rotary motion conversion, Rotary-to-Linear motion conversion, Rack and Pinion drives, Lead screws, Ball Bearing screws, End effectors – Types.

UNIT III SENSORS (6)

Principle of operation, types and selection of Position& velocity sensors, Potentiometers, Encoders, Resolvers, LVDT, Tacho generators, Proximity sensors. Limit switches – Tactile sensors - Touch sensors - Force and torque sensors.

UNIT IV VISION SYSTEMS FOR ROBOTICS (8)

Robot vision systems, Illumination techniques, Image capture- solid state cameras – Image representation - Gray scale and colour images, image sampling and quantization - Image processing and analysis –, Image data reduction – Segmentation - Feature extraction - Object Recognition- Image capturing and communication - JPEG, MPEGs and H.26x standards, packet video, error concealment- Image texture analysis.

UNIT V TRANSFORMATIONS AND KINEMATICS (5)

Matrix representation- Homogeneous transformation matrices - The forward and inverse kinematics of robots - D-H representation of forward kinematic equations of robots.

UNIT VI PLC (5)

Building blocks of automation, Controllers – PLC- Role of PLC in Robotics& FA - Architecture of PLC - Advantages - Types of PLC - Types of Programming - Simple process control programs using Relay Ladder Logic and Boolean logic methods - PLC arithmetic functions.

UNIT VII FACTORY AUTOMATION (9)

Flexible Manufacturing Systems concept - Automatic feeding lines, ASRS, transfer lines, automatic inspection - Computer Integrated Manufacture - CNC, intelligent automation. Industrial networking, bus standards, HMI Systems, DCS and SCADA, Wireless controls.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able:

- To explain the basic principles of Robotic technology, configurations, control andprogramming of Robots.
- Design an industrial robot which can meet kinematic and dynamic constraints.
- To describe the concept of Robot kinematics and dynamics, latest algorithms & analytical approaches.
- To discuss and apply the concepts of dynamics for a typical Pick and Place robot.
- To choose the appropriate Sensor and Machine vision system for a given application.

TEXTBOOKS:

1. "Automation, Production Systems and Computer Integrated Manufacturing"- M.P.Grover, Pearson Education.
2. "Anatomy of Automation" – Amber G.H & P.S. Amber, PrenticeHall.
3. R.K. Mittal & I.J. Nagrath, "Robotics & Control" TMH-2007.
4. Y. Koren, Robotics for Engineers, McGraw Hill, 1985

REFERENCES :

1. Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Eastern Economy, Prentice Hall of India P Ltd., 2006.
2. Fu KS, Gonzalez RC, Lee C.S.G, "Robotics : Control, Sensing, Vision and Intelligence", McGraw Hill, 1987.
3. Mikell P Grooveret. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, New York, 2008.
4. Saeed B Niku, ―Introduction to Robotics Analysis, Systems, Applications‖, PHI Pvt Ltd, New Delhi,2003.
5. Deh S R., "Robotics Technology and Flexible Automation", Tata McGraw Hill Publishing, Company Ltd., 1994.