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B.Tech IV-I Semester (EIE)

S. No.	Course Code	Subject	L	T	P	C
1.	15A52601	Management Science	3	1	-	3
2.	15A10701	PLC and SCADA	3	1	-	3
3.	15A04702	Embedded Systems	3	1	-	3
4.	15A10702	Biomedical Instrumentation	3	1	-	3
5.	 15A04604 15A10703 15A10704	**CBCC - II** a. VLSI Design b. Opto Electronics and LASER Instrumentation c. Digital Control Systems	3	1	-	3
6.	 15A10705 15A10706 15A10707	**CBCC - III** a. Industrial Safety and Management b. System Design using Microcontrollers c. Telemetry and Telecontrol	3	1	-	3
7.	15A10708	PLC Laboratory	-	-	4	2
8.	15A10709	Microprocessors and Embedded Systems Laboratory	-	-	4	2
		Total:	**18**	**06**	**08**	**22**

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15A52601 MANAGEMENT SCIENCE

Course Objective*: The objective of the course is to equip the student the fundamental knowledge of management science and its application for effective management of human resource, materials and operation of an organization. It also aims to expose the students about the latest and contemporary developments in the field of management.*

UNIT –I

Introduction to Management: Concept-Nature and Importance of Management, Functions-Evaluation of Scientific Management, Modern management-Motivation Theories-Leadership Styles-Decision MakingProcess-Designing Organization Structure-Principles and Types of Organization.

UNIT- II

Operations Management: Plant location and Layout, Methods of production, Work-Study-Statistical Quality Control through Control Charts, Objectives of Inventory Management, Need for Inventory Control-EOQ&ABC Analysis(Simple Problems)**Marketing Management:**
Meaning,Nature, Functions of Marketing, Marketing Mix, Channels of distribution-Advertisement and sales promotion-Marketing strategies-Product Life Cycle.

UNIT –III

Human Resource Management(HRM): Significant and Basic functions of HRM-Human Resource Planning(HRP), Job evaluation, Recruitment and Selection, Placement and Induction-Wage and Salary administration. Employee Training and development-Methods-Performance Appraisal-Employee Grievances-techniques of handling Grievances.

UNIT –IV

Strategic Management: Vision, Mission, Goals and Strategy- Corporate Planning Process-Environmental Scanning-SWOT analysis-Different Steps in Strateg Formulation, Implementation and Evaluation. **Project Management**: Network Analysis-PERT, CPM, Identifying Critical Path-Probability-Project Cost Analysis, Project Crashing (Simple Problems).

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UNIT-V

Contemporary Management Practices: Basic concepts of MIS-Materials Requirement Planning(MRP),Just-In-Time(JIT)System, Total Quality Management(TQM)-Six Sigma and Capability Maturity Models(CMM) evies, Supply Chain Management, Enterprise Resource Planning(ERP),Performance Management, Business Process Outsourcing(BPO), Business Process Re-Engineering and Bench Marking, Balance Score Card.

Course Outcome: This course enables the student to know the principles and applications of management knowledge and exposure to the latest developments in the field. This helps to take effective and efficient management decisions on physical and human resources of an organization. Beside the knowledge of Management Science facilitates for his/her personal and professional development.

TEXT BOOKS:

1. A.R Aryasri: Management Science, TMH, 2013
2. Kumar /Rao/Chalill 'Introduction to Management Science' Cengage, Delhi, 2012.

REFERENCE BOOKS:

1. A.K.Gupta "Engineering Management",S.CHAND, New Delhi, 2016.
2. Stoner, Freeman, Gilbert, Management, Pearson Education,New Delhi, 2012.
3. Kotler Philip & Keller Kevin Lane: Marketing Mangement , PHI,2013.
4. Koontz & Weihrich: Essentials of Management, 6/e, TMH, 2005.
5. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
6. Memoria & S.V.Gauker, Personnel Management, Himalaya, 25/e, 2005
7. Parnell: Strategic Management, Biztantra, 2003.
8. L.S.Srinath: PERT/CPM,Affiliated East-West Press, 2005.

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15A10701 PLC AND SCADA

Course Objective:

1. *To study the fundamentals of Data Acquisition system*
2. *To teach the concept of PLC and the Programming using Ladder Diagram*
3. *To understand the basics of SCADA and communication standards*

Course Outcome:

1. *Students will have the knowledge of data acquisition System*
2. *Students will be able to write Programs using ladder diagrams*
3. *Students will have the knowledge of SCADA, communication standards and various network protocol*

UNIT-I
INTRODUCTION TO PLC

Definition & History of PLC, Overall PLC system, PLC Input and Output modules, CPU & Programmer/Monitors, Solid state memory, the processor, Input Module (Interfaces), Power supplies, PLC advantages & disadvantages, selection criteria for PLC.

UNIT-II
PROGRAMMING OF PLC

Programming equipments, Proper construction of PLC ladder diagram, Basic components & their symbols in ladder diagram, Fundamentals of ladder diagram, Boolean logic & relay logic, and analysis of rungs. Input ON/OFF switching devices, Input analog devices, Output ON/OFF devices, Output analog devices, Programming ON/OFF Inputs to produce ON/OFF outputs. PLC timer function-PLC counter functions.

UNIT-III
INTRODUCTION TO SCADA

Introduction and brief history of SCADA, Fundamental principles of modern SCADA systems, SCADA hardware, SCADA software, Landlines for SCADA, Modern use in SCADA system, computer sites and troubleshooting, system implementation.

UNIT-IV
SCADA SYSTEM, HARDWARE AND FIRMWARE

Comparison of terms SCADA, Distributed Control Systems (DCS), PLC and smart instrument, considerations and benefits of SCADA system, Remote Terminal Units (RTUs): Control Processor, Analog input & output module, Digital input & output

module, communication Interfaces, Power supply module for RTU, Application program, PLC used as RTUs, Master station, System reliability and availability, communication architecture and philosophies.

UNIT-V

THE EVOLUTION OF SCADA PROTOCOLS

Overview of Open System Interconnection (OSI) Model, Functions of OSI Model Layers, OSI Protocols, Functions of Transmission Control Protocol/ Internet Protocol (TCP/IP), DNP3 Protocol, IEC61850 layered architecture, CIP protocol, DeviceNet, ControlNet, EtherNet/IP, Flexible Function Block Process (FFB), Process Field bus (profibus), The security Implications of SCADA protocols.

TEXT BOOKS

1. John W Webb, Ronald A. Reis, "Programmable Logic Controllers: Principles and Application", Pearson Education, 5th Edition.
2. David Bailey, Edwin Wright, "Practical SCADA for Industry", Newns, An Imprint of Elsevier, 2003.

REFERENCES

1. Ronald L Krutz "Securing SCADA system", Wiley publishimg,2006
2. John R.Hackworth, FredrickD, Hackworth Jr., "Programmable Logic Controllers: Programming Methods and applications"
3. Gordan Clark, Deem Reynders, "Practical Modem SCADA Protocols"
4. Gary Dunning, "Introduction to Programmable Logic Controllers" , Thomson, 2nd Edition.

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15A04702 EMBEDDED SYSTEMS

Course Objectives:

- To understand the fundamental concepts of Embedded systems.
- To learn the kernel of RTOS, architecture of ARM processor.

Course Outcomes:
After completion the students will be able to

- Design of embedded systems leading to 32-bit application development.
- Understand hardware-interfacing concepts to connect digital as well as analog sensors while ensuring low power considerations.
- Review and implement the protocols used by microcontroller to communicate with external sensors and actuators in real world.
- Understand Embedded Networking and IoT concepts based upon connected MCUs

UNIT-I
Introduction to Embedded Systems
Embedded system introduction, host and target concept, embedded applications, features and architecture considerations for embedded systems- ROM, RAM, timers; data and address bus concept, Embedded Processor and their types, Memory types, overview of design process of embedded systems, programming languages and tools for embedded design

UNIT-II
Embedded processor architecture
CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture. Introduction to ARM architecture and Cortex – M series, Introduction to the TM4C family viz. TM4C123x & TM4C129x and its targeted applications. TM4C block diagram, address space, on-chip peripherals (analog and digital) Register sets, Addressing modes and instruction set basics.

UNIT- III
Overview of Microcontroller and Embedded Systems
Embedded hardware and various building blocks, Processor Selection for an Embedded System , Interfacing Processor, Memories and I/O Devices, I/O Devices and

I/O interfacing concepts, Timer and Counting Devices, Serial Communication and Advanced I/O, Buses between the Networked Multiple Devices.
Embedded System Design and Co-design Issues in System Development Process, Design Cycle in the Development Phase for an Embedded System, Uses of Target System or its Emulator and In-Circuit Emulator (ICE), Use of Software Tools for Development of an Embedded System
Design metrics of embedded systems - low power, high performance, engineering cost, time-to-market.

UNIT-IV
Microcontroller fundamentals for basic programming
I/O pin multiplexing, pull up/down registers, GPIO control, Memory Mapped Peripherals, programming System registers, Watchdog Timer, need of low power for embedded systems, System Clocks and control, Hibernation Module on TM4C, Active vs Standby current consumption. Introduction to Interrupts, Interrupt vector table, interrupt programming. Basic Timer, Real Time Clock (RTC), Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI).

Unit-V
Embedded communications protocols and Internet of things
Synchronous/Asynchronous interfaces (like UART, SPI, I2C, USB), serial communication basics, baud rate concepts, Interfacing digital and analog external device, Implementing and programming UART, SPI and I2C, SPI interface using TM4C. Case Study: Tiva based embedded system application using the interface protocols for communication with external devices “Sensor Hub BoosterPack”
Embedded Networking fundamentals, IoT overview and architecture, Overview of wireless sensor networks and design examples. Adding Wi-Fi capability to the Microcontroller, Embedded Wi-Fi, User APIs for Wireless and Networking applications Building IoT applications using CC3100 user API.
Case Study: Tiva based Embedded Networking Application: “Smart Plug with Remote Disconnect and Wi-Fi Connectivity”

Text Books:

1. Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers, 2014, Create space publications ISBN: 978-1463590154.
2. Embedded Systems: Introduction to ARM Cortex - M Microcontrollers, 5th edition
   Jonathan W Valvano, Createspace publications ISBN-13: 978-1477508992
3. Embedded Systems 2E Raj Kamal, Tata McGraw-Hill Education, 2011 ISBN-0070667640, 9780070667648

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References:

1. http://processors.wiki.ti.com/index.php/Hands-On_Training_for_TI_Embedded_Processors
2. http://processors.wiki.ti.com/index.php/MCU_Day_Internet_of_Things_2013_Workshop
3. http://www.ti.com/ww/en/simplelink_embedded_wi-fi/home.html
4. CC3100/CC3200 SimpleLink™ Wi-Fi® Internet-on-a-Chip User Guide Texas Instruments Literature Number: SWRU368A April 2014–Revised August 2015.

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15A10702 BIOMEDICAL INSTRUMENTATION

Course Objective: *To learn the physiology of the human body and the Instrumentation related to Biomedical Systems.*

Course Outcome: *On successful completion of the module students will be able to:*
To introduce the concepts of physiology and the Electrical Components of a Biomedical System. To discuss the measurement of physiological parameters.
To understand the concepts of Imaging System and Telemetry ad the various Therapeutic Equipments used in Medicine.

UNIT I
ELECTRO PHYSIOLOGY: Review of Physiology and anatomy – sources of Bioelectric Potentials – Resting and Action Potentials – Propagation of Action Potentials – Electrodes theory – Bio potential electrodes – Bio chemical transducers – Transducers for Bio Medical applications.

UNIT II
BIOMEDICAL RECORDERS AND CARDIOVASCULAR MEASUREMENT: Physiology of cardiovascular and nervous system – ECE-EEE-EME – Foetal ECE-Phonocardiography –Vector Cardiography – Holtel monitoring – BP – Blood flow – cardiac output – ICCU – Bedside unit and central monitoring unit.

UNIT III
PULMONARY MEASUREMENT AND BIO TELEMETRY: Physiology of respiratory system –Respiratory rate measurement – wine and wireless Biotelemetry – Telemetering multiple information – implanted transmitters – sauces of electrical hazards and safety techniques.

UNIT IV
MEDICAL IMAGING SYSTEM: Ultrasound scanner – Echo cardiography – Coloar Doppler system – CAT and CT scan – MRI Imaging – Cine angiogram – LASER Imaging –Endoscope.

UNIT V
THERAPEUTIC UNITS: Physiotheraphy and Electrotheraphy - Short ware, Microwave diathermy –Defibrillators – Cardio vector – Hearing aid – dialysis machine.

Text Books:

1. *R.Anandanatarajan, —Biomedical Instrumentation‖, PHI Learning, 2011.*

Reference Books: .

1. *Leshie Cromwell, Fred. J. Weibell and Erich. A. Pfeiffer, —Biomedical Instrumentation and Measurements‖, 2nd Edition, PHI, 2003.*
2. *R.S. Khandpar, —Hand Book of Biomedical Instrumentation and measurement‖, McGraw Hill publishing Co., 1990.*
3. *Aston, —Principles of Biomedical Instrumentation and measurements‖, McGraw Hill publishing Co., 1990.*

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15A04604 VLSI DESIGN
(CBCC-II)

Course Objectives:

- To understand VLSI circuit design processes.
- To understand basic circuit concepts and designing Arithmetic Building Blocks.
- To have an overview of Low power VLSI.

Course Outcomes:

- Complete Knowledge about Fabrication process of ICs
- Able to design VLSIcircuits as per specifications given.
- Capable of optimizingthe design of Arithmetic / logic building Blocks at all levels of Design/Fabrication.
- Can implement circuit through various design styles (semi- Custom, Full Custom)

UNIT-I

Introduction: Basic steps of IC fabrication, PMOS, NMOS, CMOS &BiCMOS,and SOI process technologies, MOS transistors - MOS transistor switches – Basic gate using switches, working polartransistor Resistors and Capacitors.

Basic Electrical Properties of MOS and BiCMOS Circuits: Working of MOS transistors – threshold voltage; MOS design equations: I_{ds}–V_{ds} relationships, Threshold Voltage, Body effect, Channel length modulation , g_m, g_{ds}, figure of merit ω_0; Pass transistor, NMOS Inverter, CMOS Inverter analysis and design, Various pull ups loads, Bi-CMOS Inverters.

UNIT-II

Basic Circuit Concepts: Capacitance, resistance estimations- Sheet Resistance R_s, MOSDivice Capacitances, routing Capacitance, Analytic Inverter Delays, Driving large Capacitive Loads, Fan-in and fan-out.

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2µm CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

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UNIT-III

Gate level Design: Logic gates and other complex gates, Switch logic, Alternate gate circuits.

Physical Design: Floor-Planning, Placement, routing, Power delay estimation, Clock and Power routing

UNIT-IV

Subsystem Design: Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Counters, High Density Memory Elements.

VLSI Design styles: Full-custom, Standard Cells, Gate-arrays, FPGAs, CPLDs and Design Approach for Full-custom and Semi-custom devices.

UNIT-V

VHDL Synthesis: VHDL Synthesis, Circuit Design Flow, Circuit Synthesis, Simulation, Layout, Design capture tools, Design Verification Tools.

Test and Testability: Fault-modeling and simulation, test generation, design for testability, Built-in-self-test.

TEXT BOOKS:

1. Kamran Eshraghian, Eshraghian Douglas and A. Pucknell, "Essentials of VLSI circuits and systems", PHI, 2013 Edition.
2. K.Lal Kishore and V.S.V. Prabhakar, "VLSI Design", IK Publishers

REFERENCES:

1. Weste and Eshraghian, "Principles of CMOS VLSI Design", Pearson Education, 1999.
2. Wayne Wolf, "Modern VLSI Design", Pearson Education, 3rd Edition, 1997.
3. John P. Uyemura, "Chip Design for Submicron VLSI: CMOS layout and Simulation", Thomson Learning.
4. John P. Uyemura, "Introduction to VLSI Circuits and Systems", John wiley, 2003.
5. John M. Rabaey, "Digital Integrated Circuits", PHI, EEE, 1997.

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15A10703 OPTO ELECTRONICS & LASER INSTRUMENTATION
(CBCC-II)

Course Objective:
To make the students understand the application of Opto Electronics and Lasers in instrumentation industries.

Course Outcome:
Upon completion of this course the student shall be able to apply his instrumentation knowledge and understand how light and LASER can be used for measurements.

UNIT I
OPTICAL FIBERS AND THEIR PROPERTIES
Introduction to optical fiber , fiber characteristics, principles of light propagation through a fiber, Different types of fibers and their properties, Losses in the optical fiber, Dispersion, advantages and limitations of optical fibers

UNIT II
OPTO-ELECTRONIC COMPONENTS
Optical sources- LED- LD, Optical detectors- PIN- APD, Electro-optic, Magneto optic and Acousto-optic Modulators.

UNIT III
INDUSTRIAL APPLICATIONS OF OPTICAL FIBERS
Interferometer method of measurement of length – Moire fringes – Measurement of pressure, Temperature, Current, Voltage, Liquid level and strain - fiber optic Gyroscope – Polarization maintaining fibers – Applications

UNIT IV
LASER FUNDAMENTALS
Introduction to lasers - Laser characteristics – Laser configuration – Three level and four level lasers – Q-switching – Mode locking – Types of lasers: Gas lasers, Solid lasers, Liquid lasers and Semiconductor lasers

UNIT V
INDUSTRIAL APPLICATIONS OF LASER
Industrial applications of lasers – Lasers for measurement of distance, length, velocity, acceleration, current, voltage. Bio-medical applications. Holography- Principle, Methods. Holographic Interferometers and applications.

Text Books:

1. *Optical Fiber Communication – Principles and Practice, J.M. Senior, , Prentice Hall of India, 1985.*
2. *Introduction to Opto Electronics, J. Wilson and J.F.B. Hawkes, Prentice Hall of India, 2001.*

Reference Books:

1. Understanding Fiber Optics, 4th or 5th edition; Jeff Hecht; Prentice Hall publishers
2. Optical Fibre Communication and Sensors, M. Arumugam,Anuradha Agencies, 2002.
3. 3.Optical Fibre Communication, G. Keiser, McGraw Hill, 1995.
4. Lasers: Theory and Applications – by Thyagarajan K. and Ghatak A.K., Plenum Press Monte Ross, Laser Applications, McGraw Hill, 1968.

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15A10704 DIGITAL CONTROL SYSTEMS
(CBCC-II)

Course Objectives:

1. To equip the students with the basic knowledge of A/D and D/A conversion
2. To understand the basics of Z- Transform
3. To study the stability analysis of digital control system
4. To equip the basic knowledge of digital process control design

UNIT-I

Z-PLANE Analysis of Discrete-Time Control System

Introduction to Digital Control System, Review of Z-Transforms, Z-Transform method for solving difference equations; Pulse transforms function, block diagram analysis of sampled – data systems, mapping between s-plane and z-plane. Modified Z-Transforms.

UNIT – II

State Space Analysis

State Space Representation of discrete time systems, Pulse Transfer Function Matrix solving discrete time state space equations, State transition matrix and it's Properties, Methods for Computation of State Transition Matrix, Discretization of continuous time state – space equations

UNIT – III

Controllability and Observability

Concepts of Controllability and Observability, Tests for controllability and Observability. Duality between Controllability and Observability, Controllability and Observability conditions for Pulse Transfer Function.

Stability analysis-Primary strips and Complementary Strips – Constant frequency loci, Constant damping ratio loci, Stability Analysis of closed loop systems in the Z-Plane. Jury stablility test – Stability Analysis by use of the Bilinear Transformation with Routh Stability criterion.

UNIT – IV

Design of Discrete Time Control System by Conventional Methods

Transient and steady – State response Analysis – Design based on the frequency response method –Bilinear Transformation and Design procedure in the w-plane, Lead, Lag and Lead-Lag compensators and digital PID controllers.

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UNIT – V State Feedback Controllers and Observers

Design of state feedback controller through pole placement – Necessary and sufficient conditions, Ackerman's formula. State Observers – Full order, minimum order and Reduced order observers.

Text Books:

1. Discrete-Time Control systems - K. Ogata, Pearson Education/PHI, 2nd Edition
2. Digital Control and State Variable Methods by M.Gopal, TMH

References:

1. Digital Control Systems, Kuo, Oxford University Press, 2nd Edition, 2003.
2. Digital Control Engineering, M.Gopal

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15A10705 INDUSTRIAL SAFETY AND MANAGEMENT
(CBCC-III)

Course Objective:
To understand the importance of industrial safety

Course Outcome:
Students will acquire knowledge on the Industrial safety and management

UNIT I
Energy conversion – world fossil fuel reserves – world energy consumption – historical lives of fossil fuels – global energy and environmental management – environmental aspects of fossil, nuclear, hydro and biomass energy conversion – gaseous emissions – solid waste – liquid waste.

UNIT II
Energy management – need for energy conservation – energy auditing – conducting real time continuous energy audits – data collection – automated data acquisition – data analysis – role of energy manager – energy audit instruments – gas analyzer – energy conservation in industries: boilers, pumps, fans, compressed air systems, refrigeration and air conditioning systems, DG sets, electrical motors, variable speed motors.

UNIT III
Air pollutants and global climate – air pollutant effects. Pollution control laws and regulation –national and international – role of environmental monitoring in environmental management systems – continuous emissions monitoring systems. Pollution control – review of pollution control methods in thermal power plants – industrial – nuclear – automobiles – disposal/treatment of solid and liquid wastes – alternate fuels.

UNIT IV
Safety and productivity – causes of accidents in industries – accidents reporting and investigation –measuring safety performance – workman compensation rules.

UNIT V
Safety codes and standards – general safety considerations in power plants, pressure vessels and pressurized pipe lines – operation and inspection of extinguishers – preventing the spread of fire –emergency exit facilities.

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Text Books:

1. Blake Roland. P, “Industrial safety”, Prentice Hall of India, 1973.
2. Callaghan. P. O, “Energy Management”, McGraw Hill Book Co., 1993.

Reference Books:

1. Culp. A. W, “Principles of Energy Conservation”, McGraw Hill Book Co., 1991.
2. Noel de Nervers, “Air Pollution Control Engineering”, McGraw Hill Book Co., 2000.

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15A10706 SYSTEM DESIGN USING MICROCONTROLLERS
(CBCC-III)

Course Objective:

- *To introduce system design concepts to students using microcontrollers with foundational concepts of microcontroller architecture and programming .*
- *To introduce hardware and software integration for real time systems using microcontrollers and thereby imparting real time system design knowledge to students.*

Course Outcome:

- *Foundational knowledge in activating and using a generic microcontroller. Preliminary design considerations for system level implementation.*
- *Knowledge of 8051 Microcontroller hardware features and internal peripherals.*
- *Programming knowledge of 8051 microcontrollers.*
- *Knowledge of PIC Microcontroller hardware features and internal peripherals.*
- *Programming knowledge of PIC microcontrollers.*
- *Software design techniques to be followed for embedded system designing.*
- *Using real time operating systems for embedded systems.*

UNIT I

REVIEW OF MICROCONTROLLERS: Features of Typical Microcontroller – on Board peripherals – Processor Selection criteria – Microcontroller Design Specifications – Word length – Performance Issues - Power consumption – Package Types – Electrical requirements – Reset Hardware – oscillator Design – power Consideration - Development Tools –Firmware Development options – Assembly Language Vs High level Language Programming.

UNIT II

MCS51 MICROCONTROLLER AND INTERFACING: Intel MCS51 Architecture – Derivatives - Special Function Registers (SFR), I/O pins, ports and circuits, Instruction set, Addressing Modes, Assembly Language Programming, Timer and Counter Programming, Serial Communication, Connection to RS 232, Interrupts Programming, External Memory interfacing ,Introduction to 16 bit Microcontroller

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UNIT III

PIC MICROCONTROLLER AND INTERFACING: Introduction, CPU architecture,

registers, instruction sets addressing modes Loop timing, timers, Interrupts, Interrupt timing, I/O Expansion, I 2C Bus Operation Serial EEPROM, Analog to digital converter, UART-Baud Rate-Data Handling-Initialization, Special Features - serial Programming-Parallel Slave Port.

UNIT IV

SOFTWARE DEVELOPMENT AND TOOLS: Embedded system evolution trends, Round -Robin, robin with Interrupts, function-One-Scheduling Architecture, Algorithms. Introduction to-assembler-compiler-cross compilers and Integrated Development Environment (IDE). Object Oriented Interfacing, Recursion, Debugging strategies, Simulators.

UNIT V

REAL TIME OPERATING SYSTEMS: Task and Task States, tasks and data, semaphores and shared Data Operating system Services-Message queues-Timer Function-Events-Memory
Management, Interrupt Routines in an RTOS environment, basic design Using RTOS. System Design Issues – Design of Industrial Control System.

Content beyond the Syllabus:

Introduction to ARM processors and programming NXP LPC2148 microcontroller.

Text Books:

1. *David E Simon, " An embedded software primer ", Pearson education Asia, 2001.*
2. *Mohammed Ali Mazidi and Janice Gillispie Mazidi, ―The 8051 Microcontroller and Embedded System‖, Pearson Education Asia, New Delhi, 2006.*

Reference Books:

1. *Burns, Alan and Wellings, Andy, " Real-Time Systems and Programming Languages ", Second Edition. Harlow: Addison-Wesley-Longman, 1997.*
2. *Raymond J.A. Bhur and Donald L.Bialey, " An Introduction to real time systems: Design to networking with C/C++ ", Prentice Hall Inc. New Jersey, 1999.*
3. *Grehan Moore, and Cyliax, " Real time Programming: A guide to 32 Bit Embedded Development. Reading " Addison-Wesley-Longman, 1998.*