INTRODUCTION TO EMBEDDED SYSTEM DESIGN (Online)
(Professional Elective- V)

Course Code: 19EE11L9

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Floated by: Swayam
Offered by: IIT Jammu
Instructor: Prof. Dhananjay V Gadre
Duration: 12 weeks

Prerequisites: Basic Electronic components and circuits, Digital electronics and C Programming.

COURSE LAYOUT

Week 1: Introduction to Embedded Systems and Computer Systems Terminology. Modular approach to Embedded System Design using Six-Box model: Input devices, output devices, Embedded computer, communication block, host and storage elements and power supply.

Week 2: Microcontroller Based Embedded System Design. Salient Features of Modern Microcontrollers, Elements of Microcontroller Ecosystem and their significance.

Week 3: Design of Power Supply for Embedded Systems. Linear Regulator Topologies. Switching Power Supply Topologies. Power Supply Design Considerations for Embedded Systems

Week 4: Introduction to MSP430 Microcontroller. MSP430 CPU Architecture. Programming Methods for MSP430. Introduction to Lunchbox Platform.

Week 5: Fundamentals of Physical Interfacing. Connecting Input Devices: Switches, Keyboard and Output devices: LEDs, Seven Segment Displays(SSD). Assignment: MCQ/MSQ

Week 6: Advanced Physical Interfacing: Driving load - high side, low side and H-bridge. Multiplexing displays including Charlieplexing. Shaft encoder.

Week 7: Programming the MSP430. Basics of version control system - GIT. Installing and using Code Composer Studio (CCS). Introduction to Embedded C. Interfacing LEDs and Switches with MSP430 using Digital Input and Output.

Week 8: MSP430 Clock and Reset System. MSP430 Clock sources and distribution. Types of Reset Sources. Handling Interrupts in MSP430. Writing efficient Interrupt Service Routine (ISR).

Week 9: Interfacing Seven Segment Displays and Liquid Crystal Displays with MSP430. Low Power Modes in MSP430. Introduction to MSP430 Timer Module and its Modes of Operation.

Week 10: Generating Pulse Width Modulation (PWM) using Timer Capture Mode. ADC operation in MSP430. Interfacing analog inputs. Generating random numbers using LFSR and other methods. Adding DAC to MSP430. Custom Waveform generation using MSP430

Week 11: Timer Capture Modes. Measuring frequency and time period of external signals and events. Serial Communication Protocols: UART, SPI, I2C. Interfacing Universal Serial Communication Interface (USCI) Module of the MSP430 for UART Communication. Advanced Coding Exercises based on Interrupt driven Programming. Building an Electronics Project.

Week 12: Circuit Prototyping techniques. Designing Single Purpose Computers using Finite State Machine with Data path (FSMD) approach. MSP430 Based Project Design and Implementation. Recap of Course Coverage

TEXT BOOKS:

1. John Catsoulis, "*Designing Embedded Hardware*", 2nd edition. Shroff Publishers and Distributors. ISBN-10: 9788184042597.
2. Tony Givargis and Frank Vahid, "*Embedded System Design: A Unified Hardware / Software Introduction",* Wiley. ISBN-10: 812650837X.
3. John H. Davies, "*MSP430 Microcontroller Basics*" Elsevier. ISBN-10: 9789380501857.
4. Micheal Barr. *"Programming Embedded Systems in C and C++",* Shroff Publishers and Distributors. ISBN-10: 817366076X.

WEB RESOURCES:

1. https://swayam.gov.in/nd1_noc20_ee98/preview