

## CS 313: Embedded Systems (3-0-2: 4)

**Embedded systems:** Introduction, Characteristics, Application dependent requirements, Architecture, Challenges, Development Process.

Embedded System Hardware: Microprocessor, micro-controller, Von-Neumann and Harvard architecture, RISC, CISC.

**PIC Microcontroller Family:** PIC architecture, Clocking scheme, Instruction execution, Instruction pipeline. PIC Instruction set, Instruction format, Addressing modes, PIC peripherals on chip, Interrupts, PIC timers.

**Case Study:** 8051 micro-controller, ARM processor.

**Digital Signal Processors:** Features, Application, Memory, Addressing. System on Chip (SoC): Evolution, Design, Platforms, Multi Processor SOC.

**Memory:** Basic organization, Embedded SRAM, Embedded DRAMS, Flash Memory, Virtual Memory, Memory Management Unit (MMU), Paging.

**Bus Structures, interrupt handling.**

**Power Aware Architectures:** Power Density, Power Dissipation, Power vs Speed, Power consumption of CMOS circuits, Gating, Dynamic Power Management.

**Software for Embedded systems:** Features, Memory Allocation, Heap Management.

**Fundamentals of Embedded Operating System,** Real time operating system.

**Hardware-Software Co-design:** Introduction, methodology and concepts

**Suggested List of Experiments:**

STM32F401 Nucleo (ARM Cortex- M4):

1. I/O port interfacing
2. Interfacing 7-Segment Display
3. Designing a stop watch
4. Implementing Digital Lock
5. Serial Communication

System Design:

1. Counting number of persons entering and leaving a room.
2. Digital Door lock with two way authentication
3. Temperature / Optical sensor interfacing
4. Automatic Water Tap
5. Automatic Room light

**Text Books:**

1. Wayne Wolf , “Computers as Components, Second Edition: Principles of Embedded Computing System Design”, The Morgan Kaufmann Series in Computer Architecture and Design.
2. M. A. Mazidi , J. G. Mazidi and R. D. Mckinlay others, “The 8051 Microcontroller and Embedded Systems”, Prentice Hall of India.

**References:**

1. R. H. Barnett, L. O’Cull, S. Alison Cox, “Embedded C Programming and Microchip PIC”, Thomson Learning Inc.
2. Andrew M Sloss, Dominic Symes, Chris Wright, “ARM System Developers Guide: Designing optimizing System Software”,  
<http://eee.guc.edu.eg/Courses/Electronics/ELCT912%20Advanced%20Embedded%20Systems/Lectures/ARM%20System%20Developer%27s%20Guide.pdf>
3. T. Wilmshurst , “An introduction to design of small scale embedded systems”, Palgrave Macmillan Publishers.
4. J. B. Peatman , “Design with PIC Microcontroller”, John B. Peatman, Pearson Education.
5. T. Wilmshurst, “Designing Embedded systems with PIC Micro controllers: Principles and Applications”, Elsevier.