

# 20ES002 - Embedded Systems Architectures

## UNIT-I: - The Embedded Hardware

### Part-1: An Introduction:

The Hardware Side – Getting Started, The Core Level, Representing Information, Understanding Numbers, Addresses, Instructions, Registers – A First Look, Embedded Systems – An Instruction Set View, Embedded Systems – A Register View, Register Transfer Language, Register View of a Microprocessor

### Part-2: Combinational Logic – A Practical View:

Introduction, Signal Levels, Time, Signal Behavior in the Real World – the Legacy of Early Physicists, Signal Quality, Inductance in Action, Logic Circuit Models and Parasitic Components, Testing Combinational Circuits – Introduction and Philosophy, Modeling, Simulation, and Tools, Structural Faults, Functional Faults.

## UNIT-II: -Storage Elements and Finite-State Machines

Introduction, The Concepts of State and Time, The State Diagram, Finite-State Machines – A Theoretical Model, Designing Finite-State Machines- Registers, Designing Finite-State Machines – : Counting and Dividing, Practical Considerations – Timing in Latches and Flip-Flops, Practical Considerations – Clocks and Clock Distribution, Testing Sequential Circuits,

## UNIT-III: -Memories and the Memory Subsystem

Introduction, Classifying Memory, A General Memory Interface, ROM Overview, Static RAM Overview, Dynamic RAM Overview, Chip Organization, Terminology, A Memory Interface in Detail, An SRAM Design, A DRAM Design, The DRAM Memory Interface, The Memory Map, Memory Subsystem Architecture, Basic Concepts of Caching, Designing a Cache System, Caching – A Direct Mapped Implementation, Caching – An Associative Mapping Cache Implementation, Caching – A Block-Set Associative Mapping Cache Implementation, Dynamic Memory Allocation, Testing Memories.

## UNIT-IV: -Embedded Software: The C Program & Pointers and Functions

Introduction, Software and Its Manifestations, An Embedded C Program, C Building Blocks, C Program Structure, Pointers and Functions: Introduction, Bitwise Operators, Pointer Variables and Memory Addresses, The Function, Pointers to Functions, Structures, The Interrupt.

## UNIT-V: -Safety, Security, Reliability, and Robust Design

Introduction, Safety, Reliability, Faults, Errors, and Failures, Another Look at Reliability, Some Real-World Examples, Single-Point and Common Mode Failure Model, Safe Specifications, Safe, Secure, and Robust Designs, Safe and Robust Designs – The System, System Functional Level Considerations, System Architecture Level Considerations, Busses – The Subsystem Interconnect, Data and Control Faults – Data Boundary Values, Data and Control Faults – The Communications Subsystem, The Power Subsystem, Peripheral Devices – Built-in Self-Test (BIST), Failure Modes and Effects Analysis,

### Text Books:

1. Embedded Systems: A Contemporary Design Tool, 2nd Edition, by James K. Peckol, Wiley.

2. ISBN: 978-1119457503.
3. 2.What Every Engineer Should Know about Developing Real-Time Embedded Products by Kim
4. R. Fowler.

## **List of Experiments**

List of Experiments (based on ARM cortex-M series):  
Interfacing various modules to ARM Microcontroller

1. Calculator type keyboard
2. 4-Digit,7-segment LED Display
3. Dual DAC
4. TXDR Interface Using PT100 with ADC
5. Stepper Motor
6. Elevator Interface
7. 4\*4 Matrix Hex Keypad
8. Temp Sensor
9. 16 Channel 8-bit ADC
10. Logic Controller
11. Traffic Lights
12. Musical Tone Generator
13. Opto Isolated Input Interface
14. Opto Isolated Output Interface
15. DC Motor
16. Study of RISC-V ISA architecture and 2 to 3 experiments using it.