

VEEA

**VinTech
Embedded Academy**

ARM Cortex-M3/M4 Processor Course Syllabus

1. Introduction

- Course Overview
- Learning Outcomes
- Target Audience
- Development Environment Overview
- ARM Cortex-Mx Family Overview
- Applications of ARM Processors

2. Hardware/Software Requirements

- Required Hardware
- Required Software Tools

3. IDE Installation

- Installation of IDE
- Toolchain Setup
- Project Creation
- Workspace Setup
- Verification of Installation
- First Project Compilation

4. Embedded Hello World

- Creating the First Project
- Writing a Simple Embedded Program
- Compiling and Building
- Flashing the Program to Target
- Running and Testing

5. Access Level and Operation Modes of the Processor

- Privileged vs Unprivileged Modes
- Thread vs Handler Modes

- Processor States and Transitions
- Security Extensions
- Register Access Levels
- Mode Switching Mechanism
- Supervisor Calls (SVC)
- Practical Examples

6. ARM GCC Inline Assembly Coding

- Basics of Inline Assembly
- Register Usage
- Arithmetic and Logical Operations
- Examples with C and Assembly Integration

7. Reset Sequence of the Processor

- Reset Mechanism
- Initialization Flow

8. Access Level and T Bit

- T-bit in CPSR
- Thumb State vs ARM State

9. Memory Map and Bus Interfaces of ARM Cortex-Mx Processor

- Processor Memory Map
- Code, SRAM, and Peripheral Regions
- Bus Interfaces Overview
- AHB, APB, and System Bus Architecture

10. Stack Memory and Placement

- Stack Pointer (MSP, PSP)

- Stack Usage in Exception Handling
- Memory Placement of Stack
- Stack Alignment
- Examples of Stack Operations
- Context Switching with Stack
- Stack Corruption Issues
- Practical Demonstrations

11. Exception Model of ARM Cortex-Mx Processor

- Exception Handling Basics
- Vector Table
- Exception Entry and Exit
- Nested Exceptions
- Exception Return Mechanism
- Interrupt Latency
- Example Programs
- Debugging Exceptions

12. Interrupt Priority and Configuration

- NVIC Overview
- Interrupt Priority Levels
- Preemption and Grouping
- Configuring Interrupts
- Example with Peripheral Interrupts

13. Fault Handling and Analysis

- HardFaults
- BusFaults
- UsageFaults

- Memory Management Faults
- Fault Registers and Analysis
- Debugging Faults
- Practical Examples

14. Exception for System Level Services

- Supervisor Calls (SVC)
- PendSV Exception
- SysTick Timer Exception
- Examples of System Calls
- OS Context Switching with SVC and PendSV
- Real-Time OS Integration

15. Implementation of Task Scheduler

- Basics of Scheduling
- Round Robin Scheduling
- Priority-based Scheduling
- Context Switching Mechanism
- SysTick Timer for Scheduling
- Writing a Simple RTOS Kernel
- Demonstration with Multiple Tasks
- Task Synchronization Concepts
- Inter-task Communication
- Advanced Scheduling Examples

16. Bare Metal Embedded and Linker Scripts

- Introduction to Bare-Metal Development
- Understanding Linker Scripts
- Sections in Memory (.text, .data, .bss, .heap, .stack)

- Writing Custom Linker Scripts
- Memory Management in Embedded Systems
- Startup Code and Reset Handlers
- Practical Bare-Metal Examples
- Building Applications without an OS
- Low-Level Peripheral Access
- Optimization Techniques

17. Thank You

- Course Wrap-Up
- Key Takeaways
- Further Learning Paths

For Further Information, Contact Us

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