Technical Examination Board, Gujarat State, Gandhinagar

Foundation course in Embedded Application Development

Title	ESDM105: Foundation course in Embedded Application Development
Level	Certificate Course
Course Duration	Four Month (Part time) Two Week (Full Time) 90 Hrs (Th. 30 Hrs Pr. 60 Hrs)
Entry Qualification	B.E./B.Tech/Diploma/B.E. Sem.III onward/ Diploma Sem. IV onward (EC/IC/IT/CE or Similar Branch)/ BCA/MCA/B.Sc./M.Sc./Any other graduate(with Physics/IT)

Teaching Scheme:

Sub Code	Subject Name	Teaching Scheme		Examination Scheme				Term Work Marks	Total Marks
		Theory	Practical	Theory Marks	Hrs	Practical Marks	Hrs		
ESDM105	Foundation course in Embedded application	2	4	50	2	100	4	25	175

Total Week	= 15	Theory = 1 hour slot
Total Teaching slot/Week	= 04	Practical = 2 hour slot
Theory Periods	= 30	Total teaching
Practical Periods	= 60	06 hours/week (Part-time) 06 hours/day (Full time)

ESDM105: Foundation course in Embedded application

The Cortex-M processor family is optimized for cost and energy-efficient microcontrollers. These processors are found in a variety of applications, including IoT, industrial and everyday consumer devices. The ARM-Cortex microcontroller is a most popular microcontroller in the digital embedded system world and most of the industries prefer only ARM microcontrollers since it consists of enormous features to implement products with an advanced appearance. The ARM microcontrollers are cost sensitive and high performance devices which are used in a wide range of application such as industrial instrument control systems, wireless networking and sensors and automotive body system etc.

Course Objectives:

The objective of the course is to provide understanding of the techniques essential to the design and implementation of embedded systems using suitable hardware and software tools. To train the students on the Arm Cortex microcontroller which has good capacity for processing real world signals. To allow people in embedded system sectors to learn programming/Interfacing peripherals to ARM cortex based microcontroller and learn troubleshooting of microcontroller based embedded electronic systems/products.

Upon successful completion of this course, the student should be able to:

- Understand the main features of the ARM Cortex based Embedded System development environment.
- Understand the hardware interfacing of the peripherals to ARM Cortex system.
- Design new embedded systems using ARM Cortex system.

After the completion of the course, the students will be specialized in Embedded System Design using ARM Cortex.

ESDM105 : Introduction to Embedded Systems	
Unit-1	**Introduction to Embedded Systems**
1.1	Introduction to embedded systems, Application Areas, Categories of embedded systems,
1.2	Overview of embedded system architecture,
1.3	Specialties of embedded systems, recent trends in embedded systems,
1.4	Architecture of embedded systems, Hardware architecture, Software architecture,
1.5	Application Software, Communication Software, Development and debugging Tools.
Out come	Understand the basics of Embedded Systems, Working of Microcontroller, based boards, Recent Trends in Embedded Systems
Unit -2	**Embedded C**
2.1	Introduction to 'C' programming,
2.2	Storage Classes, Data Types, Controlling program flow, bitwise operations Arrays, Functions, Memory Management, Pointers,
2.3	Variable arguments in Functions, Arrays and Pointers, Pointer to Functions and advanced topics on Pointers, Structures
Out come	Programming in Embedded C Concepts of Pointers, Structures and bitwise operators in context of Embedded Systems
Unit -3	**ARM /Cortex Introduction and Architecture**
3.1	Introduction to ARM, Architecture, Overview of ARM,
3.2	Overview of Cortex Architecture, Cortex M3 based controller architecture,
3.3	Memory mapping, Introduction to Keil, Simulation
Out come	ARM architecture and its peripherals Working in keil environment and simulation
Unit -4	**Programming ARM Cortex Peripherals (GPIO, Timers, Serial Port and Interrupts)**
4.1	Introduction to Timers and interface with ARM/Cortex microcontroller,
4.2	Introduction to Interrupts and interface with ARM/Cortex microcontroller,
4.3	Introduction to Serial Port and interface with ARM/Cortex microcontroller,
4.4	Cortex M3 interrupt handling – NVIC
Out come	Participants will learn how to read the datasheet of a particular ARM based development board Program various peripherals in keil using Embedded C

Unit -5	Interfacing external peripherals to ARM Based Microcontroller Board
5.1	Introduction to external peripherals
5.2	Interfacing ARM/Cortex microcontroller with LCD
5.3	Interfacing ARM/Cortex microcontroller with key board
5.4	Interfacing ARM/Cortex microcontroller with stepper motor
Out come	Monitoring and controlling various devices through an ARM based development Board
Unit -6	**Porting on ARM/Cortex**
6.1	Types of Bootloaders, Linux boot sequence
6.2	Building Kernel, Cross Compilation Building Boot image
6.3	Buildroot, Busybox, Kernel Compilation for ARM
6.4	Porting of OS to ARM
Out come	Port the OS with applications on ARM Cross compilation Optimizing Root File System

Suggested List of Practicals

Sr. No	Practical Name
1	Study the basics of Embedded Systems.
2	Study of Microcontroller based boards.
3	Perform Programmes in Embedded C (for Concepts of Pointers, Structures and bitwise operators in context of Embedded Systems)
4	Perform various programmes using keil sumulator for ARM architecture and its peripherals.
5	Interface ARM/Cortex microcontroller with external peripherals. (LCD, keyboard, stepper motor, etc.)
6	Perform Port of OS with applications on ARM Cross compilation system.

Course Reference: (Short Term Courses – NIELIT, GoI)