



National Institute of Electronics & Information Technology,
Aurangabad
(राष्ट्रीय इलेक्ट्रॉनिकी एवं सूचना प्रौद्योगिकी संस्थान, औरंगाबाद)
Ministry of Electronics & Information Technology
Government of India

COURSE PROSPECTUS

Name of the Group: Embedded System and IOT

Name of the Course: Foundation course in Embedded Application Development

Course Code: 2022/EHW/NIELIT/05318

Starting Dates: - 01/08/2023

Duration: 4 Weeks – 90 Hours

Course Coordinator: Mr. Prashant Pal, M. Tech from IIT Kharagpur, Scientist B,
NIELIT Aurangabad

Preamble:-

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.

Objective of the Course: -

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.

Outcome of the Course: -

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
- To 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.

Expected Job Roles:

Embedded Software Developer: Design and implement software of embedded devices and systems from requirements to production and commercial deployment

Embedded Firmware Developer: Designing and implementing software of embedded devices and systems.



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Embedded Application Engineer: Developing Embedded based applications

Course Structure:

| S. No | Module Title | Duration (Hours) | |
|--------------|--|------------------------------------|-----|
| | | Theory | Lab |
| 1. | Introduction to Embedded Systems | 5 | 1 |
| 2 | Embedded C | 6 | 12 |
| 3 | ARM /Cortex Introduction and Architecture | 6 | 10 |
| 4 | Programming ARM Cortex Peripherals (GPIO, Timers, Serial Port and Interrupts) | 6 | 20 |
| 5 | Interfacing external peripherals to ARM Based Microcontroller Board | 4 | 9 |
| 6 | Porting on ARM/Cortex | 3 | 8 |
| Total | | 90 Hours(Theory-30, Lab-60) | |

Other Contents:

- I. **Course Fees :** Course fee is Rs 10,000 including GST (* Nil for SC/ST)
- II. **Registration Fee:** An amount of Rs.1000/- (including all taxes as applicable) (non-refundable) should be paid at the time of registering for the course.
- III. **Course Fee Installment Structure:-** Not Applicable for this course
- IV. **Eligibility:** Final Year Polytechnic Diploma in Electronics /Electrical/ Instrumentation

or

3rd semester B.E/B.Tech in Electronics/Electronics & Communication/ Electrical/ Electrical & Electronics/Instrumentation

- V. **Number of Seats :30**
- VI. **Selection of candidates :** The candidates passed in the qualifying examination will be based on their marks obtained, subject to eligibility and availability of seats
- VII. **Test/Interview (if applicable) :** Not Applicable
- VIII. **Counselling/Admission :** Starting date of the course
- IX. **Important Dates (if applicable) :**

| | |
|--|---------------------------------|
| Registration Starting date: | 01/06/2023 |
| Last date to submit application form: | 20/07/2023 |
| Selection intimation in website: | 21/07/2023 |
| Counselling/Admission | 24/07/2023 |
| Commencement of class work: | 01/08/2023 |
| Payment of Fee | 01/06/2023 to 20/07/2023 |

X. **Course Timings :** 13:30 Hrs to 17:30 Hrs (Excl Saturdays, Sundays and National Holidays , 13:00 Hrs to 13:30 Hrs Lunch break)

XI. **.Placement :** Support shall be provided

XII. **Lab Facilities:**

LIST OF EQUIPMENT (For a batch of 30 students)

| Description | | Qty | Specifications |
|---------------------|--|-----|--|
| 1 | Classroom | 1 | |
| 2 | Student Chair | 30 | |
| 3 | Student Table | 15 | |
| 4 | Smart Interactive Display | 1 | |
| 5 | White Board | 1 | |
| Computer Lab | | | |
| 1 | Desktop computer with accessories | 25 | Installed with <ul style="list-style-type: none"> • OpenSTM,CubeMX • Keil Software • Buildroot • Busybox |
| 2 | ARM Cortex Based STMicroelectronics Nucleo Board | 10 | |
| 3 | ARM Cortex M3 Based Development Board | 30 | |
| 4 | tTl converter, LCD Display, stepper motor,Keypad | 15 | |

XIII. **Course Contents:**

| S. No | Module Title | Topics | Duration (Hours) | | Learning Outcome |
|-------|---|---|------------------|-----|---|
| | | | Theory | Lab | |
| 1. | Introduction to Embedded Systems | Introduction to embedded systems, Application Areas, Categories of embedded systems, Overview of embedded system architecture, Architecture of embedded systems, Hardware architecture, Software architecture, Application Software, Communication Software, Development and debugging Tools. | 5 | 1 | <ul style="list-style-type: none"> • Understand the basics of Embedded Systems • Working of Microcontroller based boards • Recent Trends in Embedded Systems |

| | | | | | |
|--------------|---|---|------------------------------------|----|---|
| 2 | Embedded C | Introduction to 'C' programming, Storage Classes, Data Types, Controlling program flow, bitwise operations Arrays, Functions, Memory Management, Pointers, Variable arguments in Functions, Arrays and Pointers, Pointer to Functions and advanced topics on Pointers, Structures | 6 | 12 | <ul style="list-style-type: none"> • Programming in Embedded C • Concepts of Pointers, Structures and bitwise operators in context of Embedded Systems |
| 3 | ARM /Cortex Introduction and Architecture | Introduction to ARM Architecture, Overview of ARM, Overview of Cortex Architecture, Cortex M3 based controller architecture, Memory mapping, Introduction to Keil, Simulation | 6 | 10 | <ul style="list-style-type: none"> • ARM architecture and its peripherals • Working in keil environment and simulation |
| 4 | Programming ARM Cortex Peripherals (GPIO, Timers, Serial Port and Interrupts) | Introduction to Timers and interface with ARM/Cortex microcontroller, Introduction to Interrupts and interface with ARM/Cortex microcontroller, Introduction to Serial Port and interface with ARM/Cortex microcontroller, Cortex M3 interrupt handling – NVIC | 6 | 20 | <ul style="list-style-type: none"> • Participants will learn how to read the datasheet of a particular ARM based development board • Program various peripherals in keil using Embedded C |
| 5 | Interfacing external peripherals to ARM Based Microcontroller Board | Introduction to external peripherals, Interfacing ARM/Cortex microcontroller with LCD, Interfacing ARM/Cortex microcontroller with key board, Interfacing ARM/Cortex microcontroller with stepper motor | 4 | 9 | <ul style="list-style-type: none"> • Monitoring and controlling various devices through an ARM based development board |
| 6 | Porting on ARM/Cortex | Types of Bootloaders, Linux boot sequence, Building Kernel, Cross Compilation Building Boot image, Buildroot, Busybox, Kernel Compilation for ARM, Porting of OS to ARM | 3 | 8 | <ul style="list-style-type: none"> • Port the OS with applications on ARM • Cross compilation • Optimizing Root File System |
| Total | | | 90 Hours(Theory-30, Lab-60) | | |



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XIV. Registration details: -

https://docs.google.com/forms/d/e/1FAIpQLSd69UzzCLO_meZelkf0IEUFfZybVPb-LqHf_69NbTjbGWMVOQ/viewform

