# Course Prospectus

# Foundation Course in Embedded Application Development

# (NSQF Level-4)

# **Mode:** ONLINE (Blended)

| | |
|---|---|
| **Name of the Group:** Embedded System Group | |
| **Course Name:** Foundation Course in Embedded Application Development | |
| **Course Code:** ED 101 | |
| **NSQF Level:** 04 | |
| **Duration:** 90 Hrs | |
| **Course Start Date:** 05-09-2022 | |
| **Course Coordinator:** Mr. Shoukath Cherukat | |
| **Last Date of Registration:** 31-08-2022 | |

## Preamble:

In today's world, embedded systems are all over, homes, offices, cars, factories, hospitals and consumer electronics. The inherent value of embedded systems lies in its pervasiveness. They are literally embedded in all electronic products, from consumer electronics to office automation, automotive, medical devices and communications. As time progressed, use of microprocessor-specific assembly-only as the programming language reduced and embedded systems moved onto C as the embedded programming language of choice. C is the most widely used programming language for embedded processors/controllers. Assembly is also used but mainly to implement those portions of the code where very high timing accuracy, code size efficiency, etc. are prime requirements. As assembly language programs are specific to a processor, assembly language didn't offer portability across systems. To overcome this disadvantage, several high level languages, including C, came up. Some other languages like PLM, Modula-2, Pascal, etc. also came but couldn't find wide acceptance. Amongst those, C got wide acceptance for not only embedded systems, but also for desktop applications. Due to the wide acceptance of C in the embedded systems, various kinds of support tools like compilers & cross-compilers, ICE, etc. came up and all this facilitated development of embedded systems using C.

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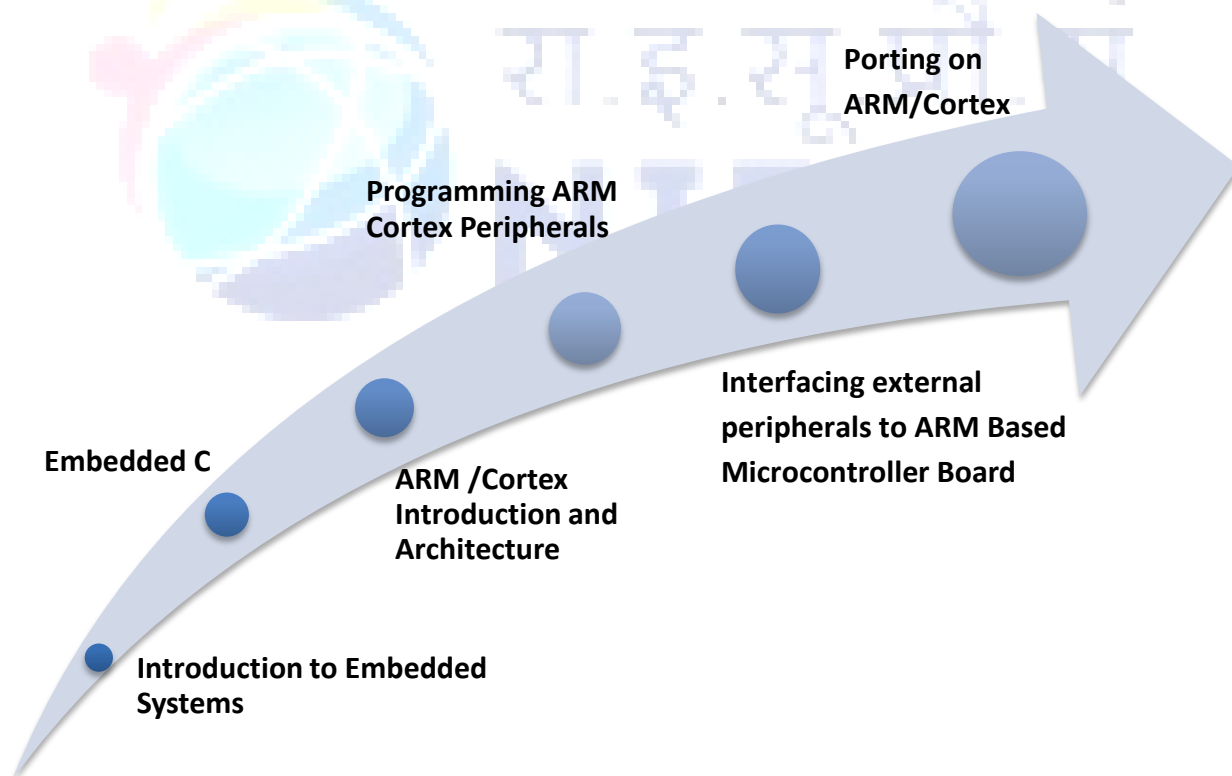
## Objective of the Course:

To make the candidates becoming familiar in embedded system concepts, Embedded 'C' language such as Memory management, Pointers, Data structures and architecture of the ARM Cortex processor for highly deterministic real-time applications.

## Outcome of the Course:

After the successful completion of the module, the students will be able to:

✓ Understand the basic components of a computer, C language programs that perform I/O functions and implement simple data structures, manipulate numbers in multiple formats, and understand how software uses global memory to store permanent information.
✓ Understand how the computer stores and manipulates data (characters, integers, and fixed-point numbers) and how basic arithmetic and logical operations are performed.

## Full Flow of Course

**Porting on ARM/Cortex**

**Programming ARM Cortex Peripherals**

**Interfacing external peripherals to ARM Based Microcontroller Board**

**Embedded C**

**ARM /Cortex Introduction and Architecture**

**Introduction to Embedded Systems**

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# Course Structure

This course contains totally six modules.

| S.No | Module Name | Duration (in Hours) |
|:---:|:---|:---:|
| 1. | Introduction to Embedded Systems | 6 |
| 2. | Embedded C | 18 |
| 3. | ARM /Cortex Introduction and Architecture | 16 |
| 4. | Programming ARM Cortex Peripherals (GPIO, Timers, Serial Port and Interrupts) | 26 |
| 5. | Interfacing external peripherals to ARM Based Microcontroller Board | 13 |
| 6. | Porting on ARM/Cortex | 11 |
| **Total Duration** | | 90 |

# Course Fees

Course fee is Rs. 6300/- Including GST.

| Registration Fee | Rs. 1000/- for SC-ST (Refundable *) | Rs. 1000/- for others (Adjustable with total fee) | |
|:---:|:---:|:---:|:---:|
| | SC-ST Candidates (Fee including GST in Rs.) | General Candidates (Fee including GST in Rs.) | Last Date |
| **Total** | NIL | 6300 | 04-09-2022 |
| **\*Caution deposit (Rs. 1000/-) will be refunded for eligible SC/ST candidates who will be successfully completing the course with NSQF certification under SCSP/TSP scheme.** | | | |

*GST is Applicable as per Govt. Norms GST (currently it is 18%).*

# Registration Fee.

(**Non-Refundable if candidate is selected for admission but did not join and if a candidate has applied but not eligible.**)

However, the above registration fee shall be refunded on few special cases as given below

- ✓ Candidates are eligible but not selected for admission.
- ✓ Course postponed and new date is not convenient for the student.
- ✓ Course cancelled.

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## Eligibility

- ✓ Final Year Polytechnic Diploma in Electronics /Electrical/ Instrumentation
  or
- ✓ 3rd semester B.E/B.Tech in Electronics/Electronics & Communication/ Electrical/ Electrical & Electronics/Instrumentation

## Number of Seats:  20

## How to Apply?

Candidates can apply online in our website http://reg.nielitchennai.edu.in. Payment towards non-refundable registration fee can be paid through any of the following modes:

- ✓ Online transaction: Account Name: NIELIT CHENNAI, Account No:  31185720641, Bank name: State Bank of India (SBI), Branch: Kottur (Chennai), IFSC Code: SBIN0001669.
- ✓ Pay through UPI Mobile Apps

**Note**: *The Institute will not be responsible for any mistakes done by either the bank concerned or by the depositor while remitting the amount into our account*

## Last date of Registration: 31st August, 2022

## Registration Procedure

All interested candidates are required to fill the Registration form online with registration fees before 31st  August, 2022 with all the necessary information at http://reg.nielitchennai.edu.in. .

## Selection of candidates:

**The selection to the course shall be based on the following criteria:**

Selection of candidates will be based on their marks in the qualifying examination subject to eligibility and availability of seats.

- ✓ The first list of Provisionally Selected Candidates will be published on NIELIT Chennai website (www.nielit.gov.in/chennai ) **1st September, 2022** by **5:00 PM**. In case of vacancy, an additional selection list will be prepared and the selection will be intimated by email only.
- ✓ Provisionally selected candidate has to upload their document on registration portal for online verification.

- ✓ **For SC/ST :**
  - Original Copies of Proof of Age, Qualifying Degree (Consolidated Mark sheet & Degree Certificate/Course Completion Certificate), 10<sup>th</sup> and 12<sup>th</sup> mark sheets.
  - Self-attested copy of community certificate.
  - One passport size photograph.
  - AADHAR Identity proof must for SC/ST Candidates (For availing concession).
  - Candidates under fee-waver category (SC-ST) have to give undertaking (notarized) through post indicating that they will not discontinue the course in between.

- ✓ **For Others (General, OBC, EWS) :**
  - Original Copies of Proof of Age, Qualifying Degree (Consolidated Mark sheet & Degree Certificate/Course Completion Certificate), 10<sup>th</sup> and 12<sup>th</sup> mark sheet.
  - One passport size photograph.
  - Self-attested copy of Govt. issued photo ID card

- ✓ After document verification, selected candidates (other than SC-ST) have to pay the remaining course fee of **Rs. 5,300/-** or as applicable on or before **04-09-2022** by payment mode mentioned above.
- ✓ Selected candidates are requested to upload the proof of remittance of fee on registration portal and also send the proof of remittance of fee as email to shoukath[at]nielit[dot]gov[dot]in / trng[dot]chennai[at]nielit[dot]gov[dot]in.

**Admission**: All provisionally selected candidates whose documents are verified and paid the fees (full or first instalment) and verified by accounts section of NIELIT Chennai will get a welcome message in his/her login ID provided during registration. The Credential and URL for online portal will be shared through WhatsApp or email.

## Discontinuing the course

- ✓ No fees (including the security deposit) under any circumstances, shall be refunded in the event of a student who have completed the process of admission or discontinuing the course in between. No certificate shall be issued for the classes attended. Only Grade Sheet will be issued.

- ✓ If candidates are not uploading consecutive 3 assignments within assigned time their candidature will be cancelled without any notice and all fees paid will be forfeited.

- ✓ If candidates are not appearing for any internal examinations/practical their candidature will be cancelled without any notice and all fees paid will be forfeited

**NIELIT**

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**Course Timings**: This program is a practical oriented one and hence there shall be more lab than theory classes. The classes and labs are online cloud based from 10:00 am to 2:00 pm and Monday to Friday.

**Location**: NIELIT Chennai is located at Gandhi Mandapam Road, Kotturpuram, Chennai (Landmark: Opp.To Anna Centenary Library).
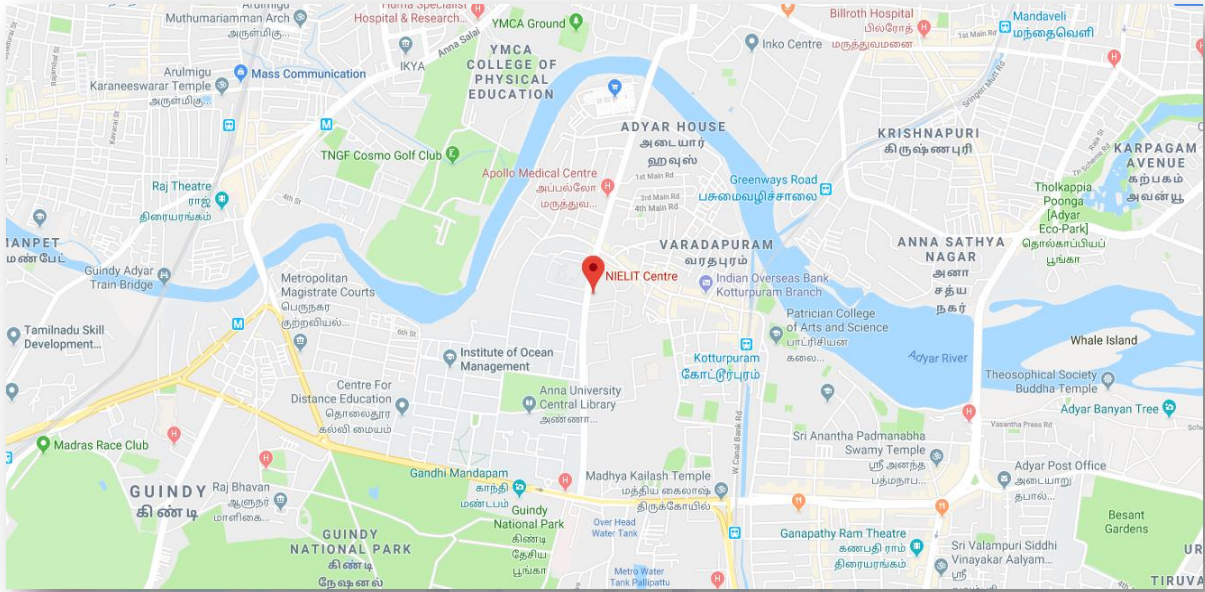


**Address**:

National institute of Electronics and Information Technology

ISTE Complex, No. 25, Gandhi Mandapam Road, Chennai – 600025

E-mail: shoukath[at]nielit[dot]gov[dot]in/ Phone: 044-24421445

Contact Person: Mr. Shoukath Cherukat     Mobile: 94474 23306 (Call @ 9 AM to 6 PM)

## Course enquiries

Students can enquire about the various courses either on telephone or by personal contact between 9.15 A.M. to 5.15 P.M. (Lunch time 1.00 pm to 1.30 pm) Monday to Friday.

## Placement:

Students who have completed the course successfully and qualified, will be given placement guidance and career counselling to crack the interviews.

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## Important Dates

> **Last Date of Registration:** 31-08-2022
> **Display of Provisional Selection List:** 01-09-2022
> **Payment of course fee:** 01-09-2022 to 04-09-2022
> **Course Start Date:** 05-09-2022

## Examination & Certification

✓ Final Certificates will be issued after successful completion of all the modules including mini project. For getting certificate a candidate has to pass each module individually with minimum required marks of 50%.

## NSQF Examination Pattern:

| Theory (Each Question will carry 1 mark) Duration (in Min): 90 | | Practical Duration (in Min): 180 | | Internal Assessment (Marks) | Project/ Presentation/ Assignment (Marks) | Total Marks |
|---|---|---|---|---|---|---|
| Paper | Marks / Paper | Paper | Marks/ Paper | | | |
| 1 | 100 | 1 | 60 | 20 | 20 | 200 |

## Grading Scheme

✓ Following Grading Scheme (on the basis of total marks) will be followed:

| Grade | S | A | B | C | D | Fail |
|---|---|---|---|---|---|---|
| **Marks Range (in %)** | 85 to 100 | 75 to 84 | 65 to 74 | 55 to 64 | 50 to 54 | Below 50 |

✓ Final Grading as per above grading scheme will be given on the basis of total marks obtained out of 200 marks, whereas it is essential to pass each paper individually with more than 50% marks(Theory, practical, assignment and internal assessment)

**Annexure**

## Detailed Syllabus of the Course

## 1. Introduction to Embedded Systems

- ✓ Introduction to embedded systems
- ✓ Application Areas
- ✓ Categories of embedded systems
- ✓ Overview of embedded system architecture
- ✓ Specialties of embedded systems
- ✓ Recent trends in embedded systems
- ✓ Architecture of embedded systems
- ✓ Hardware architecture
- ✓ Software architecture
- ✓ Application Software
- ✓ Communication Software
- ✓ Development and debugging Tools

## 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

## 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

## 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 GPIO
- ✓ Introduction to Serial Port and interface with ARM/Cortex microcontroller
- ✓ Cortex M3 interrupt handling – NVIC

## 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

## 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