राष्ट्रीय इलेक्ट्रॉनिकी एवं सूचना प्रौद्योगिकी संस्थान, चेन्नई
National Institute of Electronics & Information Technology, Chennai

Ministry of Electronics & Information Technology
Government of India

रा.इ.सू.प्रौ.सं NIELIT Chennai

COURSE PROSPECTUS

Embedded System Junior Developer

(O-Level Embedded System Design)

NSQF Level: 4

NSQF Level 4 | 450 Hours | Embedded System Junior Developer (O-Level Embedded System Design)

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Course Prospectus

Course Name:	Embedded System Junior Developer (O-Level 'Embedded System Design')
Course Code:	ED151-2
NSQF Level:	4
Duration:	450 Hrs
Last Date of Registration:	16th November 2026
Course Start Date:	23rd November 2026
Fee Details:	**Registration Fee -** Rs. 1000/- (Adjusted with Total Fee) **Total Fee –** Rs. 29,500/- (Fee is waived for SC/ST students)

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 their pervasiveness. They are literally embedded in all electronic products, from consumer electronics to office automation, automotive, medical devices and communications. We live in the age where information is just one click away and talking just one touch away.

The Embedded Industry is growing rapidly with the introduction of wide variety of Product for various applications catering to different sector demands. This increases the complexity of embedded system design; currently there is a shortage of qualified engineers with good Embedded Design and Development skills. Sector will continue to grow with introduction of new innovative products & applications; therefore, the need for Skilled Engineers will continue to grow. Hence, there need an advanced training program in Embedded Field, this course focuses on the architecture and programming of embedded processors, development of applications using Microcontroller/Embedded Linux Systems and porting the applications on ARM.

Objective of the Course

The objective of Embedded System Junior Developer (O-Level 'Embedded System Design') program is to introduce the participants to the necessary skills and knowledge to excel in the field of Embedded System Applications using suitable Hardware and Software tools. The program is of immediate relevance to industry and makes the participants exactly suitable for the Embedded Industry

Outcome of the Course

After successful completion of this Course, students will be able to:

- ✓ **Master Embedded C & ARM Cortex:** Gain expertise in embedded systems, focusing on ARM Cortex processors and real-time applications.
- ✓ **Develop Real-World Solutions:** Build complete embedded products using Linux OS on target boards, configure toolchains, and debug systems effectively.
- ✓ **Connect & Analyze with IoT:** Implement IoT applications using Python and data analytics, connecting sensors, processing data, and integrating machine learning.
- ✓ **Dive Deep into Protocols & Drivers:** Understand embedded protocols and develop device drivers within the Linux kernel for complex application development.

✓ **Graduate Industry-Ready:** Equip yourself with the skills and knowledge to contribute to diverse real-world projects in the dynamic field of embedded systems.

Course Progression

- 1.Embedded System Design & C-Programming
- 2.Microcontroller - ARM Cortex M series – Architecture, Peripheral Programming
- 3. Sensor data acquisition and actuation in Embedded Systems
- 4. Linux Internals
- 5. Employability Skills & 6. Project Work/OJT

Course Structure

This course contains total 5 modules. After completing **Five Modules**, the students must do a six-week **project** using any of the course related relevant topics studied to earn the Embedded System Junior Developer certificate, provided must passed both Theory and Practical conducted by NSQF.

Module	NOS / Module Name	Duration (in Hours)
NOS1	Embedded System Design & C- Programming	60
NOS2	Microcontroller - ARM Cortex M series - Architecture, Peripheral Programming	60
NOS3	Sensor data acquisition and actuation in embedded systems	60
NOS4	Linux Internals	60
NOS5	Employability Skills	60
Project (NOS Code: NIE/ELE/N0220)	Project Work/OJT	150
Total Duration		**450**

Course Fees

The course fee is **Rs. 29,500/-** including GST. Can be paid as a single instalment or in Two (2) instalments as given below,

Fee Component	SC/ST Candidate	General/OBC/EWS Candidate	Last Date
Registration Fee	Nil	Rs. 1000/- for others (Adjustable with total fee)	16th Nov 2026
Tuition Fee (Including NSQF Registration & Examination Fee)			

Fee Component	SC/ST Candidate	General/OBC/EWS Candidate	Last Date
1st Instalment	Nil	Rs. 14,250/-	23rd Nov 2026
2nd Instalment	Nil	Rs. 14,250/-	22nd Jan 2027
Total Course Fee	**Nil**	**Rs. 29,500/-**	-

Registration Fee

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

SC/ST: Nil
Others: Rs. 1,000/- (Adjustable with Total fee for candidates)

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

- Candidates are eligible but not selected for admission.
- The course has been postponed, and the new date is not convenient for the student.
- Course cancelled.

Eligibility

- Completed 12th or equivalent in Science with Physics and Maths

  (or)

- Completed 2nd Year of 3-Year Diploma in Electronics and Communication Engineering/ Electrical Engineering/CS/IT and allied branches after class 10th

  (or)

- Acquired NSQF Level 3.5 in Electronics and Communication Engineering/ Electrical Engineering/CS/IT and allied branches with 3 years of Experience

  (or)

- Acquired NSQF Level 3 in Electronics and Communication Engineering/ Electrical Engineering/CS/IT and allied branches with 1.5-year relevant experience

Number of Seats: 500

Note: Seats are allocated based on the merit of the Qualification.

How to Apply?

Candidates can apply online in our website https://nva.nielit.gov.in/ payment towards the 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: 16th November 2026

Registration Procedure

All interested candidates are required to fill the Registration form online with registration fees before **16th November 2026** with all the necessary information.

Selection Criteria 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 Provisionally Selected Candidates will be informed regarding **selection via email**. In case of vacancy, additional selection lists will be prepared and will be intimated by email only.
- Provisionally selected candidate must upload their document on registration portal for online verification.
  - Original Copies of Proof of Age, Qualifying Degree (Consolidated Mark sheet & Degree Certificate/Course Completion Certificate), 10th and 12th mark sheet.
  - One passport size photograph.
  - Self-attested copy of Govt. issued photo ID card (Aadhaar).
- After document verification, selected candidates must pay first instalment of **Rs. 14,250/-** or as applicable on or before **23rd November 2026** 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 ishant@nielit.gov.in / trng.chennai@nielit.gov.in

Admission

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

> **Note: All Provisionally Selected Candidates must visit NIELIT Chennai for Certificate Verification. Otherwise, their candidature will be cancelled without any intimation.**

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

Course Timings

This program is a practical oriented one and hence there shall be more lab than theory classes. The cloud based online theory classes will be on forenoon and lab session will be conducted mostly on afternoon time.

Address

National Institute of Electronics and Information Technology [NIELIT]

ISTE Complex, First Floor No. 25, Gandhi Mandapam Road, Chennai - 600025

E-mail: ishant@nielit.gov.in

Phone: 044-24421445

Contact Person: Mr. Ishant Kumar Bajpai

Mobile: 9445240125 [Call @ 9 AM to 5 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.

Important Dates

Last Date of Registration:	16th Nov 2026
Payment of first instalment fee:	on or before 23rd November 2026
Course Start Date:	23rd November 2026
Payment of Second Instalment fee:	on or before 22nd January 2027

Examination & Certification

Final Certificates will be issued after successful completion of all the modules including mini project. For getting certificate a candidate must pass each module (Theory and Practicals) individually with minimum pass percentage required marks is 50%.

Examination Scheme

Examination scheme for each module is as follows:

Assessment Components	NOS Included	Duration* (in mins)	Marks
Theory Paper 1 – Embedded System Design & C-Programming	1	90	100
Theory Paper 2 – Microcontroller - ARM Cortex M series - Architecture, Peripheral Programming	2	90	100
Theory Paper 3– Sensor data acquisition and actuation in embedded systems	3	90	100
Theory Paper 4 – Linux Internals	4	90	100
Practical Paper 1– Embedded System Design & C-Programming	1	180	100
Practical Paper 2– Microcontroller - ARM Cortex M series - Architecture, Peripheral Programming	2	180	100
Practical Paper 3– Sensor data acquisition and actuation in embedded systems	3	180	100
Practical Paper 4 – Linux Internals	4	180	100
Employability Skills	5		50
OJT/Project	1,2,3,4		100
		Grand Total	**950**

Grading Scheme

- Following Grading Scheme (based on 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 based on total marks obtained in all modules. For last module (NOS Code: NIE/ELE/N0220) grade will be given based on project demonstration.

Lab Infrastructure Details

Hardware Facilities:

- Development Boards - STM32, ARM Cortex-M4, Arduino Uno, NodeMCU, MSP430, Beagle Bone Black, Raspberry Pi
- Sensors–PIR, Ultrasonic, Soil Moisture, Accelerometer & Gyro meter
- Camera Module, Sense Hat, Capacitive Touch Screen
- Wireless Sensor Network Radio and Related Modules with Integrated Antenna
- Aardvark I2C/SPI Host adapter, I2C/SPI development board, CAN Development board, Komodu CAN Duo Interface

Software Facilities:

- C Programming IDE's Dev C++, Code::Blocks
- Keil Uvision, STM32Cube-MX, STM32Cube-IDE
- Ubuntu Linux system
- Proteus VSM

Faculty Profile

Ishant Kumar Bajpai (Scientist D), extensive experience spans over a decade and revolves around implementing funded projects in two key areas: the Internet of Things (IoT) and Very Large-Scale Integration (VLSI) with applications in the Biomedical and Automotive industries. His research interests are focused on FPGA implementations of Digital Signal Processing (DSP) systems

PRASANTH B R (Project Engineer – IoT), with 8 years of experience in Embedded Systems and IoT. He holds Masters in Embedded Systems and a Bachelor's in CSE, with expertise in Embedded C, ARM Cortex, Embedded Linux, and RTOS. Prior to NIELIT, he served as a Research Fellow at DRDO, and his professional interests span IoT applications, VLSI, ARM Cortex programming, and IoT data analysis, with a strong focus on practical, Industry-aligned solutions.

RAGHAVENDRAN S (Project Engineer – RPA), with 7 years of experience bridging the gap between hardware and software automation. Expertise spans across Robotic Process Automation (RPA), Embedded Systems, and the Internet of Things (IoT). Leveraging a foundational background in Electronics and Instrumentation, he specializes in designing and delivering high-impact training sessions and hands-on laboratory modules.

Detailed Syllabus of the Course

Module 1(NOS1): Embedded System Design & C- Programming | Duration: 60 Hours

Objective:

To set the required background 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.

Module Description:

C and Embedded-C

- Introduction to 'C' programming
- Storage Classes
- Data Types
- Controlling program flow
- Arrays
- Functions
- Memory Management
- Pointers
- Arrays and Pointers
- Pointer to Functions and advanced topics on Pointers
- Structures and Unions
- Data Structures
- Linked List
- Stacks, Queues
- Conditional Compilation
- Pre-processor directives
- File operations
- Bitwise operations
- Typecasting

Embedded Concepts

- 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

Module 2(NOS2): Microcontroller - ARM Cortex M series - Architecture, Peripheral Programming

Duration: 60 Hours

Objective:

The objective is used to provide good understanding of Microcontroller - ARM Cortex M series - Architecture, Peripheral Programming

Module Description:

Introduction to ARM Cortex

- Architecture Introduction to 32-bit Processors
- The ARM Architecture
- Overview of ARM
- Overview of Cortex Architecture
- Cortex M4 Register Set and Modes
- Cortex M4 Processor Core
- Data Path and Instruction Decoding
- ARM Cortex M4 Development Environment
- Assembler and Compiler
- Linkers and Debuggers
- ARM-Thumb & Thumb2 instructions
- Mixing ARM & Thumb Instructions
- Memory hierarchy
- Memory Mapping
- Cache

Cortex M4 Microcontrollers & Peripherals

- Cortex M4 based controller architecture
- Memory mapping, Cortex M4 Peripherals – RCC
- GPIO
- Timer, System timer
- UARTs, LCD, ADC & PWM
- Cortex M4 interrupt handling – NVIC
- Application development with Cortex M4 controllers using standard peripheral libraries

Module 3(NOS3): Sensor data acquisition and actuation in embedded systems

Duration: 60 Hours

Objective:

The objective of the course is to provide a thorough understanding about and hands-on practice Sensor data acquisition and actuation in embedded systems

Description:

Introduction to Transducers

- Overview of transducers and their role in measurement and control systems
- Classification of transducers: sensors and actuators
- Basic principles of transduction

Sensor Fundamentals

- Introduction to sensors and their functions

- Classification of sensors based on the measured quantity (temperature, pressure, etc.) Classification of sensors based on the sensing mechanism (resistive, capacitive, etc.) Sensor characteristics: sensitivity, accuracy, linearity, and range

Common Types of Sensors & Sensor Applications

- Temperature sensors: thermocouples, RTDs, thermistors. Pressure sensors: piezoresistive, capacitive, and optical sensors. Proximity sensors: inductive, capacitive, and photoelectric sensors. Motion sensors: accelerometers, gyroscopes, and proximity detectors
- Industrial applications of sensors in manufacturing and process control. Environmental monitoring and sensing. Biomedical sensors and applications. Automotive and transportation sensors

Actuator Fundamentals

- Introduction to actuators and their functions, Classification of actuators based on the output (mechanical, electrical, etc), Actuator characteristics: response time, force, torque, and displacement
- Common Types of Actuators, Electric actuators: motors (DC, AC, stepper), solenoids, Pneumatic and hydraulic actuators: cylinders, valves, Piezoelectric actuators, Electroactive polymer (EAP) actuators

Actuator Applications

- Robotics and automation, Motion control systems, Fluid control and valve actuators
- Haptic and tactile feedback systems Sensor and Actuator Integration, Sensor and actuator interfacing with microcontrollers and embedded systems, Signal conditioning and amplification techniques, Calibration and compensation methods, Practical considerations for sensor and actuator integration

Sensor and Actuator Integration

Sensor and actuator interfacing with microcontrollers and embedded systems, Signal conditioning and amplification techniques, Calibration and compensation methods, Practical considerations for sensor and actuator integration

Module 4(NOS4): Linux Internals — Duration: 60 Hours

Objective:

To Skilling the students in Configure, Deploying and Debugging the Linux OS onto a Target Board to build a complete Embedded Product using Linux Kernel.

Description:

Architecture of Embedded Linux:

- Basic Operating System Concepts
- History& Benefits of Linux
- Fundamentals of Embedded Linux OS
- What is Kernel?
- Task of kernels
- Types of kernels
- Kernel Architecture Overview
  - User Space
  - Kernel Space

- Kernel Functional Overview
  - File System
  - Process Management
  - Address Spaces and Privilege Levels
  - Memory Management
  - System Calls

Configuring the Linux Environment:

- Linux environment
- Types of Hosts
- Types of Host/Target Development Setups
- Types of Host/Target Debug Setups
- Embedded Environment Tools
- GNU Tool-chain Cross Compilers

Tool-chain: Configuration and Cross-Compilation:

- What is a tool- chain?
- Native vs. cross-compilation
- Toolchain Components
- Toolchain choices
- Using build root to build the toolchain
- Configuration options
- Adding path variables to startup scripts (.bashrc)
- The CROSS_COMPILE variable
- Validating the cross-compiler

Linux Bootloader & U-Boot:

- Boot-loader Phases
- U-boot – Embedded boot loader
- What does u-boot do?
- Navigating the u-boot sources
- Configuring and Cross-compiling u-boot
- Installing u-boot on the target
- Understanding u-boot commands
- Changing environment variables to setup kernel booting
- Transferring files to the target using tftp

Embedded Linux Kernel:

- Kernel Features
- Kernel Subsystems
- Memory Manager & Scheduler
- Embedded Storage
- I/O Subsystem
- Network Subsystem
- Navigating the kernel sources
- Kernel Configuration
- Kernel Compilation
- Booting the kernel using u-boot
- Module compilation and Installation to RootFS
- Procedure for adding a new driver to the kernel & Applying patches

Building Root File System:

- Introduction to File system
- Linux directory structure
- Organization and Important directories /dev file system
- What next after kernel booting
- init and startup scripts
- Downloading & Compiling RootFS
- RootFS in Flash/SD Card Storage

Porting OS in ARM Board:

- Kernel Compilation
- Booting the kernel using u-boot
- Porting Linux in ARM Board

Module 5: Employability Skill — Duration: 60 Hours

After completing this program, participants will be able to:

- Outline the importance of Employability Skills for the current job market and future of work.
- List different learning and employability-related GOI and private portals and their usage.
- Research and prepare a note on different industries, trends, required skills, and the available opportunities.

Constitutional Values – Citizenship:

- Explain constitutional values, including civic rights and duties, citizenship, responsibility towards society, and personal values and ethics such as honesty, integrity, caring, and respecting others that are required to become a responsible citizen.
- Demonstrate how to practice different environmentally sustainable practices.
- Becoming a Professional in the 21st Century.
- Discuss relevant 21st-century skills required for employment.
- Highlight the importance of practicing 21st-century skills like Self-Awareness, Behavior Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn, etc., in personal or professional life.
- Create a pathway for adopting a continuous learning mindset for personal and professional development.

Basic English Skills:

- Show how to use basic English sentences for everyday conversation in different contexts, in person and over the telephone.
- Read and understand text written in basic English.
- Write a short note/paragraph/letter/e-mail using correct basic English.
- Career Development & Goal Setting
- Create a career development plan.
- Identify well-defined short- and long-term goals.

Communication Skills:

- Demonstrate how to communicate effectively using verbal and nonverbal communication etiquette.
- Write a brief note/paragraph on a familiar topic.
- Explain the importance of communication etiquette, including active listening for effective communication.
- Role-play a situation on how to work collaboratively with others in a team.
- Diversity and Inclusion
- Demonstrate how to behave, communicate, and conduct appropriately
- Discuss the significance of escalating sexual harassment issues as per the POSH act.

Financial and Legal Literacy:

- Discuss various financial institutions, products, and services.
- Demonstrate how to conduct offline and online financial transactions safely and securely and check passbook/statement.
- Explain the common components of salary such as Basic, PF, Allowances (HRA, TA, DA, etc.), tax deductions.
- Calculate income and expenditure for budgeting.
- Discuss legal rights, laws, and aids.

Essential Digital Skills:

- Describe the role of digital technology in day-to-day life and the workplace.
- Demonstrate how to operate digital devices and use the associated applications and features safely and securely.
- Demonstrate how to connect devices securely to the internet using different means.
- Follow the dos and don’ts of cybersecurity to protect against cybercrimes.
- Discuss the significance of displaying responsible online behavior while using various social media platforms.
- Create an email id and follow email etiquette to exchange emails.
- Show how to create documents, spreadsheets, and presentations using appropriate applications.
- Utilize virtual collaboration tools to work effectively.

Entrepreneurship:

- Explain the types of entrepreneurship and enterprises.
- Discuss how to identify opportunities for potential business, sources of funding, and associated financial and legal risks with its mitigation plan.
- Describe the 4Ps of Marketing-Product, Price, Place, and Promotion and apply
- them as per requirement.
- Create a sample business plan for the selected business opportunity.

Customer Service:

- Classify different types of customers.
- Demonstrate how to identify customer needs and respond to them in a professional manner.
- Discuss various tools used to collect customer feedback.

- Discuss the significance of maintaining hygiene and dressing appropriately.

Getting ready for Apprenticeship & Jobs:

- Draft a professional Curriculum Vitae (CV).
- Use various offline and online job search sources to find and apply for jobs.
- Discuss the significance of maintaining hygiene and dressing appropriately for an interview.
- Role-play a mock interview, searching and registering for apprenticeship opportunities.

Project Work / OJT — Duration: 150 Hours

Description:

Its compulsory module for participants to project their knowledge in implementation of Embedded Systems Project in Realtime application. The students must do a six-week project using any of the course related relevant topics studied to earn the Embedded System Junior Developer certificate, provided must passed both Theory and Practical conducted by NSQF, the students can select Embedded system projects. The project can be implemented using ARM, RPi or Beagle Bone Black (BBB) as per Industry relevant MCUs.

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Key Details

Course Name:	**Embedded System Junior Developer**
Course Code:	**ED151-2**
Duration:	**450 Hours**

1. Last Date of Registration
   16 November 2026
2. Date of First Selection
   20 November 2026
3. Payment of First Instalment – Rs.14,250
   on or before 23 November 2026
4. Course Start Date
   23 November 2026
5. Payment of Second Instalment - Rs.14,250
   on or before 22 January 2027

Registration Fee

General: **₹1000**

SC / ST: NIL

Total Course Fee

General: **₹29,500**

SC / ST: NIL