COURSE PROSPECTUS

Name of the Group:	Embedded Systems
Name of the Course:	**Online** Certificate course on **Embedded Linux**
Course Code:	ED201
Starting Date:	10th May, 2021
Duration:	2 Weeks
Course Coordinator:	Karthick Rajan. N
Last date of Registration:	7th May, 2021

Preamble:

Linux by itself is a kernel and Embedded Linux is Open-Source and generally refers to a complete system to a Linux distribution targeted at embedded devices. There is no Linux kernel specifically targeted at embedded devices, the same Linux kernel source code can be built for a wide range of devices, workstations, embedded systems, and desktops though it allows the configuration of a variety of optional features in the kernel itself.

In the process of embedded development context, there can be an embedded Linux system which uses the Linux kernel and other software or an embedded Linux distribution which is a pre-packaged set of applications meant for embedded systems and is accompanied by development tools to build the system.

Embedded Linux, though utilizing the same Linux kernel, is quite different from the standard Linux OS and is specifically customized for embedded systems. Therefore it is has a much smaller size, requires less processing power and has minimal features. Based on the requirements of the underlying embedded system, the Linux kernel is modified and optimized as an embedded Linux version. Such an instance of Linux can only run device-specific purpose-built applications. Usage of Linux OS in embedded systems continues to grow because of high-performance, scalable, stable alternative to traditional proprietary embedded operating systems and supports a new hardware architectures, Platforms and variety of applications and networking protocols.

In the today marketplace, many companies still build their own embedded Linux distributions in their embedded products and the present available academic curriculum is not much enough to fulfil the requirement of Skills needed to build embedded Linux based systems. Because of lack of hands-on experience among professionals, there is a huge demand in providing skill-based training in Embedded Linux which will bridge the skill-gap among engineering graduates.

Objective of the Course:

To Skill the engineering graduates in Deploying and Debugging the Linux OS onto a Target Board to build a complete Embedded Product using Linux Kernel.

Outcome of the Course: After successful completion of this Course, Students can:

1. Equipped in Setting Linux environment for ARM based Target Boards.

2. Gained Hands on Experience to Configure Tool-Chain for ARM Platforms.

3. Exposed to Linux Booting Process and learned to configure Linux Kernels on ARM based Embedded Boards.

4. Develop ARM based Embedded Applications with Linux OS.

Course Structure:

S. No	Topics	Duration (in Hrs.)
1	Introduction	2
2	Architecture of Embedded Linux	2
3	Commands in Linux	2
4	Configuring the Linux Environment	2
5	Tool-chain: Configuration and Cross-Compilation	2
6	Linux Boot loader& U-Boot	2
7	Embedded Linux Kernel	2
8	Building Root File System	2
9	Porting OS in ARM Board	2
10	Embedded Linux Application Development	2
	Total	**20**

Other Details:

Course Fees: Rs. 2,000/- (Including GST) (Non-Refundable)

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

1. If course postponed and new date is not convenient for the student.
2. If course cancelled.

Payment schedule: The Fee is to paid in one instalment as given below.

Instalment No.	Last Date for Payment	Amount (in Rs.)
1.	07-05-2021	Rs.2,000/-

Eligibility: Students and Graduates of B.E./B. Tech in Electronics/ Electronics & Communication/ Electrical/ Electrical and Electronics/Instrumentation/ Electronics & Instrumentation / Instrumentation & Control /Computer Science/Information Technology /M.Sc.(Electronics)/AMIE in Electronics/ Electronics & Communication

Number of Seats: 30

How to apply:

Candidates can apply online in our website https://reg.nielitchennai.edu.in/ .Payment towards Course fee can be paid through any one of the following modes:

- ✓ Online transaction: **Beneficiary Name: NIELIT CHENNAI, Account No: 31185720641, Branch: Kottur (Chennai), IFSC Code: SBIN0001669**.
- ✓ Pay through Unified Payment Interface (UPI) payment methods Eg: Google Pay, Paytm, BHIM, Phone Pe
- ✓ DD drawn from a nationalized bank (preferably SBI) in favor of ―NIELIT Chennai‖ payable at Chennai.

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: 7th May, 2021

Selection of candidates: First Come First Serve basis

Admission Procedure:

All interested candidates are required to fill the Registration form with the Course fees before **7thMay, 2021** with all the necessary following documents.

- Self-attested copy of Govt. issued photo ID card.
- Candidates have to submit the proof of qualification.

Note: Working days are from Monday to Friday.

Discontinuing the course: No fees under any circumstances shall be refunded in case of a student discontinuing the course. No certificate shall be issued if discontinued.

Course Duration: 2 Weeks/20Hrs. (Monday-Friday)

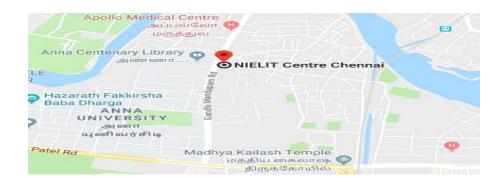**Course Timings**: 10.30 AM to 12.30 PM

Mode of Training: Online

Certification:
After Successful completion of the course, examination will be conducted and accordingly Certificate will be issued.

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

National Institute of Electronics and Information Technology, Chennai

Address: National Institute of Electronics and Information Technology Chennai Centre,
ISTE Complex, No. 25, Gandhi Mandapam Road, Chennai – 600025
E-mail: trng.chennai@nielit.gov.in / Phone: 044-24421445
Contact Person: Karthick Rajan. N, Mobile: 9940569468, 9080298798

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.

Annexure

Detailed Syllabus of the Course

1. Introduction:

- ✓ Basic Operating System Concepts
- ✓ History& Benefits of Linux
- ✓ Fundamentals of Embedded Linux OS
- ✓ Comparison of Embedded OS
- ✓ Embedded OS Tools and IDE
- ✓ Embedded Linux Applications and Products.

2. Architecture of Embedded Linux:

- ✓ 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

- ➢ Inter Process Communication (IPC) – Pipes, FIFo & Shared Memory
- ➢ Device Drivers
- ➢ Network

3. Commands in Linux:

- ✓ Log In Linux system and Log in Remote Linux Systems- Getting Help
- ✓ Accessing & Working with the Command Line and Shell
- ✓ System Access, Entering Commands
- ✓ Boot Methods-Creating User Accounts &Managing Users
- ✓ Creating Groups & Managing Groups
- ✓ Directory Management
- ✓ File Permissions and Ownership
- ✓ vi Text Editor

4. 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

5. Tool-chain: Configuration and Cross-Compilation:

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

6. 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

7. **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

8. **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

9. **Porting OS in ARM Board:**

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

10. **Embedded Linux Application Development**

- ✓ Application Developments using Input Devices
- ✓ Application Developments using Output Devices
- ✓ Application Developments using Peripherals