IIT Guwahati

The IoT Academy
Connecting The Unconnected

Course Curriculum

Advanced Certification in

Embedded Systems and IoT

By E&ICT Academy, IIT Guwahati

ABOUT THE
IIT GUWAHATI

Indian Institute of Technology Guwahati, the sixth member of the IIT fraternity, was established in 1994. The academic programme of IIT Guwahati commenced in 1995.At present the Institute has eleven departments and three inter-disciplinary academic centres covering all the major engineering, science and humanities disciplines, offering BTech, BDes, MA, MDes, MTech, MSc and PhD programmes. Within a short period of time, IIT Guwahati has been able to build up world class infrastructure and a reputation for itself.

ABOUT
E&ICT ACADEMY, IIT GUWAHATI

Electronics and ICT Academy aims to provide specialized training to the faculties of Engineering, Arts, Commerce, Science colleges and Polytechnics institutes by developing short term training programmes on fundamental and advanced topics in IT, Electronics & Communication, Product Design, Manufacturing. In addition, the Academy conducts specialized customized training programmes and research promotion workshops for corporate sector & educational institutions.

COURSE CURRICULUM

C PROGRAMMING & DATA STRUCTURE 01

Module-1: C Programming and Data Structure

- *Keywords and Data types*
- *Operators*
- *Flow control*
- *Loops*
- *Memory allocation*
- *Storage class*
- *Functions*
- *Arrays*
- *Sorting and searching techniques*
- *Strings*
- *Pointers*
- *Function pointer*
- *Enumeration & volatile*
- *Structure and union*
- *File handling concepts*
- *Dynamic memory allocation*
- *Command line arguments*
- *Data structures*
- *Linked-list*
- *Stack and Queue*
- *Tree*
- *Graph*

EMBEDDED SYSTEMS 02

Module-2: Basic Embedded Systems

- *What is an Embedded System?*
- *What is a Microprocessor?*
- *Processor Architectures*
- *Difference between microprocessors and microcontrollers*
- *Types of Microcontrollers*
- *Programming Languages for Embedded system*

Modules -3: NODEMCU (Esp8266)

- *Install IDE Software*
- *Programming Of Nodemcu*
- *Pinout of Nodemcu*
- *Programming Of Nodemcu*
- *Bi-Directional Visitor Counter*
- *Traffic light controller*

Module-4: Connectivity protocols (wired and wireless) and Sensors/Actuators

- *UART/USART*
- *RS232*
- *RS485*
- *SPI*
- *I2C*
- *Modbus*
- *CANBus*
- *Ethernet*
- *Wifi*
- *Zigbee*
- *BLE*
- *LORA*
- *Sensors*
- *Sensors types-analog and digital*
- *Temperature/humidity sensor*
- *Ultrasonic sensors*
- *Photoresistor*
- *Smoke sensor*
- *Gyroscope sensor*
- *Accelerometer*
- *OLED display*

Modules -5: Network Layered Architecture Communication

a.OSI model

- Physical Layer
- Datalink layer
- Network layer
- Transport layer
- Session layer
- Presentation layer
- Application layer

b.TCP/IP MODEL

- Network layer
- Internet layer
- Transport layer
- Application layer

c. IP v 4 and IPv6

d. Wireless sensor networks

- Layered Network Architecture
- Clustered Network Architecture

e.Introduction to telecom network

- CDMA and 2g
- 3g 4g and 5g

ADVANCED EMBEDDED SYSTEM 03

Module-6: CORTEX-M ARCHITECTURE And CMSIS

- *What Is Arm Cortex-m?*
- *What Are 32-bit Processors?*
- *The Cortex -M Family Of 32-bit Processors?*
- *Arm Processor Architecture*
- *Load-store Architecture*
- *The Register Bank*
- *Program Status Register*
- *Introduction To CMSIS*
- *Introduction To Hardware Abstraction Layer(hal)*
- *ARM Vs Thumb Instruction*

Module-7: Download And Install Software Requirements

- *Download And Install Stm32cubemx*
- *Download And Install Keil uvision 5*

Module-8: Memory, Peripherals and Interfaces

- *GPIO PROGRAMMING and nested vector interrupt controller*
- *Stack memory and placement*
- *Direct memory access*
- *Peripherals of the microcontroller (ADC,DAC,UART/USART,SPI,I2C,USB,CAN,TIMERS AND COUNTERS)*
- *GPIO driver*
- *UART driver*
- *I2C driver*
- *SPI driver*
- *ADC/DAC driver*
- *RTC and Timers driver*

Module-9: RTOS

- *What is RTOS?*
- *Introduction to freeRTOS*
- *Downloading and installing freeRTOS*
- *The CMSIS RTOS API*
- *Thread management*
- *Memory pools*
- *Synchronization(Semaphores. Mutex)*
- *Inter Process Communication (Pipes, FIFOs, Shared Memory, Message Queues)*
- *Timer and time Management*

Module-10: Embedded LINUX

- *Introduction to Linux*
- *Understand Linux Filesystem and Partitioning*
- *Linux System Administration*
- *Linux Network Administration*
- *Linux System Programming using Process, IPC, Synch and Threads*
- *Process Management*
- *Signals and Handlers*

Module-11: R-PI and Embedded LINUX

a. ***Linux in Embedded System***

b. ***Linux-based Embedded System Component Stack***

- *Bootloader*
- *Kernel*
- *Root file system*
- *Device tree*
- *System programs*
- *Application*

c. ***Anatomy of a Linux-based system***

- *The Linux Kernel internals*
- *Device tree*
- *System programs and BusyBox*

d. ***Configuration & Build Process of an Embedded Linux System***

- *yocto*

Module-12: Introduction to IoT and Architecture

- *What is IoT*
- *IoT applications in different domains*
- *Trends in IoT Market*
- *Edge vs Cloud functional partitioning*

Module-13: IoT Architecture

- *Smart things*
- *Gateways*
- *Middleware*
- *Cloud*
- *Applications*

Module-14: IoT Protocols Theory

- *HTTP/rest*
- *MQTT*
- *COAP*
- *AMQP*
- *WEBSOCKETS*
- *6LoWPAN*

Module-15: Node-RED

- *Installation of Nodejs on Local pc*
- *Installation of Node-red on local*
- *Local broker installation*
- *Connection between local broker and Node-RED*
- *Node-RED dashboard*

Module-16: LWIP TCP/IP STACK

- *Introduction to LWIP stack*
- *DHCP/Static ip interface*
- *MQTT over LWIP*
- *SMTP over LWIP*
- *HTTP and FTP over LWIP*

Module-17: IOT Security

- *Introduction to MBED TLS and SSL*
- *Importance of security in IoT application*
- *Use of hardware accelerated AES encryption on ARM MCU*

Module-18: : Introduction of Cloud Computing

- *About Cloud and Cloud Computing*
- *Benefits of cloud*
- *History of cloud computing*
- *Deployment Models*

- **Industry Grade Capstone Project Assessment**

CONTACT DETAILS

Program Information:

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