Chennai

Domain - IoT, Embedded Systems

Embedded Systems

1. **Embedded C Programming and Data structures**

Overview of C Programming language, Introduction to GNU Toolchain and GNU Make utility, Linux environment and vi editor, Tokens of C - Keywords, Data-Types, Variables, Constants, Operators, Identifiers, Storage Class Specifiers, Control Flow Statements, Arrays, Multidimensional arrays, Data Input & Output, Strings, Loops, Functions and Recursion, Pointers - Introduction, Pointer Arithmetic, Pointers and Arrays, Pointers and Functions, Pointers and Strings, Structures, Unions, Enum, Typedef, Bit field operators and pointers with structures, Preprocessors, C and Assembly, Files, I/O, Variable number of arguments, Command Line arguments, Error handling, Debugging and Optimization of C programs, Bit operations, Handling portability issues in C, Hardware, Time, Space and Power aware Programming. Algorithms and Abstract Data Types, Complexity of Algorithms, Linked Lists, Stacks, Queues, Searching and Sorting Algorithms, Hashing, Trees.

2. **Microcontroller Architecture and Programming**

a. Microcontroller Architectures – Harvard, Von Neuman, CISC, RISC

b. Memory Architectures – Flash, RAM, NVRAM, Serial Flash, EEPROM

c. Analog circuits – ADC, Comparators, DAC,

d. General Purpose IO

e. Clocks, Timers, Watchdog, Real Time Clock

f. Embedded Peripheral Interfacing - Serial peripherals: UART, SPI, I2C, CAN

g. Interrupts and Nested Interrupts, Interrupt Controllers

3. **Operating System Concepts and Linux Programming**

a. Process Management, File Management, Device Management, Scheduling, Memory Management

b. IPC, Synchronization Techniques, Shared Memory

c. Interrupts and Interrupt Vectors, Handlers and Service Routines

d. Device Drivers, Kernel Programming, Device Tree Sources, System Calls

e. Linux System and Application Programming

f. Filesystem Types, Virtual File Systems - Proc FS, SysFS, Dev FS,

g. Libraries – Static and Dynamic Libraries,

h. Bootloader Concepts

i. Real Time Operating System Concepts - Schedulers, Priority based Scheduling Algorithms, Determinism, Priority Inversion and Inheritance

4. **ARM**

Overview of ARM Architecture and Organization, Introduction to Cortex-M Architecture, Programming Model and Instruction Set Architecture, Alignment and Endianness, Register access, State, Privilege, Stack, System Control Block, Power Modes, Memory Model, NVIC, Exception Handling, Bit- Banding, Peripheral Programming, SVCall, SysTick, PendSv, MPU, DMA, Mixing Assembly and C programs, Introduction to CMSIS & CMSIS Components, Overview of Cortex A & R

architectures.

5. **RISC V**

Why RISC-V processor, RISC-V processor overview, ARM vs RISC-V, Modes in RISC-V, Setting up of necessary tools, RISC-V register set and calling convention, Instruction formats and type, Build Process, Practical examples of instructions, Detail description on Control and Status Registers, Exception handling, Examples in assembly for exception handling, Interrupts, Interrupt Entry and Exit procedure.

6. **Embedded Hardware Design Concepts and Power Supplies**

a. Discrete Analog Circuit Design – OpAmps circuits: Amplifiers, Comparators, Integrators, Differentiators, Hysteresis

b. Microcontroller Board Bring Up – Crystal Oscillators, Power Supply Decoupling, Reset Circuits, Analog and Digital Ground Isolations

c. Power Supply Circuits – Linear Regulators, Low Drop Out oscillators, Switched Mode Power Supplies – Buck, Boost, Buck Boost, Isolated, Non-Isolated

d. Input and Output Device Interfacing – Analog Sensors, Serial Peripheral Interfacing, Digital Sensor Interfacing, LCD Interfacing, OLED Interfacing, Memory Chip Interfacing

e. Power supply requirements for embedded systems, Low-power design techniques, Power modes of microcontrollers (sleep, deep sleep), Energy-efficient software design

7. **Testing and Debugging in Embedded Systems**

a. Testing methodologies: unit testing, integration testing, system testing

b. On-chip debugging techniques: JTAG, SWD, Fault- tolerance and error-handling mechanisms

c. Testing tools: oscilloscopes, logic analyzers, debuggers

IoT

1. **Introduction to IoT**

a. Fundamentals of IoT: Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, IoT frameworks, IoT and M2M.

b. Sensors Networks: Definition, Types of Sensors, Types of Actuators, Wireless Sensor Networks

2. **Networking and Communication Protocols**

a. Overview of Basic Networking Concepts (TCP/IP, OSI Model), MQTT, CoAP, LoRaWAN and Cellular Technologies in IoT, Bluetooth Low Energy (BLE), Network Topologies for IoT

b. Wireless Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, BACnet, Modbus. c. IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT

3. **IoT Applications**

a. Basics of the Python programming language, Programming on the Raspberry Pi. Python on Raspberry Pi, Python Programming Environment, Python Expressions, Strings, Functions and Function arguments, Lists, List Methods, Control Flow.

b. Data Acquisition Techniques from Sensors

c. Data Analytics in IoT

4. **Security and Privacy in IoT** - Common IoT Security Challenges and Threats, Best Practices for Securing IoT devices, Overview of Encryption Methodologies (TLS, End-to-End Encryption),Privacy Concerns in Data Collection and Compliance Standards, Basics of Network Security

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POSITION DETAILS

ADVT. NO.: CORP/GRP.A/06/2024

APPLY

Post	Scientist C (Level 11)
No. of Posts	1
Domain(s)	IoT, Embedded Systems
Location	Chennai
Age	33 Years (Age relaxation as per Govt. of India Instructions)
Educational Qualification	1) First Class B. E. / B. Tech. / MCA/ or equivalent degree in relevant discipline OR 2) Postgraduate in Engineering/Technology in relevant discipline OR 3) First Class Postgraduate degree in Science in relevant discipline or domain specific discipline OR 4) PhD in relevant discipline
Post Qualification relevant Experience	B.E. / B.Tech. / MCA / or equivalent degree - 3 years; Postgraduate in Engineering/Technology - 1 year; Postgraduate degree in Science - 3 years; PhD - Nil
Skill Sets	• Programming Languages: C, C++, Shell Scripting, Assembly • Hardware Development: Analog and Digital Circuit Design, Microcontroller based Hardware Design, Sensor Interfacing, Power Circuit Design -AC to DC, DC to DC,SMPS Design • Embedded Firmware Development: Baremetal Firmware Development in C and C++ for Microcontrollers • RTOS firmware development, Hardware Abstraction Layer Development, Low Level Drivers, Linux Application Development, Linux Kernel Development, Linux Device Drivers, System Calls, IPC mechanisms, POSIX compliant firmware development
Job Profile	IoT and Embedded Systems Development • IoT Hardware Development with wireless communication interfacing, power conditioning, and Sensor Interfacing for Applications such as Agriculture, Smart Cities, Automotive etc. • IoT firmware development for Embedded Linux and RTOS based systems • Build Systems Development, Cross compilations, Board Support Package Development and Customization, SDK Development, Product Debugging, Unit Testing and Integration Testing • Field Testing, Deployment and Productization activities associated with IoT systems for outdoor environments • Documentation, Publications, Patents, Copyrights
Salary	CTC - Rs. 22 LPA
Duration	

BACK APPLY