
EMBEDDED SYSTEM CONCEPTS

Course Code: 13EC2201

L P C**4 0 3**

Prerequisites: Requires pre-knowledge of Digital logic design, FPGAs, Microprocessors and microcontrollers, Computer organization.

Course Educational Objectives:

1. To introduce student to hardware units, embedded software and state-of-art embedded systems and RTOS.
2. To describe the devices which include on-chip/off chip peripherals, communication and networking buses.
3. To provide an understanding of interrupt service mechanism and embedded programming in C/C++, Java
4. To explain modeling of embedded systems using Data flow graphs, Control Data flow graphs, petri net models etc.
5. To define verification process and hardware-software co-design

Course Outcomes: Upon the course-completion, student will be able to

1. Explain various hardware and software units that comprise an embedded system
2. Understand processor and memory organization and describe the devices
3. Interpret embedded programming and device drivers
4. Understand the use of verification process and hardware-software co-design

UNIT-I**INTRODUCTION:**

Embedded systems, Processor embedded into a system, embedded hardware units and devices in a system, embedded software in a system, Examples of embedded systems, embedded system-on-chip (Soc) and use of VLSI circuit design technology, Processor selection, Memory selection.

UNIT-II**DEVICES, BUSES AND PROTOCOLS:**

I/O types and examples, Serial communication devices, Parallel device ports, Sophisticated interfacing features in a device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock, Sensors, Analog to Digital Converters, Actuators.

Defining Buses and Protocols, On-board buses for Embedded Systems, External Buses, Automotive Buses and Wireless Communication Protocols.

UNIT-III**DEVICE DRIVERS AND INTERRUPTS SERVICE****MECHANISM:**

Programmed-I/O busy-wait approach without interrupt service mechanism, ISR concept, Interrupt sources, Interrupt servicing (Handling) mechanism, Multiple Interrupts, Context and the periods for context switching, interrupt latency and deadline, Classification of processors, Interrupt service mechanism from context-saving angle, Device driver programming.

UNIT-IV**PROGRAMMING CONCEPTS AND EMBEDDED****PROGRAMMING IN C, C++ AND JAVA:**

Software programming in Assembly language (ALP) and in High level language 'C', C program elements: Header and source files and preprocessor directives, Program elements: Macros and functions
Program elements: Data types, data structures, modifiers, statements, loops and pointers, Object-Oriented programming, embedded programming in C++, Embedded programming in Java.

UNIT-V**PROGRAM MODELLING CONCEPTS :**

Program Models, DFG Models, State Machine Programming Models for Event-controlled Program Flow, Modeling of Multiprocessor systems.

DESIGN TECHNOLOGY

Systems Synthesis and Hardware/ Software Co-Design, Verification, Hardware/Software co-simulation.

TEXTBOOKS:

- [1] Raj Kamal, “*Embedded systems: Architecture, programming and design*”, TMH, 2nd Edition, 2007.
- [2] Lyla B. Das, “*Embedded Systems an Integrated Approach*”, Pearson, First Impression, 2013.

REFERENCES:

- [1] Frank Vahid, Tony D. Givargis, “*Embedded System Design – A Unified Hardware/Software Introduction*”, John Wiley, 2002.
- [2] Arnold S Burger, “*Embedded system Design*”, CMP books, 2010.
- [3] David Simon, “*An embedded software primer*”, PEA, 2008.
- [4] Steve Heath, “*Embedded systems Design*”, ELSEVIER, 2nd Edition, 2005.