EMBEDDED SYSTEM CONCEPTS

Course Code:15EC2201

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

Course Outcomes:

At the end of the course the student will be able to

CO1: Analyze various hardware and software units that comprise an embedded system.

CO2: Describe the various buses and protocols.

CO3: Comprehend concepts of interrupt procedures and device drivers.

CO4: Acquire knowledge in different Embedded Programming Languages.

CO5: Design the programming modeling concepts and synthesize Hardware and Software Co-Design.

UNIT I (10-Lectures)

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 (10-Lectures)

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 (10-Lectures)

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 (10-Lectures)

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 (10-Lectures)

PROGRAM MODELLING CONCEPTS :

Program Models, DFG Models, and 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.