

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: **ELECTRONICS AND COMMUNICATION ENGINEERING**

1. Subject Code: **ECN - 578** Course Title: **Digital System Design**
2. Contact Hours: **L: 3** **T: 0** **P: 0**
3. Examination Duration (Hrs.): **Theory: 3** **Practical : 0**
4. Relative Weight: **CWS: 25** **PRS: 0** **MTE: 25** **ETE: 50** **PRE: 0**
5. Credits: **3** 6. Semester: **Autumn** Subject Area: **PCC**
8. Pre-requisite: **Digital Logic Design or Equivalent**
9. Objective: To acquaint with the hardware description languages such as VHDL/Verilog for understanding the principles for designing digital and embedded systems.
10. Details of the Course:

Sl.No.	Contents	Contact Hours
1.	Introduction to Digital and Embedded systems design: Digital Design Using ROMs, PLAs and PLAs, BCD Adder, 32 - bit adder, A shift and add multiplier, Array multiplier, and Binary divider. Introduction to Embedded system, Design cycle in the development phase for an embedded system, Use_ of target system or its emulator and In-circuit emulator, Use of software tools for development of an ES.	4
2.	Hardware Description Languages (HDL): Digital system Design Process, Hardware Description Languages, Hardware Simulation, Hardware Synthesis, Levels of Abstraction, Characterizing Hardware Languages, Objects and Classes, Signal Assignments, Concurrent and Sequential Assignments.	6
3.	Design Organization and Parameterization: Definition and usage of Subprograms, Packaging Parts and Utilities, Design Parameterization, Design Configuration, Design Libraries. Type Declarations and Usage, Operators, Subprogram Parameter Types and Overloading, Other Types and Types Related Issues, Predefined Attributes, User Defined Attributes. Dataflow Description: Multiplexing and Data Selection, State Machine Description, Three State Bussing. Behavioral Description of Hardware: Process Statement, Assertion Statement, Sequential Wait Statements, Formatted ASCII I/O Operations, IC Design Flow. Practical Designs	8

4.	EPGA Architecture: Designing and Implementation of Finite State Machines for FPGA; Synthesis Techniques and Timing Analysis; Placement and Routing; Embedded Hardware and Software Design with FPGA.	8
5.	DSP Processor Architecture: Architecture; Functional Units; Fetch and Execute Packets; Pipelining; Registers; Linear and circular Addressing Modes; Instruction Set Assembler Directives for TMS320C6x or ADSP21xx; Linear Assembly; ASM statement within C; C-Callable Assembly Function; Timers; interrupts; Multichannel Buffered Serial Ports; Direct Memory Access; Memory Considerations; Fixed and Floating Point Format Code Improvement ; Constraints Programming Examples Using : C, Assembly, and Linear Assembly.	8
6.	ARM Architecture and Organization: ARM Assembly Programming; THUMB Assembly Programming; ARM-THUMB Interworking; Assembly and C Mixed Programming; Exception Handling; ARM Tool chain (Assemblers, Compilers, Linkers & Debuggers); Firmware Programming; Cache & MMU; Peripheral Programming; ARM Cortex family of Processors and architecture; Operating modes, Registers and Memory Map of Cortex-M3; Embedded OS; Porting of Embedded OS on ARM.	8

11. Suggested Books:

Sl.No.	Name of Books/Authors	Year of Publication
1.	Embedded System Design: Embedded System Foundations of Cyber- Physical Systems by Peter Marwedel, Springer	2010
2.	Embedded System Design: A Unified Hardware/Software introduction by Frank Vahid, Tony Givargis, John Wiley & Sons, Inc.	2001
3.	Fundamental of Logic Design - Charles H. Roth, and Larry L. Kinney, Brooks/Cole Inc.	2014
4.	Digital Logic and Microprocessor Design with VHDL, Enoch O. Hwang, Publisher- Thomson/Nelson	2006
5.	Digital Design and Computer Architecture, David Money Harris and Sarah L. Harris, Elsevier.	2012
6.	VHDL for Programming Logic, Kevin Skahill, Person Education	2004
7.	ARM System-on-Chip Architecture, Furber, S., 2nd ed. Pearson Education.	2000
8.	DSP Applications Using C and the TMS320C6x DSK, Rulph Chassaing, John Wiley & Sons, Inc.	2002