1.	Title of the course	Computer System Design Laboratory
2.	Course number	CS401P
3.	Structure of credits	0-0-3-2
4.	Offered to	UG
5.	New course/modification to	Modification To CS4191/8
6.	To be offered by	Department of Computer Science and Engineering
7.	To take effect from	July 2022
8.	Prerequisite	Nil
9.	**Course Objective(s):** To provide hands-on experience on design and integration of key components of a computer system and to prototype the design on FPGA board.	
10.	**Course Content:** Digital component design using Verilog HDL: Structural, Behavioral and Dataflow modeling; Processor design and High-level synthesis: Multicycle data and control path design, Five-stage pipeline processor design, Memory system design and synthesis, Test-bench and simulation on the gate-level netlist, Synthesis and bit-stream generation for target FPGA board, Simulation-based verification of the processor; Assembly programming and machine-code generation, Execution of machine code on the processor, and Verification of output; System integration: Installation of cross-compiler on a host machine, Cross-compiling highlevel language to machine code and execute it on processor, Building virtual machine (VM) on a prototyped processor, Building operating system on a prototyped processor, Integrating assembler and compiler with the built-system, System testing	
11.	**Textbook(s):** 1. Nisan N and Schocken S, *The Element of Computing Systems: Building a Modern Computer from First Principles*, MIT Press (2008). 2. Patterson D and Hennessy J L, *Computer Organization and Design: Hardware/Software Interface RISC-V Edition*, Morgan Kaufmann (2019).	
12.	**Reference(s):** 1. Wentzlaff Parallel Research Group, *OpenPiton: an Open Source Research Processor*, Princeton Unversity (2018).	