Computer Architecture (PCC-CS 492)

Laboratory Instructor's Manual

Last Revised

January, 2025

Dept. of CSE
Techno Main, Salt Lake

General INSTRUCTIONS FOR STUDENTS

1. **Do not enter into the Laboratory without prior permission.**
2. **Switch off your mobile during Lab schedule and maintain silence.**
3. **Save your file only on the specific destination as instructed.**
4. **Do not play games, view movies, chat and listen music.**
5. **Do not change desktop setting, screen saver or any other system settings.**
6. **Do not use any external storage device without prior permission.**
7. **Do not install any software without prior permission.**
8. **Do not browse any restricted, illegal or spam sites.**

INSTRUCTIONS FOR LABORATORY TEACHERS

1. **Submission related to lab assignments, which are completed, should be done during the next lab session.**
2. **The promptness of submission should beencouraged by way of marking and evaluation patterns that will benefit the sincere students.**

Program Outcomes (POs)

PO1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and engineering specialization to the solution of complex engineering problems.

PO2. **Problem analysis:** Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural and engineering sciences.

PO3. **Design/Development of solutions:** Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety and the cultural societal and environmental considerations.

PO4. **Conduct investigations of complex problems:** Use research based knowledge including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage:** Create, select and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to access societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.

PO8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work:** Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

PO10. **Communications:** Communicate effectively with the engineering community and with the society at large. Be able to comprehend and write effective reports documentation. Make effective presentations and give and receive clear instructions.

PO11. **Project management and finance:** Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

PO12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

PSO1: Ability to develop the solutions for scientific, analytical and research-oriented problems in the area of Computer Science and Engineering.

PSO2: Ability to apply suitable programming skills integrated with professional competence to develop applications catering to the industrial and societal needs in the field of Computer Science and Engineering and its allied areas.

NAME OF THE PROGRAM: *CSE*	**DEGREE:** *B.Tech*
COURSE NAME: *Computer Architecture*	**SEMESTER:** *4th*
COURSE CODE: *PCC-CS 492*	**COURSE CREDIT:** *2*
COURSE TYPE: *LAB*	**CONTACT HOURS:** *4P*

Syllabus

All laboratory assignments are based on Hardware Description Language (VHDL or Verilog) Simulation.

Pre-requisite: The hardware based design has been done in the Analog & Digital Electronics laboratory and Computer Organization laboratory

1. **HDL introduction**
2. **Basic digital logic base programming with HDL**
3. **8-bit Addition, Multiplication, Division**
4. **8-bit Register design**
5. **Memory unit design and perform memory operatons.**
6. **8-bit simple ALU design**
7. **8-bit simple CPU design**
8. **Interfacing of CPU and Memory**

COURSE OUTCOME

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CO1	Construct suitable combinational or sequential module's solution circuit schematic in Xilinx platform using VHDL.
CO2	Develop a formal test bench using informal requirements in VHDL and simulate the test cases to check the productivity of the circuit.
CO3	Construct integrated circuit designs using clock, memory and processing units and further integrate them together to observe their behavioral and functional execution using Xilinx and ISim.
CO4	Inspect various schematic presentation and simulation features of Xilinx as an environment through hardware description language and gather expertise as an individual.
CO5	Compose structured and informative report of the solution to the corresponding problem along with verifies test cases.

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Exp. No.	List of Experiments	CO	PO	PSO	BTL
1.	Illustration of basic Gates: AND, OR & NAND Verify the results using a test bench	CO1,CO2, CO4, CO5	PO1, PO2, PO5, PO9, PO10	PSO1, PSO2	BTL3
2.	Design of Half Adder (Using Basic Gate), Full Adder(Using Basic Gate) and Full adder using 2 half adder. Verify the results using a test bench	CO1,CO2, CO4, CO5	PO1, PO2, PO5, PO9, PO10	PSO1, PSO2	BTL3
3.	Design of 8-bit Adder using Full Adder as component Verify the results using a test bench	CO1,CO2, CO4, CO5	PO1, PO2, PO5, PO9, PO10	PSO1, PSO2	BTL6
4.	Create a 4 bit adder_subtractor composite circuit using 1 bit adder and XOR gate as components Verify the results using a test bench	CO1,CO2, CO4, CO5	PO1, PO2, PO5, PO9, PO10	PSO1, PSO2	BTL6
5.	Create a Half Subtractor, Full Subtractor, Full Subtractor using 2 half Subtractor, 8-bit Subtractor using Full Subtractor Verify the results using a test bench	CO1,CO2, CO4, CO5	PO1, PO2, PO5, PO9, PO10	PSO1, PSO2	BTL3, BTL6
6.	Create a 4-bit comparator. Use buses for each of the input signal lines Verify the results using a test bench	CO1,CO2, CO4, CO5	PO1, PO2, PO5, PO9, PO10	PSO1, PSO2	BTL3
7.	Create 8:1 Multiplexer with select line. Use buses for each of the input signal lines. Create 8:1 DeMultiplexer with select line. Use buses for each of the input signal lines Verify the results using a test bench	CO1,CO2, CO4, CO5	PO1, PO2, PO5, PO9, PO10	PSO1, PSO2	BTL3, BTL5
8.	Design a behavioral simulation of JK flip flop and D flip flop. Consider clock period = 1 ps Design a behavioral simulation of T flip flop. Verify the results using a test bench	CO1,CO2, CO4, CO5	PO1, PO2, PO5, PO9, PO10	PSO1, PSO2	BTL3

RUBRIC

Criteria Score	Excellent 80%+	Good 70-80%	Average 60-70%	Poor <60%	CO Mapping	PO/ PSO Mapping
Subject Knowledge and understanding	Student demonstrates an accurate understanding of the lab assignments and is able to associate with the theoretical concepts. Also, student is up to date with the latest lessons pertained in class.	Student demonstrates fair understanding of the assignments, requires occasional assistance to correlate with the theoretical concepts and the latest lesson in class	Student demonstrates average understanding of the assignments, requires regular assistance to correlate with the theoretical concepts and the latest lesson in class	Student demonstrates poor understanding of the assignments, requires regular assistance to correlate with the theoretical concepts and the latest lesson in class	CO1, CO2, CO3, CO4	PO1, PO2, PO3, PO4 PSO1
Lab techniques/ Procedure and Execution	Student is well acclimatised with the working environment and platform. Also, student is capable of looking out for answers with respect to the tool utilised on his/her own and is keen on exploring the environment.	Student is fairly competent in following instructions to execute assignments. Needs assistance in looking out for answers with respect to the tool.	Student demonstrates average competence in following instructions to execute assignments. Needs frequent assistance in looking out for answers with respect to the tool. Not very keen on exploration.	Student demonstrates poor competence in following instructions to execute assignments. Needs regular assistance in looking out for answers with respect to the tool. Not able to explore.	CO1, CO2, CO3, CO4	PO1, PO2, PO3, PO5 PSO1
Debugging and Testing	Student is proficient in debugging, is also able	Student is fairly competent in debugging,	Student shows average debugging	Student shows poor to no debugging	CO2, CO4	PO1, PO2, PO3, PO5

RUBRIC

Criteria Score	Excellent 80%+	Good 70-80%	Average 60-70%	Poor <60%	CO Mapping	PO/ PSO Mapping
	to generate suitable test cases to check reliability of the programs.	though needs occasional assistance with respect to generating test cases to check for reliability	skills and requires assistance, Needs frequent help with respect to generating test cases to check for reliability	skills Needs regular help with respect to generating test cases to check for reliability		PSO1
Design and Documentation	Student is capable of creating detailed, creative and full-proof report of the experiment/s conducted in the lab along with elaborate test cases.	Student is capable of preparing well documented report. Lacks finesse in representation though.	Student prepares average documented report. Illustrates inconsistencies in assignment detailing and output representations. Lacks accuracy in representation.	Student prepares poorly documented report. Lacks accuracy in representation of detailing of assignment and output	CO5	PO10
Organization of work (Individual and in a team)	Student is well capable of working independently and also is able to extend help to fellow mates in need	Student is fairly capable in working on his/her own. Sometimes seeks help from instructors for final execution.	Student rarely is able to work on his/her own. Requires assistance from fellow classmates regarding understanding of tool and environment	Student is not able to work on his/her own. Requires regular assistance from instructors.	CO1, CO2, CO3, CO4, CO5	PO9