North South University

Course Outline (includes lecture plan and course outcome)

Course Schedule/Timing: Lecture – 3 Hours/week, Lab – 3 Hours/week

1. **Course Number and Title:** **CSE231 Digital Logic Design**
   CSE231L Digital Logic Design Laboratory

   Instructor: Tanjila Farah (TnF)

   Office: SAC 929

   Email: tanjila.farah@northsouth.edu

   Lab Room: 5th Floor of SAC Building and 8th floor OAT

2. **Course Summary:**

   This course provides an introduction to logic design and basic tools for the design of digital logic systems. A basic idea of number systems will be provided, followed by a discussion on combinational logic: logic gates, Boolean algebra, minimization techniques, arithmetic circuits (adders, subtractors), basic digital circuits (decoders, encoders, multiplexers, shift registers), programmable logic devices (PROM, PAL, PLA). The course will then cover sequential circuits: flip-flops, state transition tables and diagrams, state minimization, state machines, design of synchronous/asynchronous counters, RAM/ROM design. An introduction to programmable logic will also be provided. Hands-on experience will be provided through project on design of a sequential logic system. This course has separate mandatory laboratory session every week as CSE 231L.

3. **Course Objective:**

   The objectives of this course are

   a. to introduce Boolean logic operation and Boolean Algebra
   b. to teach students how to use Boolean Algebra and K-maps to realize two-level minimal/optimal combinational circuits
   c. to exposed students in the introductory design process of combinational and sequential circuits
   d. to teach the operation of latches, flip-flops, counters and registers.
   e. to explain how to analyze and design sequential circuits built with various flip-flops.
   f. to introduce using simulation tool for digital system design.

4. Course Outcomes (COs):

Upon successful completion of this course, students will be able to

Sl.	CO Description	Weightage (%)
CO1	Apply principles of Boolean algebra to logic functions.	10%
CO2	Analyze combinational and sequential circuits.	20%
CO3	Design combinational and sequential circuits. construct gate-level implementation of a combinational logic function using fundamental logic gates (AND/OR/NOT), Multiplexers, Decoders and Programmable logic gates (ROMs, PLAs and PALs)	40%
CO4	use simulation tool (e.g. Logisim) to construct Digital Logic Circuit in schematic level	10%
CO5	operate laboratory equipment build, and troubleshoot simple combinational and sequential circuits	20%

5. Mapping of CO-PO:

Sl.	CO Description	PO	KP	Bloom's taxonomy domain/ level	Delivery methods and activities	Assessment tools
CO1	Apply principles of Boolean algebra to logic functions.	**a**	**K3**	**Cognitive/ Apply**	**Lectures, notes**	**Assignment, Exam**
CO2	Analyze combinational and sequential circuits.	**b**	**K3**	**Cognitive/ Analyze**	**Lectures, notes**	**Assignment, Exam**
CO3	Design combinational and sequential circuits. construct gate-level implementation of a combinational logic function using fundamental logic gates (AND/OR/NOT), Multiplexers, Decoders and Programmable logic gates (ROMs, PLAs and PALs)	**c**	**K5**	**Cognitive/ Create**	**Lectures, notes**	**Assignment, Exam**
CO4	use simulation tool (e.g. Logisim) to construct Digital Logic Circuit in schematic level	**e**	**K6**	**Cognitive/ Apply, Psychomotor/ Manipulation**	**Lab class**	**Design Project**
CO5	operate laboratory equipment build, and troubleshoot simple combinational and sequential circuits	**e**	**K6**	**Cognitive/ Remember, Psychomotor/ Precision**	**Lab class**	**Lab work**

6. Resources

Text books:

No	Name of Author(s)	Year of Publication	Title of Book	Edition	Publisher's Name	ISBN
1	M Morris Mano & M D Ciletti	2012	Digital Design	5th ed.	Pearson Education	ISBN-13: 978-0-13-277420-8

Reference books:

No	Name of Author(s)	Year of Publication	Title of Book	Edition	Publisher's Name	ISBN
1	J F Wakerly	2005	Digital Design: Principles and Practices	4th ed.	Prentice Hall	ISBN-13: 978-0131863897

Reference Software:

No	Software	
1	Logisim	Available online

7. Weightage Distribution among Assessment Tools

Assessment Tools	Theory Weightage (%)
Class Performance	5
Assignment	NON CREDIT
Quizzes	15
Midterm Exam	25
Final Exam	30
Term Project	10
Lab work	15

8. Grading policy: As per NSU grading policy available in

http://www.northsouth.edu/academic/grading-policy.html

Make-up Policy:
No make-up testes for the missed Quizzes.

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Lecture Plan:

Course Topics	**Min. Coverage**
Numerical representation of numbers Binary, octal, decimal, hexadecimal, complements, signed/unsigned numbers, binary codes, error detecting/correcting codes	4.5 hours
Boolean algebra Logic gates, Boolean algebra, Boolean functions, canonical and standard forms	3 hours
Combinational logic design Minimization techniques (Boolean algebra, Karnaugh map), don't care conditions, universal gate implementation	4.5 hours
Combinational circuits Analysis, design procedure, binary adder/subtractor, decoders, encoders, multiplexers, combinational logic implementation using decoders and multiplexers	6 hours
Synchronous sequential logic Sequential circuits, flip-flops, timing diagrams, state transition tables, state transition diagrams (Mealy and Moore models), state minimization and assignment, design implementation	6 hours
Sequential circuits: Registers and counters Synchronous/Asynchronous counters, registers, shift registers	6 hours
Memory design (RAM, ROM) Programmable logic: Implementation of logic functions using programmable logic devices ROM, PLA, PAL	3 hours

Class Structure:

1. Lectures: Attendance and participation of all of them is strongly encouraged.

2. Laboratory: You must pass in your lab to attain a passable grade in theory. 20% marks from your lab will be directly added to your theory

3. Assignments: You will be given some design assignments. You will use pen and papers and tools to solve those problems.

4. Projects: You will have to submit a hardware design project at the end of the semester. You will work on the project as a group.

5. Exams: There will be one midterm, one final exam and no make-ups.