Institute of Business Administration

CSE 241: Digital Logic Design

(Tentative Course Outline and Syllabus)

IBA SMCS

School of Mathematics and Computer Science

Fall 2024

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CSE 241: Digital Logic Design

1 Logistics

Course:	CSE 241: Digital Logic Design
Class timings:	Tuesday/Thursday 2:30 to 3:45 a.m and Tuesday lab 4:00 to 6:45
Class room:	MCC 15
Instructor(s):	Mr. Muhammad Zain Uddin
Email:	zuddin@iba.edu.pk
Phone:	2136
Office room:	First Floor, NBP Building, Office no. 22/C, Main Campus and TR Lab, Tabba building
Office hours:	Monday and Tuesday, 11:30pm – 12:00 pm
TA:	Muhammad Ibrahim Iqbal 27085
TA email:	m.iqbal.27085@khi.iba.edu.pk

2 Course Description/Objectives

This course is an introduction to the basic principles of digital electronics and logic design. At the conclusion of this course, the student will be able to quantitatively identify the fundamentals of computers, including binary number systems, special number systems, binary coded number systems, arithmetic and logic operations, logic gates, Boolean algebra, Karnaugh mapping, combinational logic, flip-flops, adders, counters, and registers. The student will gain the practical skills necessary to work with digital circuits through problem-solving and hands-on laboratory experience with logic gates, encoders, flip-flops, counters, shift registers, adders, etc. also by using different software like Logisim and Icarus

3 Program Learning Outcomes/Graduate Attributes

Graduate attributes (program learning outcomes - PLOs) taken from `https://www.seoulaccord.org/document.php?id=79`.

PLO-1. **Academic Education**

[Educational depth and breadth]

Completion of an accredited program of study designed to prepare graduates as computing professionals

PLO-2. **Knowledge for Solving Computing Problems**

[Breadth and depth of education and type of knowledge, both theoretical and practical]

Apply knowledge of computing fundamentals, knowledge of a computing specialization, and mathematics, science, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements

PLO-3. **Problem Analysis**

[Complexity of analysis]

Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines

PLO-4. **Design / Development of Solutions**

[Breadth and uniqueness of computing problems, i.e., the extent to which problems are original and to which solutions have previously been identified or codified]

Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations

PLO-5. **Modern Tool Usage**

[Level and appropriateness of the tool to the type of activities performed]

Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations

PLO-6. **Individual and Team Work**

[Role in, and diversity of, the team]

Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings

PLO-7. **Communication**

[Level of communication according to type of activities performed]

Communicate effectively with the computing community and with society at large about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions

PLO-8. **Computing Professionalism and Society**

[No differentiation in this characteristic except level of practice]

Understand and assess societal, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice

PLO-9. **Ethics**

[No differentiation in this characteristic except level of practice]

Understand and commit to professional ethics, responsibilities, and norms of professional computing practice

PLO-10. **Life-long Learning**

[No differentiation in this characteristic except level of practice]

Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional

4 Course Learning Outcomes

The cognition levels are based on Bloom's revised taxonomy.[1]

Course Learning Outcome		
CLO	**Description**	**Cognition**
CLO-1	Understand and apply fundamental concepts of digital logic design.	Cognitive
CLO-2	Analyze and design combinational logic circuits.s	Cognitive
CLO-3	Analyze and design sequential logic circuits.	Cognitive
CLO-4	Demonstrate the ability to code digital logic circuits using hardware description languages.	Psychomotor
CLO-5	Collaborate effectively in teams to perform lab work and complete project tasks.	Affective

4.1 CLO's to PLO's Mapping

	PLO-2	PLO-5	PLO-6
CLO-1	✓		
CLO-2	✓		
CLO-3	✓		
CLO-4		✓	
CLO-5			✓

5 Format and Procedures:

The LMS site will be used to share the syllabus, give out assignments, and to share other course resources.

The University's standard policies on attendance, inclusivity, office one clo, and academic integrity apply in this course. These are described in later sections below.

6 Course Requirements

- Class participation policy: Background reading for next session and active participation in class discussions.
- **Textbooks:**
  - *Introduction to Logic Design* by Alan Marcovitz and McGraw Hill.
  - *Digital Systems – Principles and Applications, 10th Ed.* by R. Tocci, N. Widmer and Prentice Hall.
  - *Digital logic fundamentals* by Thomas Floyd.

[1] Anderson, Lorin W.; Krathwohl, David R., eds. (2001). A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives. Allyn and Bacon

- **References:**
  - *Digital Design and Computer Architecture RISC-V Edition* by Sarah Harris and David Harris.
  - *The Science of Computing, 1st Edition* by Carl Burch.
  - *Computer System Architecture* by Morris Mano.

7 Grading Procedures

Grades will be computed as follows.

Tentative	
Homework	10%
Quizzes	10%
Project	15%
Labs	15%
Midterm	20%
Final	30%

- There will be six to eight quizzes and five assignments.
- The project is divided into two parts and each part has multiple phases which will be discussed in class.

8 Makeup Policy

No make-up for exams (midterm or final) or any of the quizzes will be given unless it's approved by the examination department.

9 Attendance Policy

IBA attendance policy applies.

10 Academic Integrity

Each student in this course is expected to abide by the IBA Code of Conduct. Scholastic dishonesty shall be considered a severe violation of these rules and regulations and is subject to strict disciplinary action as prescribed by IBA regulations and policies. Academic dishonesty includes but is not limited to, cheating on exams, plagiarism on assignments, and collusion.

Kindly refer to `https://examination.iba.edu.pk/CheatingPlagiarism.php` for more details.

- **PLAGIARISM:** Plagiarism is the act of taking the work created by another person or entity and presenting it as one's own for the purpose of personal gain or of obtaining academic credit. Plagiarism includes the submission of or incorporation of the work of others

without acknowledging its provenance or giving due credit according to established academic practices. This includes submitting material that has been appropriated, bought, received as a gift, downloaded, or obtained by any other means. Students must not, unless they have been granted permission from all faculty members concerned, submit the same assignment or project for academic credit for different courses.

- **CHEATING:** The term cheating shall refer to the use of or obtaining of unauthorized information in order to obtain personal benefit or academic credit.
- **COLLUSION:** Collusion is the act of providing unauthorized assistance to one or more persons or of not taking the appropriate precautions against doing so.

  Any student violating academic integrity a second time in this course will receive a failing grade for the course, and additional disciplinary sanctions may be administered.
- **SHARING CREDENTIALS:** It has been observed that some students share their credentials (log-in IDs and passwords) of LMS, portal, email, etc., with other students. These credentials are private and confidential and not to be shared with anyone. Any violation will be considered aiding in plagiarism/collusion/cheating and appropriate action might be taken against such students.

11 Office hours

Office hours will be scheduled, circulated, and posted soon. During these hours I will be available to answer questions or provide additional help.

12 Weekly breakdown of classes

Week 1: Course overview/Number System.

- Course overview and learning objectives.
- Logistics: rules, assessments, grading, and project.
- Number Systems types and conversion
- Binary codes
- Digital input types and Truth table

Weeks 2,3,4: Logic Gates, Boolean Algebra, K map. **Quiz 1,2, Assignment 1**

- Logic gates: Definition, Arithmetic and symbolic representation
- Boolean Postulates and Theorems
- Boolean Functions and their Complements
- Sum of Min Terms and Product of Max Terms
- Standard forms and Canonical Forms
- Simplification of Boolean expressions
- Karnaugh maps

- Multi-variable (2,3,4) K-maps

Weeks 5,6,7: Function of Boolean Algebra. **Quiz 3,4, Assignment 2,3**

- Encoder Decoder
- Adder and Subtractor (Full and Half)
- Multiplexer and De-multiplexer
- Designing circuitry using Mux/Dmux
- designing circuitry using functions.
- Revision.
- Karnaugh maps
- Multi-variable (2,3,4) K-maps

Week 8,9: Mid-Term and Mid-term break.

Week 10: Mid-term review and Sequential circuits introduction.

- Mid-term copies reviews.
- Sequential circuit introduction.
- Latches (SR) and Flip Flops (D,T and JK).

Weeks 11,12,13: Sequential circuits. **Quiz 5,6, Assignment 4**

- Characteristic Tables, Characteristic Equations of flip flop
- Timing diagrams
- Design and Analysis of Clocked Sequential Circuits (FSM)
- State Equations, State Tables, State Diagrams
- designing circuitry using functions.

Weeks 14,15,16: Registers, Counters and Projects. **Quiz 7,8, Assignment 5**

- Designing Counters (Synchronous and Asynchronous).
- Up/Down Counter.
- Registers.
- Project Evaluation.
- Revision.

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