Course Code: CSE223 & CSE224 **Credits**: 1+2

Course Title: Digital Electronics & Lab **CIE Marks**: 60

SEE Marks: 40

Course Description (from syllabus)/Rational:

Digital Electronics course provides an introduction to the control of engineering systems using programmable logic, with specific focus on programmable logic devices. In Fall 2020 semester, the course rational is define form the context of digital logic, digital arithmetic, programmable logic and computer architecture. Design simple combinational logics using basic gates and to optimize Boolean logic using Karnaugh map, even considering "don't care" condition. The course will also introduce the basic sequential logic components.

Course Learning Outcome: (at the end of the course, student will be able to do:)

CLO1	Able to understand the conversion among different number systems. Be introduced to basic logic gates- AND, OR and NOT, XOR, XNOR and be able to build simple logic circuits using basic gates.
CLO2	Able to apply the basic properties of Boolean algebra to simplify Boolean functions and construct combinational circuits from them.
CLO3	Able to solve the Boolean functions using Karnaugh map and “don’t care” condition. Consequently a student can then design any combinational circuits based on the real life scenarios.
CLO4	Able to develop basic sequential logic components such as SR Latch, SR Flip-Flop and their usage.

Teaching and Learning Activities (TLA)

TLA1	Interactive discussion using Online/multimedia or whiteboard.
TLA2	Group presentation regarding related problems and assigned task.
TLA3	Evaluation of class performances to reach each student in a class for every topic.

Course Delivery Plan (include Lab if any)

Week/Lessen (hour)	Discussion Topic & Book Reference	Student Activities during Online and Onsite and TLA	Assessment and Mapping with CLO
Wk 1 Lessen 1 (1.5 each) Lab Session 1 (2.0)	**Lesson-1:** Introduction to the word "Digital" and Number System Conversions. (Ref. Text, 03-15) **Lab 01:** Introduction to basic equipment.	Lesson-1: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1** Lab 01: Working with IC and fundamental equipment;	CLO1
Wk 2 Lessen 2 (1.5 each) Lab Session 2 (2.0)	**Lesson-2:** Error detecting code (Parity bit), Boolean Algebra and Logic Gates. (Ref. Text, 31-45) **Lab 02:** Introduction to basic logic gate;	Lesson-2: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1** Lab 02: Review exercise and solve problem using IC;	CLO1, CLO2 **Assignment 1** (will be due by Wk3) -Problem solving using logic gate.
Wk 3 Lessen 3 (1.5 each) Lab Session 3 (2.0)	**Lesson-3:** Universality of NAND and NOR gates. Implementing circuits from Boolean expression, and parity Checker Circuits. (Ref. Text, 46-50) **Lab 03:** Introduction to Universal logic gate, Verification of De Morgan's Theorem.	Lesson-3: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1** Lab 03: Problem solving using Boolean expression; **Student Submit Assigment-1 in LMS or BLC (online)**	CLO2
Wk 4 Lessen 4 (1.5 each) Lab Session 4 (2.0)	**Lesson-4:** Boolean Functions simplification and Standard Forms. (Ref. Text, 51-65) **Lab 04:** Introduction to combinational circuit. ***Discussion on Course Projects.***	Lesson-4: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA2** Lab 04: Problem solving for combinational circuit (Real life problem);	CLO2, CLO3 **Class Test# 1** (Either online or onsite based on Wk1-Wk3 discussion) based on CLO1, CLO2

Wk 5 Lessen 5 (1.5 each) Lab Session 5 (2.0)	**Lesson-5:** Simplification of Boolean Expression using K-Map Design. (Ref. Text, 73-89) **Lab 05:** Boolean function to circuit implementation.	Lesson 5: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA2** Lab 05: Review exercise and problem solving using Boolean function; ***Course Project Allocation among teams.***	CLO1, CLO2
Wk 6 Lessen 6 (1.5 each) Lab Session 6 (2.0)	**Lesson 6:** Designing Combinational Circuits: Adder Circuit (Half and Full), Subtractor Circuit, Carry Look Ahead Adder. (Ref. Text, 133-142) **Lab 06:** Working with binary arithmetic function.	Lesson 6: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1** Lab 06: Implement binary adder and subtractor;	CLO2, CLO3 **PRN#1:Project Concept Presentation by Team** **Class Test# 2** (either online or onsite based on Wk 4, Wk 5 discussion) based on CLO2, and CO3 **Assignment 2** (will be due by Wk 8) – Combinational Circuit
Wk 7	**Midterm Exam Week** **Topics: Wk 1 – Wk 6**		
Wk 8 Lessen 7 (1.5 each) Lab Session 7 (2.0)	**Lesson 7:** Decoder (Definition, Truth Table, Block Diagram, Circuit Diagram, Implementation). (Ref. Text, 150-155) **Lab 07:** Design and implementation of Decoder Circuits.	Lesson 7: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1, TLA2** Lab 07: Problem solving using decoder; **Student Submit Assigment-2 in LMS or BLC (online)**	CLO2, CLO3

Wk 9 Lessen 8 (1.5 each) Lab Session 8 (2.0)	**Lesson 8:** Application of Decoder in real life. Boolean function with decoder. (Ref. Text, 150-155) **Lab 08:** Function implementation using decoder.	Lesson 8: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1, TLA2** Lab 08: Real life problem solving using decoder.	CLO2, CLO3
Wk 10 Lessen 9 (1.5 each) Lab Session 9 (2.0)	**Lesson 9:** Application of Encoder in real life. Design and Implementation of a Encoder Using Basic Logic Gates (Ref. Text, 155-158) **Lab 09:** Design and implementation of encoder Circuits.	Lesson 9: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1, TLA2** Lab 09: Problem solving for encoder using basic gate;	CLO1, CLO2
Wk 11 Lessen 10 (1.5 each) Lab Session 10 (2.0)	**Lesson 10:** Multiplexer (Definition, Truth Table, Block Diagram). Function Implementation using Multiplexer. De-multiplexer. (Ref. Text, 158-163) **Lab 10:** Working with Multiplexer.	Lesson 10: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1, TLA2** Lab 10: Problem solving using Multiplexer;	CLO1, CLO2 **Class Test# 3** (either online or onsite based on Wk 8, Wk 9 and Wk 10 discussion) based on CLO2, and CO3
Wk 12 Lessen 11 (1.5 each) Lab Session 11 (2.0)	**Lesson 11:** Design and Implementation Sequential circuit (SR latch, SR flip-flop). (Ref. Text, 190-196) **Lab 11:** Group Project Presentation Sharing by Team Lead on behalf of the team.	Lesson 11: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1, TLA2, TLA3** Lab 11: Course project presentation by Team;	CLO1, CLO4 **PRN#2:Project Implementation Presentation by Team**

Wk 13 Lessen 12 (1.5 each) Lab Session 12 (2.0)	**Lesson 12:** Review class on topics discussed of Wk 8, Wk 9, Wk 10, Wk 11 and Wk 12 for preparing for the final exam. **Lab 12:** Lab Performance Test and Project based assessment of course projects.	Lesson 12: Online/Onsite discussion; Review Feedback online; Using Interactive content e.g. Voice over PPT, PPT, Video, H5P; **TLA1, TLA3** Lab 12: Final project display and assessment test.	CLO1, CLO2, CLO3, CLO4 **Lab Assessment Test** (based on course project presentation and final test)
Wk 14	**Final Exam Week** **Topics: Wk 8, Wk 9, Wk 10, Wk 11 and Wk 12**		

Text Books:

1. Digital Logic Design – Morris Mano (5th Edition)
2. Digital Fundamentals- Floyd (8th Edition)

Reference Books:

1. Digital Systems-Principles and Application- Tocci (10th Edition)

Appendix-1: Program outcomes

POs	Category	Program Outcomes
PO1	**Engineering Knowledge**	Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis**	Identify, formulate, research the literature and analyze complex engineering problems and reach substantiated conclusions using first principles of mathematics, the natural sciences and the engineering sciences.
PO3	**Design/Development of Solutions**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety as well as cultural, societal and environmental concerns.
PO4	**Investigations**	Conduct investigations of complex problems, considering design of experiments, analysis and interpretation of data and synthesis of 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 contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
PO7	**Environment and sustainability**	Understand the impact of 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, responsibilities and the norms of the engineering practice.
PO9	**Individual work and teamwork**	Function effectively as an individual and as a member or leader of diverse teams as well as in multidisciplinary settings.
PO10	**Communication**	Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions.
PO11	**Project management and finance**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work as a member or a leader of a team to manage projects in multidisciplinary environments.
PO12	**Life Long Learning**	Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.