University/Academy: Arab Academy for Science, Technology & Maritime Transport
Faculty/Institute: College of Engineering & Technology
Program: B.Sc Computer Engineering

Form no. (12): **Course Specification**

1- Course Data

Course Code: **CC216**	Course Title: **Digital Logic Design**				Academic Year/Level: year **2** / semester **4**
Specialization: **Computer Engineering**	**Credit Hours**: 3	**Lecture**: 2	**Tutorial:** 2	**Lab:** 2	**Prerequisite**: CC111

2- Course Aim

To Develop Engineering Skills in design and analysis of digital logic circuits with application to digital computer.

3- Intended Learning Outcomes

a- Knowledge and Understanding	a5. Engineering principles in the fields of logic design, circuit analysis, machine and assembly languages, computer organization and architectures, memory hierarchy, advanced computer architectures, embedded systems, signal processing, operating systems, real-time systems and reliability analysis. • Define digital and analog concepts. • Describe Logic levels and digital waveforms. • Describe various parameters of a pulse waveform and explain the basic logic operation. • List different number systems (Decimal, Binary, Octal and Hexadecimal). • Explain the conversion process between number systems. • Explain the binary arithmetic (addition, subtraction, multiplication and division) for signed and unsigned binary numbers. • List different codes (Gray code, Excess-3 code, Binary Coded Decimal). • Define the logic gate concept. • Describe different types of logic gates (AND, OR, NOT, NAND, Negative OR, NOR, Negative AND, Exclusive OR and Exclusive NOR). • Describe laws and rules of Boolean algebra. • Explain how to simplify the Boolean expression using Boolean algebra technique. • Show the standard forms of Boolean expressions (Sum of Products form and Product of Sums form). • Explain how to simplify the Boolean expression using KARNAUGH map. • Describe the Universal Gates (NAND, NOR). • Describe the basic Adders (Half Adder and Full Adder) • Explain Binary Parallel Adder. • Describe Carry Look Ahead Adder. • Describe the comparator circuit. • Explain different types of Decoders and show their applications. • Explain different types of Encoders and show their applications. • Explain different types of Multiplexers and show their applications. • Explain different types of De-multiplexers and show their applications. • Explain different types of Latches (S-R Latch, Gated S-R Latch and Gated D-Latch) and show their applications. • Explain different types of Edge Triggered Flip-Flops (S-R Flip-Flop) and show their applications. • Explain different types of Edge Triggered Flip-Flops (D Flip-Flop and J-K Flip-Flop) and show their applications.

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b- Intellectual Skills	b1.Select/Apply appropriate mathematical and computer-based methods for modeling and analyzing problems and select appropriate solutions for engineering problems based on analytical thinking. • Calculate the period, frequency, Pulse Width and duty cycle for different waveforms. • Apply the conversions of numbers from one number system to another one. • Perform the binary arithmetic operations on the signed and unsigned binary numbers. • Apply the code conversions from any certain code to another. • Determine the truth table for each logic gate. • Demonstrate the output waveforms for different logic gates. • Simplify Boolean expressions using Boolean algebra techniques. • Apply DEMORGAN'S Theorems for Boolean expressions. • Construct the truth table for sum of products and product of sums. • Simplify Boolean expressions using KARNAUGH map. • Implement Boolean expressions using universal gates. • Construct the truth table for the Half and Full Adder. • Design Full Adder using Half Adder. • Design parallel adder. • Demonstrate the output waveforms for parallel adder. • Demonstrate the internal architecture of the decoder. • Show how to expand the 3-8 Decoder to obtain the 4-16 Decoder. • Demonstrate the internal architecture of the Encoder. • Show how to expand the 8-3 Encoder to obtain the 16-4 Encoder.

	• Demonstrate the internal architecture of the Multiplexer. • Show how to expand the 8-1 Multiplexer to obtain the 16-1 Multiplexer. • Demonstrate the internal architecture of the DEMULTIPLXER. • Demonstrate the internal architecture of the S-R Latch. • Determine the output waveform for S-R latch. • Demonstrate the internal architecture of the Gated S-R Latch. • Determine the output waveform for Gated S-R latch. • Demonstrate the internal architecture of the Gated D Latch. • Determine the output waveform for Gated D latch. • Demonstrate the internal architecture of the S-R flip-flop. • Determine the output waveform for S-R flip-flop. • Demonstrate the internal architecture of the D flip-flop. • Determine the output waveform for D flip-flop. • Demonstrate the internal architecture of the J-K flip-flop. • Determine the output waveform for J-K flip-flop. • Demonstrate the internal architecture of the asynchronous and synchronous counters. • Demonstrate the internal architecture of different types of shift registers.
c- Professional Skills	c2.Create and/or re-design a process, component or system, and carry out specialized engineering designs with neatness and aesthetics in design and approach. • Design 4X1 Multiplexer and 1X4 DEMULTIPLEXER. • Design a DECADE counter. • Design an irregular counter. • Design the up/down counter. c3.Use computational facilities and techniques, measuring instruments, workshops and laboratory equipment, wide range of analytical tools, techniques, and software packages pertaining to the computer engineering to design experiments, collect, analyze and interpret results and develop required computer programs. c5.Apply safe systems at work and observe the appropriate steps to manage risks. • Connect a switch to a L.E.D on the breadboard to examine the effect of Binary 1 and Binary 0 on the L.E.D. • Connect ICs that contain several Logic Gates and examine the output on the L.E.D. • Connect the Half Adder and the Full Adder Circuits. • Connect a 2-Bit Adder. • Connect 1-Bit and 2-Bit Comparators. • Connect BCD to 7-Segment Decoder/Driver (0 to 9) and examine the output on the 7-segment display. • Connect BCD to 7-Segment Decoder/Driver (A to F) and examine the output on the 7-segment display. • Connect BCD To 7-Segment Decoder/Driver (0 to F) and examine the output on the 7-segment display. • Connect the of 555 Timer Acts as Oscillator (ASTABLE State). • Connect a 2-Bit Asynchronous Counter and examine the output on the 7-segment display.
d- General Skills	d2.Work in stressful environment and within constraints, communicate effectively, lead and motivate individuals and effectively manage tasks, time, and resources. • Verify theory with practice.

4- Course Content

Week No.1	Introduction to Digital Concepts
Week No.2	Number systems, Operations, and Codes
Week No.3	Logic Gates
Week No.4	Boolean Algebra and Logic Simplification
Week No.5	Boolean Algebra and Logic Simplification
Week No.6	Functions of Combinational Logic
Week No.7	7th Week Exam+Revision
Week No.8	Decoders, Encoders, MUX, DMUX

Week No.9 Decoders, Encoders, MUX, DMUX
Week No.10 Flip-Flops and Related Devices
Week No.11 Flip-Flops and Related Devices
Week No.12 12th Week Exam+Revision
Week No.13 Flip-Flops Applications
Week No.14 Counters
Week No.15 Shift Registers
Week No.16 Presentation of projects and Final Exam.

5- Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

6-Teaching and Learning Methods for Students with Special Needs

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

The academic advisors of each student, as well as dedicated department TAs monitor the students' progress and solve any problem he/she may encounter.

7- Student Assessment

a-Procedures used	1-Written Examinations to assess The Intended Learning Outcomes. 2-Class Activities (Reports, Discussions, ------) to assess The Intellectual Skills.	
b- Schedule:	Assessment 1 Assessment 2 Assessment 3 Assessment 4	7th Week Written Exam 12th Week Written Exam Continuous Assessments 16th Week Final Written Exam
c- Weighing of Assessment	7th Week Examination 12th Week Examination Final-term Examination Oral Examination Practical Examination Semester Work Total	30 % 20 % 40 % 0 % 0 % 10 % 100%

8- List of References:

a- Course Notes	
b- Required Books (Textbooks)	Floyd, Thomas L, "Digital Fundamentals (1671)", Pearson Education 10ED
c- Recommended Books	• M. Mano, Digital Design, 3rd Edition, Prentice Hall, 2002. • J. P. Hayes, Introduction to Digital Logic Design, Addison Wesley, 1993. • John F. Wakerly, Digital Design Principles and Practices, 4th Edition, Prentice Hall, 2005.
d- Periodicals, Web Sites, etc.	N/A

Course Instructor:
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