Course Specifications

General Information

Course name	Digital Electronics (1)
Course number	PHYS3324
Faculty	
Department	
Course type	Major Needs
Course level	3
Credit hours (theoretical)	3
Credit hours (practical)	0
Course Prerequisites	

Course Objectives

1 - The purpose of the course is to teach principles of digital electronics. The material covers a variety of topics including Boolean algebra, basic gates, logic circuits, flip-flops, registers, arithmetic circuits, counters, interfacing with analog devices, and computer memory.

Intended Learning Outcomes

Knowledge and Understanding

* 1. Students will be able to represent numerical values in various number systems and perform number conversions between different number systems. 2. Students will demonstrate the knowledge of: operation of logic gates (AND, OR, NAND, NOR, XOR, XNOR) using IEEE/ANSI standard symbols Boolean algebra including algebraic manipulation/simplification, and application of DeMorgan's theorems Karnaugh map reduction method . 3. Students will demonstrate the knowledge of operation of basic types of flip-flops, registers, counters, decoders, encoders, multiplexers, and de-multiplexers. 4. Students will be able to analyze and design digital combinational circuits including arithmetic circuits (half adder, full adder, and multiplier). 5. Students will be able to analyze sequential digital circuits. 6. Students will demonstrate knowledge of the nomenclature and technology in the area of memory devices: ROM, and RAM. 7. Student will demonstrate the knowledge of converting signal from analog to digital and from digital to analog, using Op-amps. 8. Student will be able to design simple digital electronic circuits.

Course Contents

1 - Chapter1: Digital Systems and Binary Numbers (Brief) Digital System, Boolean Numbers, Number-Base Conversions, Octal and Hexadecimal Number

2 - Chapter2: Boolean algebra and Logic Gates Basic Definitions, Axiomatic Definition of Boolean algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, and Digital Logic Gates.

3 - Chapter3: Gate-Level Minimization The Map Method, Four-Variable Map, Product-of-Sums Simplification, Dont-Care Conditions, NAND and NOR implementation, and Exclusive OR function.

4 - Chapter4: Combinational Logic Combinational Circuits, Analysis Procedure, Design Procedure, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoder, Encoders, Multiplexers

5 - Chapter5: Synchronous Sequential Logic Sequential Circuits, Storage Element: Latches, Storage Element: Flip-Flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Design Procedure

6 - Chapter6: Registers and Counters Registers, Shift Register, Ripple Counter, Synchronous Counters, Other Counter,

7 - Chapter7: Memory and Programmable Logic Memory (Binary) cell, Random-Access Memory

8 - Chapter 8: OP-AMPS Clocks (oscillator circuit, 555 timer), Op-Amps terminals, terminal voltages and currents, inverting and non-inverting Op-Amp, summing Op-Amp circuit, difference op amp, ADC circuit, DAC circuit

Students Assessment

Assessment Method	TIME	MARKS
Homeworks		10
quiz		5
Midterm		20
project		15
Final Exam	two hours	50

Books and References

Course note	M. Morris Mano, Digital Design: With an Introduction to the Verilog HDL, 5th Edition, Prentice Hall 2012
	2. Anil K. Maini, Digital Electronics: Principles, Devices and Applications, Wiley 2007.
Recommended books	1. Thomas L. Floyd, Digital Fundamentals, 9th Edition, Pearson Education International, 2006