

Course Title: COEN 3323: Digital Systems (with Lab)
Also listed as EEEN 3331: Digital Systems (with Lab)

Semester Credit Hours: 3 (2,3)

I. Course Overview

This course addresses the understanding and design of digital systems. Topics progress through Boolean algebra and logic gates; combinational logic; sequential logic and synchronous sequential logic systems; and design of logic circuits.

II. PMU Competencies and Learning Outcomes

Knowledge of digital systems and skill in their design, as taught in this course, are major components world wide of professional engineering practice. Throughout the semester, students are assisted to develop this knowledge and skill. Students are encouraged in development of professional engineering competencies including critical thinking skills, problem solving skills, and application of these in class discussions, assignments, and lab exercises. Professional demeanor and a team approach to understanding problems are practiced throughout lectures and discussions. Professional active communication skills (written and oral) are encouraged through discussions and assignments. Students are led to develop awareness of the professional role and responsibilities of engineers in a global society. Effective use of the most modern technology is integral to the development of the knowledge and skills acquired in this course.

III. Detailed Course Description

This course presents students with knowledge and design applications in the field of Digital Systems. Students are led from the basics of Boolean algebra and logic gates through increasing understanding to the design of logic circuits.

IV. Requirements Fulfilled

This is a required course for majors in computer engineering

V. Required Prerequisites

Successful completion of:

- COEN 2311: Circuits I
- COEN 2111: Circuits I Lab

VI. Learning Outcomes

In this course, students:

- Acquire the ability to formulate and solve problems involving Boolean algebra.
- Learn to design digital systems using simple logic elements.
- Learn to apply Karnaugh Maps to digital logic systems.
- Develop understanding of digital codes and number systems.
- Develop understanding of sequential logic circuits and their applications.

VII. Assessment Strategy

The assessment strategy measures a student's understanding of digital systems and their design.

- Class participation is monitored as an indicator of each student's level of involvement, understanding, and commitment
- Homework and lab assignments are utilized to provide feedback to students and to indicate individual progress in achievement of understanding.
- A student project and report are required as measures of the student's ability to integrate knowledge acquired and apply it in real-world examples.
- Communication skills are measured through the student's in-class participation in discussions, written assignments, and presentation of the student report.
- Examinations are used to indicate student's progress in mastery of course content and lab expertise
- An end-of-semester final examination is used to measure the student's mastery in understanding and application of the knowledge and design skills in the course.

Assessment in this course is designed to assist students to further their understanding of the university's learning objectives. Student's preparation for the capstone experience is enhanced through progressive skill building in active listening, oral and written communication, decision making individually and as a team member, problem solving, and professional viewpoint. In cooperation with the instructor, each student selects one assignment to become a part of the student's professional portfolio.

VIII. Course Format

The class consists of lectures, class discussions, written assignments to be completed outside of class, lab assignments, a student project and report, and examinations.

Classroom Hours: **Class: 2 hours per week classroom lecture**
Lab: 3 hours per week

IX. Topics to be Covered

- A. Introduction to digital concepts
- B. Number systems
 - 1. Operations
 - 2. Codes
- C. Logic gates
- D. Boolean Algebra and logic simplification
- E. Karnaugh Maps
- F. Combinational logic
- G. Sequential logic circuits
- H. Memory and storage
- I. Introduction to microprocessors
- J. Integrated circuit technologies

X. Laboratory Exercises

Weekly lab exercises supplement instruction in the classroom and provide each student with hands-on utilization of digital system hardware and measurement instrumentation. Weekly labs are performed on topics as follows:

- A. Instruments and measurements
- B. Logic gates and Boolean laws
- C. DeMorgan's Theorems
- D. Combinational logic circuits
- E. Universal property of NAND and NOR gates
- F. Adders and multiplexers
- G. Encoders and decoders
- H. Seven-segment display
- I. Comparators
- J. Look-ahead carry adders
- K. Arithmetic logic unit
- L. Latches and flip-flops
- M. Counters
- N. Shift registers

XI. Technology Component

- A. Students in this class are expected to have a computer account with the appropriate server to enable class communications. Media assisted instruction is a tool in this class. Use of appropriate technology for assignments and in-class work is required, for example, use of a scientific calculator, and use of the university computer labs. Use of the Internet may be indicated as notified by the instructor to support global understanding of applications.

- B. Lab work for this course is completed using the lab exercises and appropriate technology in the PMU Digital Systems and Computer Architecture Laboratory. The lab experience is designed to integrate knowledge and theory into applied practice.

XII. Special Projects/Activities

Students complete a project and present a project report (written and oral presentation). The project should demonstrate the student's ability to utilize the knowledge acquired in an application of professional quality.

XIII. Textbooks and Teaching Aids

A. Required Textbook

Thomas L. Floyd, *Digital Fundamentals*, 8th ed., Prentice Hall, 2003

B. Alternative Textbooks

None

C. Supplemental Print Materials

As notified by the instructor.

D. Supplemental Online Materials

As notified by the instructor.