COURSE OUTLINE

ELEC 165 DIGITAL FUNDAMENTALS & SYSTEMS

Prepared By: Robert Jennings
A. **TITLE**: Digital Fundamentals & Systems

B. **COURSE NUMBER**: ELEC 165

C. **CREDIT HOURS**: 3

D. **WRITING INTENSIVE COURSE**: No

E. **COURSE LENGTH**: 15 WEEKS

F. **SEMESTER(S) OFFERED**: Fall and Spring

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY**: 3 hours of lecture per week.

H. **CATALOG DESCRIPTION**: This course covers topics which include: number systems, logic operations and codes, logic gates, Boolean algebra and logic simplification, combinational logic analysis, functions of combinational logic, latches, flip-flops, counters and shift registers. Semiconductor memories (SRAM, DRAMS, PROMS, EPROMS, and EEPROMS) and Digital to Analog and Analog to Digital Converters are also covered.

I. **PRE-REQUISITES/CO-REQUISITES**:
   Pre or Co-Requisites: Electric Circuits I and Laboratory (ELEC 101/109, or permission of instructor.

J. **GOALS (STUDENT LEARNING OUTCOMES)**:

By the end of this course, seventy percent of the students will be able to:

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<tr>
<th>Course Objectives ((STUDENT LEARNING OUTCOMES))</th>
<th>Institutional SLO*</th>
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| 1. Perform number systems conversions from; A. Hexadecimal to Decimal  
B. Decimal to Hexadecimal                                                                                     | 2. Crit. Thinking  
3. Prof. Competence                                                                                           |
| 2. Using a given 3 variable truth table, provide the simplest expression for the output using Karnaugh mapping with the “Can’t Happen” conditions. | 2. Crit. Thinking  
3. Prof. Competence                                                                                           |
| 3. Design and analyze a Synchronous UP/DOWN digital counter                                                     | 2. Crit. Thinking  
3. Prof. Competence                                                                                           |
| 4. Describe the internal operations of a successive-approximation type of Analog to Digital Converter.       | 2. Crit. Thinking  
3. Prof. Competence                                                                                           |

*Intuitional Student Learning Objectives (SLO) shown above:
Communication (2) Critical Thinking (3) Professional Competence (4) Inter-Intrapersonal Skills

K. **TEXTS**

L. REFERENCES: As determined by the instructor.

M. EQUIPMENT: As determined by the instructor.

N. GRADING METHOD: A-F

O. MEASUREMENT CRITERIA/METHODS:
   - Examination performance
   - Quizzes
   - Design Project

P. DETAILED LECTURE OUTLINE:

I. Number Systems, Operations, and Codes
   A. Decimal Numbers
   B. Decimal-to-Binary Conversion
   C. Binary Arithmetic
   D. Hexadecimal Numbers
   E. Binary Coded Decimal (BCD) code

II. Logic Gates
   A. The Inverter
   B. The AND, OR, NAND and NOR gates
   C. The Exclusive-OR and Exclusive-NOR gates

III. Boolean Algebra and Logic Simplification
   A. Boolean Operations and Expressions
   B. Laws and Rules of Boolean Algebra
   C. DeMorgan’s Theorems
   D. Boolean Analysis of Logic Circuits
   E. Simplification Using Boolean Algebra
   F. Boolean Expression and Truth Tables
   G. The Karnaugh Map

IV. Combinational Logic Analysis
   A. Implementing Combinational Logic
   B. The Universal Property of NAND and NOR gates

V. Functions of Combinational Logic
   A. Adders
   B. Comparators
   C. Decoders
   D. Encoders
   E. Code Converters
   F. Multiplexers and De-multiplexers

VI. Latches and Flip-Flops
   A. Latches
B. Flip-Flops

VII. Counters
   A. Asynchronous Counters
   B. Synchronous Counters
   C. Up/Down Synchronous Counters
   D. Design of Synchronous Counters
   E. Cascaded Counters
   F. Shift Counters/Registers
   G. Counter Decoding
   H. Counter Applications

VIII. Solid State Memories
   A. Static Read – Write Memories (SRAM)
   B. Dynamic Read – Write Memories (DRAM)
   C. Mask Read Only Memories (MASKROM)
   D. Programmable Read Only Memories (PROM and EPROM)
   E. Electrical Erasable Programable Read Only Memories (EEPROM)
   F. FLASH Memories

IX. Digital to Analog Converters
   A. Binary-Weighted-Input
   B. R/2R Types

X. Analog to Digital Converters
   A. Flash (Simultaneous)
   B. Successive-Approximation Type

Q. LABORATORY OUTLINE: (Not applicable -- No Lab. as part of this courses)