1. **Course Number and Course Title**
   COE221 – Digital Systems

2. **Credit Hours**
   3-3-4

3. **Prerequisites and/or Co-Requisites:**
   Prerequisite: PHY 102 & PHY102L (General Physics II & Lab) or CMP 120 (Programming I)

4. **Name and Contact Information of Instructor:**
   Dr. Fadi Aloul
   Office: EB1-252
   Email: faloul@aus.edu
   Phone: (06) 515-2784
   Office Hours: Posted on office door

5. **Course Description (Catalog Description):**
   Covers number systems, representation of information, introduction to Boolean algebra, combinational circuits analysis and design, and sequential circuit analysis and design.

6. **Textbook and other Supplemental Material:**
   Textbook:

   M. Mano and M. D. Ciletti, Digital Design *5th edition*. Prentice Hall, 2012.

   Other supplemental material:
   None

7. **Learning Outcomes:**
   Upon completion of the course, students will be able to:
   1. Convert decimal numbers to/from binary, octal, hexadecimal and carry out simple and signed arithmetic operations in these base systems.
   2. Manipulate logic expressions using the theorems of Boolean Algebra and synthesize simple logic circuits using basic logic gates like AND, OR, NAND and NOR.
   3. Minimize Boolean functions with 3, 4 variables using Karnaugh maps.
   4. Use basic MSI components such as encoders, multiplexers and decoders in designing reasonably sized digital circuits.
   5. Understand functional and timing properties of different kinds of latches and flip flops.
   6. Translate verbal description of a given sequential system to a circuit design following procedures for designing synchronous sequential circuits.
   7. Design a sequential circuit starting from a state diagram, using flip-flops and basic MSI sequential components such as shift registers, counters, one shot and register banks.

8. Build and test simple digital circuits using SSI/MSI/LSI components on logic breadboards, and to use schematic captures to create and simulate simple circuits using the Multisim software tool.

8. Teaching and Learning Methodologies:

Methods include lectures, labs, homeworks, quizzes, exams and class discussions.

9. Course Topics and Schedule:

Topic	Weeks
Binary numbers, base conversion and binary codes	2
Boolean Algebra and Logic gates	2
Minimization Techniques	2
Combinational Logic	3
Synchronous Sequential Logic	4
Introduction to Programmable Logic	2
Review	1
Total:	**16**

10. Schedule of Laboratory and other Non-Lecture Sessions:

Assignment	Due Date (tentative)
Lab 0 – Instrumentation Familiarization	2nd week of classes
Lab 1 – Number Systems & Logic Gates	3rd week of classes
Lab 2 – Intro to MultiSim	4th week of classes
Lab 3 – Digital Logic Gates and Boolean Algebra	5th week of classes
Lab 4 – Simplification	6th week of classes
Lab 5 – Code Converters & Parity Generators	7th week of classes
Lab 6 – Adders, Subtractors, and Comparators	9th week of classes
Lab 7 – Multiplexers, Decoders, Multisim Lab	10th week of classes
Lab 8 – Latches & FlipFlops (Part 1)	11th week of classes
Lab 9 – Latches & FlipFlops (Part 2)	12th week of classes
Lab 10 – Counters	13th week of classes
Lab 11 – Counters & Shift Registers	14th week of classes

11. Out-of-Class Assignments with Due Dates:

Assignment	Due Date (tentative)
Homework 1	4rd week of classes
Homework 2	6th week of classes
Homework 3	8th week of classes
Homework 4	10th week of classes
Homework 5	12th week of classes
Homework 6	14th week of classes

12. Student Evaluation:

Assessment	Weight	Due Date (tentative)
Quizzes, HWs and Participation	10 %	
Labs	10 %	
Midterm #1 Exam	25 %	October 20, 2015
Midterm #2 Exam	25 %	November 24, 2015
Final Exam	30 %	As Set by Registrar Office

13. Contribution of Course to Program Outcomes

COE Program outcome	Emphasis in this course
(a) an ability to apply knowledge of mathematics, science, and engineering	◑
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	○
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	○
(d) an ability to function on multidisciplinary teams	
(e) an ability to identify, formulate, and solve engineering problems	◑
(f) an understanding of professional and ethical responsibility	
(g) an ability to communicate effectively	
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	
(i) a recognition of the need for, and an ability to engage in life-long learning	
(j) a knowledge of contemporary issues	
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	○

Emphasis: ● High; ◑ Medium; ○ Low; Blank – Nothing Specific Expected

CMP Program outcome	Emphasis in this course
a) An ability to apply knowledge of computing and mathematics appropriate to the discipline	◑
b) An ability to analyze a problem, and identify and define requirements	◑
c) An ability to design, implement, and evaluate a computer-based system	
d) An ability to function effectively on teams to accomplish a common goal	
e) An understanding of professional, ethical, legal, security and social issues	
f) An ability to communicate effectively with a range of audiences	
g) An ability to analyze the local and global impact of computing	
h) Recognition of the need for and an ability to engage in continuing	

professional development	
i) An ability to use current techniques, skills, and tools necessary for computing practice	○
j) An ability to apply mathematical foundations, algorithmic principles, and computer science	
k) An ability to apply design and development principles in the construction of software.	

Emphasis: ● High; ◑ Medium; ○ Low; Blank – Nothing Specific Expected