**STUDENT WARNING:** This course syllabus is from a previous semester archive and serves only as a preparatory reference. Please use this syllabus as a reference only until the professor opens the classroom and you have access to the updated course syllabus. Please do NOT purchase any books or start any work based on this syllabus; this syllabus may NOT be the one that your individual instructor uses for a course that has not yet started. If you need to verify course textbooks, please refer to the online course description through your student portal. This syllabus is proprietary material of APUS.

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**Course Summary**

**Description**

**Course Description:** This course presents digital and logic circuit analysis and design. The course covers six main parts: Boolean algebra and Boolean function simplification; basic logic gates, combinational functional blocks, and combinational circuit design using gates and functional blocks; digital circuit description by VHDL language; basic flip-flops, sequential circuit analysis and design; registers, static and dynamic memories, ROM and RAM, programmable logic devices, and field programmable gate arrays (FPGA’s); and register transfer language, basic computer structure, operation and design. Students will be introduced to the concepts of digital circuit theory and design, will practice with circuit analysis software, will gain solid skills to analyze and design digital circuits for various applications, and will get familiar with the structure and operation of a digital processor. NOTE: This course requires the student to purchase additional materials that are not covered by the book grant. Please refer to the Course Materials section for additional details. Prerequisites: ELEN305

**Course Scope:**

This course covers the fundamentals of the analysis and design of digital circuits at the gate and system level. The course starts with Boolean algebra and logic gates as the basic building blocks of all digital circuits. It then introduces methods for designing combinational circuits using the basic gates. Flip-flops are then introduced as the building blocks, along with gates, of sequential circuits. Methods for designing sequential circuits using gates and flip-flops are presented. Hardware description languages, simulation and data flow programming are used throughout the course.

**Objectives**

After completing the course, the student should be able to accomplish these Course Objectives (CO):

1. **CO-1.** Demonstrate a binary representation of data, binary codes, and conversion among data representation systems.
2. **CO-2.** Apply Boolean algebra to represent and simplify digital logic circuits.
3. **CO-3.** Design a combinational circuit using simulation software and a programmable logic device.
4. **CO-4.** Design digital circuit using a hardware description language.
CO-5. Design an arithmetic circuit using simulation and a programmable logic device.

CO-6. Design a sequential digital system using simulation and a programmable logic device.

CO-7. Evaluate methods of digital circuit design against specified design requirements and constraints.

CO-8. Prepare effective communication material using technical data.

Outline

Week 1: Number Systems, Binary Codes, Binary Code Conversion, Digital Signals

Course Objective(s)

CO-1

Readings

Chapter 1

Chapter 2

Assignment(s)

Week 1 Forum - Introduction

Tutorial 1: Software Installation Tutorial

Week 2: Basic Gates

Course Objective(s)

CO-2, CO-3

Readings

Chapter 3

Chapter 6.1 and 6.2

Assignment(s)

Week 1/2 Assignment

Week 2 Forum – Basic Gates

Tutorial 2: MultiSim Simulation Tutorial

Week 3: Boolean Algebra and Reduction Methods

Course Objective(s)

CO-2, CO-3, CO-8

Readings
Sections 5.1, 5.2, 5.3 and 5.5

Assignment(s)

Week 3 Forum – Circuit Simplification

Lab 1: MultiSim Simulation Lab

**Week 4: Sum of Products and Product of Sums**

Course Objective(s)
CO-2, CO-3

Readings
Sections 5.5, 5.7 and 5.8

Assignment(s)
Week 3/4 Assignment
Quiz 1
Tutorial 3: LabVIEW Simulation Tutorial

**Week 5: Circuit Design with Karnaugh Maps**

Course Objective(s)
CO-2, CO-3, CO-8

Readings
Sections 5.9 and 5.10

Assignment(s)
Week 5 Forum – Karnaugh mapping
Lab 2: LabVIEW Simulation Lab

**Week 6: Specifications**

Course Objective(s)
CO-3, CO-6, CO-8

Readings
Chapter 9

Assignment(s)
Week 5/6 Assignment
Week 6 Forum - Specifications
Lab 3: LabVIEW Programming Lab

**Week 7: Hardware Description Languages (VHDL)**

Course Objective(s)
CO-4

Readings
Section 5.6
Appendix E

Assignment(s)
Week 7 Forum - VHDL
Tutorial 4: VHDL Tutorial

**Week 8: Arithmetic Circuits**

Course Objective(s)
CO-4, CO-5

Readings
Chapter 7

Assignment(s)
Week 7/8 Assignment
Midterm Test

**Week 9: Multiplexers, Demultiplexers, Encoders and Decoders**

Course Objective(s)
CO-7, CO-8

Readings
Chapter 8

Assignment(s)
Week 9 Forum – Applications
Lab 4: Design Methods Lab

**Week 10: Flip-flops and latches**

Course Objective(s)
CO-6
Week 11: Registers and counters schematics

Course Objective(s)
CO-6, CO-8

Readings
Sections 12.1 to 12.9

Assignment(s)
Week 11 Forum - Counters
Lab 5: Registers and Counters Lab (part 1)

Week 12: Registers and counters in VHDL and LabVIEW

Course Objective(s)
CO-6, CO-8

Readings
Chapter 13

Assignment(s)
Week 11/12 Assignment
Quiz 2
Lab 5: Registers and Counters Lab (part 2)

Week 13: Derivation of state graphs and tables

Course Objective(s)
CO-6, CO-8

Readings
Section 12.11

Assignment(s)
Week 13 Forum – State Machines

Lab 6: State Machine Simulation Lab (part 1)

**Week 14: State Machine Schematics**

Course Objective(s)

CO-6, CO-8

Readings

Section 12.11

Assignment(s)

Week 13/14 Assignment

Week 14 Forum – State Machines

Lab 6: State Machine Simulation Lab (part 2)

**Week 15: State machines in VHDL**

Course Objective(s)

CO-6, CO-8

Readings

Section 12.11

Assignment(s)

Lab 7: VHDL State Machine Lab

**Week 16: State Machines in LabVIEW**

Course Objective(s)

CO-6, CO-7, CO-8

Readings

Lesson

Assignment(s)

Week 16 Forum – Evaluation

Final Test

Lab 8: LabVIEW State Machine Lab

**Evaluation**
This is an upper level course. All students' work is to be presented as such in terms of quality and content. The grading system will be based on your participation in the forums, assignments, tutorials, labs, quizzes, and test.

**Reading Assignments:** Please refer to the Course Outline section of this syllabus for the weekly reading assignments.

**Week 1 Self-introductions:** During Week 1 forum, each student must post a self-introduction (bio) to the class. This self-introduction is a requirement by the University, and is due by mid-night of Sunday of Week 1, along with two reply posts to other students. Your response must be at least 100 words (a requirement) and include the following information:

- a. Your name
- b. Your major
- c. Where you are in the program of study - what percentage of the program have you completed?
- d. Your academic and career goals
- e. Your thoughts on what the word digital means and how digital is different from analog

**Forums:** There will be twelve forums (1% each), counting 12% of the final grade. The forums will consist of specific questions to be answered, broad questions to be discussed, or polls for students to post their questions on the topics covered in that week. In each forum, a student is required to contribute an initial post in all weeks. Some weeks require two reply posts to other students in class. In weeks were reply posts are required, the initial post will be 60% of the grade and each reply post will be 20% of the grade.

**Assignments:** There will be seven assignments (2% each) during the course worth a total of 14% of the total grade. Each weekly assignment will cover one or more chapters in the book used in this course. For all problems requiring mathematical calculations, all work must be shown.

**Quizzes:** There will be two quizzes (5% each), counting 10% of the final grade. Tests will be open book, and open note. Tests will be non-proctored and will be design based. Students must complete each test within its time limit.

**Tests:** There will be two tests (8% each), counting 16% of the final grade. Tests will be open book, and open note. Tests will be non-proctored and will be design based. Students must complete each test within its time limit.

**Tutorials:** There will be four tutorials (1% each), counting 4% of the final grade. Tutorials will introduce new software and hardware to the course and will require evidence of successful completion of the tutorial.

**Labs:** There will be eight labs (5% each), counting 40% of the final grade. Labs will require a written lab report as well as evidence of successful completion of the lab.

**Grading:**

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<th>Name</th>
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<tr>
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<td>Week 1 Forum: Introduction</td>
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<td>Week 2 Forum: Basic Gates</td>
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<td>Week 3 Forum - Circuit Simplification</td>
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<td>Week 5 Forum - Karnaugh Map</td>
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<td>Week 6 Forum - Specifications</td>
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<td>Week 13 Forum - State Machines</td>
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<td>Lab 2: LabVIEW Simulation</td>
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<td>Lab 3: LabVIEW Programming</td>
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<td>Lab 4: Design Methods</td>
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<td>Lab 5: Registers and Counters</td>
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<td>Lab 6: State Machine Schematics</td>
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<td>Lab 7: State Machine VHDL</td>
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<td>Tutorial 3: LabVIEW Simulation</td>
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<td>Tutorial 4: VHDL</td>
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<td>Final Test</td>
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### Materials

**Book Title:** NI Student Software Suite - this item is not covered by the APUS Book Grant

**Author:** National Instruments

**Publication Info:** National Instruments

**ISBN:** 779252-3501

**Book Title:** NI Elvis Kit - this item is not covered by the APUS Book Grant

**Author:** National Instruments

**Publication Info:** National Instruments

**ISBN:** 780381-02
Book Title: NI myRIO Embedded Student Design Device - this item is not covered by the APUS Book Grant
Author: National Instruments
Publication Info: National Instruments
ISBN: 782692-01

Book Title: NI myRIO Starter Accessory Kit - this item is not covered by the APUS Book Grant
Author: National Instruments
Publication Info: National Instruments
ISBN: 783068-01

Book Title: myParts Kit from Texas Instruments - this item is not covered by the APUS Book Grant
Author: National Instruments
Publication Info: National Instruments
ISBN: 783752-01

Book Title: Fundamentals of Logic Design, 7th ed - The VitalSource e-book is provided via the APUS Bookstore
Author: Roth, Charles H. / Kinney, Larry L.
Publication Info: Cengage
ISBN: 9781133628477

Book Title: Additional required items are available to order from the APUS Bookstore. If you buy these items from other vendors, you may not receive all the parts you need for your course. These items (as noted) are not covered by the APUS Book Grant.
Author: N/A
Publication Info: N/A
ISBN: N/A

Textbook:
Author: William Kleitz
Book Title: Digital Electronics: A Practical Approach with VHDL
Publisher: Pearson/Prentice Hall
ISBN: 9781323086483

*Digital Electronics: A Practical Approach with VHDL, by William Kleitz* - The VitalSource e-book is provided via the APUS Bookstore.

Please visit [http://apus.libguides.com/bookstore](http://apus.libguides.com/bookstore) for more information.

Please visit [http://apus.libguides.com/er.php](http://apus.libguides.com/er.php) and search by the course number (ex: LITR210) to access your required resources.
Lab Materials:

Selected Bibliography

There are numerous online resources to help you in better understanding the objectives outlined in this course. Please see the APUS Online Library, which has several circuit theory related textbooks available online.


Course Guidelines

Citation and Reference Style

- Attention Please: Students will follow the APA Format as the sole citation and reference style used in written work submitted as part of coursework to the University. Assignments completed in a narrative essay or composition format must follow the citation style cited in the APA Format.

Tutoring

- Tutor.com offers online homework help and learning resources by connecting students to certified tutors for one-on-one help. AMU and APU students are eligible for 10 free hours* of tutoring provided by APUS. Tutors are available 24/7 unless otherwise noted. Tutor.com also has a SkillCenter Resource Library offering educational resources, worksheets, videos, websites and career help. Accessing these resources does not count against tutoring hours and is also available 24/7. Please visit the APUS Library and search for 'Tutor' to create an account.

Late Assignments

- Students are expected to submit classroom assignments by the posted due date and to complete the course according to the published class schedule. The due date for each assignment is listed under each Assignment.
- Generally speaking, late work may result in a deduction up to 20% of the grade for each day late, not to exceed 5 days.
- As a working adult I know your time is limited and often out of your control. Faculty may be more flexible if they know ahead of time of any potential late assignments.

Turn It In

- Faculty may require assignments be submitted to Turnitin.com. Turnitin.com will analyze a paper and report instances of potential plagiarism for the student to edit before submitting it for a grade. In some cases professors may require students to use Turnitin.com. This is automatically processed through the Assignments area of the course.

Academic Dishonesty

- Academic Dishonesty incorporates more than plagiarism, which is using the work of others without citation. Academic dishonesty includes any use of content purchased or retrieved from web services such as CourseHero.com. Additionally, allowing your work to be placed on such web services is academic dishonesty, as it is enabling the dishonesty of others. The copy and pasting of content from any web page, without citation as a
Submission Guidelines

- Some assignments may have very specific requirements for formatting (such as font, margins, etc) and submission file type (such as .docx, .pdf, etc). See the assignment instructions for details. In general, standard file types such as those associated with Microsoft Office are preferred, unless otherwise specified.

Disclaimer Statement

- Course content may vary from the outline to meet the needs of this particular group.

Communicating on the Forum

- Forums are the heart of the interaction in this course. The more engaged and lively the exchanges, the more interesting and fun the course will be. Only substantive comments will receive credit. Although there is a final posting time after which the instructor will grade comments, it is not sufficient to wait until the last day to contribute your comments/questions on the forum. The purpose of the forums is to actively participate in an ongoing discussion about the assigned content.
- “Substantive” means comments that contribute something new and hopefully important to the discussion. Thus a message that simply says “I agree” is not substantive. A substantive comment contributes a new idea or perspective, a good follow-up question to a point made, offers a response to a question, provides an example or illustration of a key point, points out an inconsistency in an argument, etc.
- As a class, if we run into conflicting viewpoints, we must respect each individual's own opinion. Hateful and hurtful comments towards other individuals, students, groups, peoples, and/or societies will not be tolerated.

University Policies

Student Handbook

- Drop/Withdrawal policy
- Extension Requests
- Academic Probation
- Appeals
- Disability Accommodations

The mission of American Public University System is to provide high quality higher education with emphasis on educating the nation’s military and public service communities by offering respected, relevant, accessible, affordable, and student-focused online programs that prepare students for service and leadership in a diverse, global society.

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