George Mason University  
Electrical and Computer Engineering Department  

ECE 301: Digital Electronics

**Instructor:** Ahmad A. Salman  
**Class:** MW 4:30 – 5:45 PM.  
Nuygen Engineering Bldg., Room 3707  
(703) 993 - 1561  
asalman@gmu.edu  

**Office Hours:**  
Room 3707

**Class:** Innovation Hall, Room 105  
**Class:** Tuesday 3:00 – 4:00 PM.  
Wednesday 2:00 – 4:00 PM.

**Prerequisites:** Grade of C or better in MATH 125 or MATH 112.

**Notes:** Not intended for those majoring in electrical or computer engineering.

**Required Text:** *Fundamentals of Digital Logic with VHDL Design, 3rd Edition*  
by Stephen Brown and Zvonko Vranesic  

**BlackBoard:** All material and additional information about this course can also be found on an ECE301 page on the Blackboard Educational Management System at Mason. Please see: [https://mymasonportal.gmu.edu](https://mymasonportal.gmu.edu)

**Schedule:** A detailed schedule is provided on Blackboard.

**LABORATORY TEACHING ASSISTANTS**

Prasad Waman Khedekar  
**Email:** pkhedeka@masonlive.gmu.edu  
**Office Hours:** Monday: 7:30 – 9:00 PM. (Room 3203, Hardware Lab)  
Thursday: 12:00 – 1:30 PM. (Room 3203, Hardware Lab)

Sunil Kumar Rajendran  
**Email:** srajend2@masonlive.gmu.edu  
**Office Hours:** Wednesday: 7:00 – 8:00 PM. (Room 3505, Hardware Lab)  
Friday: 3:00 – 5:00 PM. (Room 3203, Hardware Lab)
COURSE DESCRIPTION

Introduces digital systems, circuits, and computers. Topics include binary systems and codes, digital logic gates and circuits, microelectronics and integrated circuits, coding and multiplexing, multivibrators, shift registers, counters, A/D converters, and elementary computer architecture.

LEARNING OBJECTIVES

Students who successfully complete this course will achieve the following learning objectives:

- Student will be able to analyze combinational logic circuits.
- Student will be able to minimize Boolean expressions using Boolean algebra and Karnaugh maps.
- Student will be able to specify a Boolean expression in either of the standard forms, and design the associated two-level combinational logic circuits.
- Student will be able to design a minimum-cost combinational logic circuit, given the circuit specifications.
- Student will be able to design complex digital logic circuits and systems from simple logic circuits.
- Student will be able to design a 1-bit adder circuit.
- Student will be able to design a multiple-bit adder/subtractor circuit.
- Student will be able to analyze sequential logic circuits.
- Student will be able to design a 1-bit memory element from basic logic gates.
- Student will be able to design registers and shift-registers from 1-bit memory elements.
- Student will be able to design counters from 1-bit memory elements.
- Student will be able to design a minimum-cost sequential logic circuit, given the circuit specifications.

CLASS

Active participation in class has been shown to improve learning and retention. Each lecture will include in-class exercises to facilitate active engagement. The exercises will focus on the material covered in the lecture and in the assigned reading. They will range from simple exercises based on a single topic, to more complex exercises that require you to assimilate multiple concepts.

You are expected to prepare for each class. This includes reviewing previously covered material, as well as completing the assigned reading.
LABORATORY

The laboratory experiments complement the material covered in the lectures and in the assigned readings. They focus on the historical design methodology, making use of discrete components, a breadboard, and circuit wiring to realize combinational and sequential logic circuits. Each experiment will provide hands-on experience with one or more of the concepts covered in class.

You are expected to be prepared for each lab. This includes review of the associated lecture materials, completion of the associated reading, and, most importantly, completion of the pre-lab. You will NOT be allowed to participate in the lab unless you have completed the pre-lab.

You will be expected to complete a lab report for each laboratory experiment.

The laboratory experiments are administered by the teaching assistants. They will provide additional materials regarding the lab, including the lab schedule, pre-lab requirements, and lab report guidelines.

**Failure to complete all of the laboratory experiments will result in a failing grade for the course.**

The experiments to be performed include:

1. Binary numbers.
2. Basic logic gates.
3. Combinational logic circuits.
4. Combinational logic circuits (alternate Lab #5)
5. NAND and NOR circuits (Lab #4)
6. Adder circuits (alternate Lab #8)
7. BCD Adder circuit (Lab #9)
8. Multiplexers (Lab #6)
9. Flip-flops (Lab #10)
10. Counter circuits (Lab #11)
11. Clocked sequential logic circuits (Lab #12)
Homework

Homework is an essential part of the learning process. It is your opportunity to make use of the concepts discussed in class and in the assigned reading, and to apply these concepts to various types of problems. It will help you identify those things that you do not understand, and help you prepare for the exams.

You are expected to complete the assigned reading and ALL of the problems in the problem set on each homework assignment. You are encouraged to work together, to understand how to solve each of the problems, and to develop a more complete understanding of the material. However, you must submit your own work. If you copy another student's work, both of you will receive a 0 for the homework assignment.

Homework assignments will be posted on Blackboard, on a weekly basis. You will have one week to complete each assignment. Homework must be submitted at the BEGINNING of class on the date that it is due in HARDCOPY. Late homeworks will NOT be accepted.

Of the assigned problems, only one problem will be graded at random and will be worth 8 points. The remaining points out of 20 will be equally distributed among other problems on the homework assignment based on whether or not a problem was attempted.

The lowest homework grade will be dropped at the end of the semester.

Homework solutions should be formatted as follows:

1. Your name should appear at the top-left on all pages of your solutions.
2. The class number (ie. ECE 301) and the assignment number should appear below your name.
3. Your number in the attendance sheet should appear above your name. (will be assigned on 2nd week)
4. All pages should be numbered at the top-right.
5. All pages should be stapled together.
6. All solutions should be written neatly and clearly – if we cannot read it we will not grade it!
7. Solutions to individual problems should be clearly separated – you should either use a horizontal line to separate problem solutions or you should start the solution to a problem on a new page.

Failure to follow the above guidelines will result in points deduction up to getting a 0 on the assignment!
EXAMS

There will be three exams in this course:

- Midterm #1
- Midterm #2
- Final Exam (during finals week)

See the detailed schedule for the date of each of the exams.

All exams are closed book. I will provide the necessary reference materials for each exam.

Use of calculators will be specified for each exam.

There will be NO makeup exams. If you cannot make one of the scheduled exams, you must speak with me in advance to arrange for an alternate time to take the exam.
ATTENDANCE

You are expected to attend class. You cannot receive credit for in-class exercises if you are absent from class. You are responsible for all material covered in class and in the assigned reading. Should you miss class, you must consult with one of your classmates to obtain the missed material.

Attendance in lab is mandatory. Attendance will be taken every week. If you miss a lab experiment you must arrange with the TA to make it up at an alternate time. If you consistently miss your lab session, we reserve the right to refuse to offer you an opportunity to make up the missed lab experiment. In such a case, you will receive a 0 for the missed lab.

GRADING

The final grade for the course is based on my best assessment of your understanding of the material and your participation in the class during the semester. The exams, homework assignments, and in-class exercises will be used to determine your preliminary final grade according to the following weighting:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendence/Exercises</td>
<td>5%</td>
</tr>
<tr>
<td>Homework</td>
<td>15%</td>
</tr>
<tr>
<td>Lab Experiments</td>
<td>15%</td>
</tr>
<tr>
<td>Midterm #1</td>
<td>20%</td>
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<tr>
<td>Midterm #2</td>
<td>20%</td>
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<tr>
<td>Final</td>
<td>25%</td>
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HONOR CODE

All rules of the GMU Honor Code system will be enforced in both the lecture and the lab. You must review the rules of the GMU Honor Code and be familiar with them. The GMU Honor Code can be found at: http://academicintegrity.gmu.edu/honorcode/

You are encouraged to discuss homework problems with other students and/or obtain assistance of the instructor or the teaching assistants. Nevertheless, please write down your own solutions which represent your understanding of the material. Duplicating another student's homework solutions, hardware/software designs, diagrams, source code, pre-labs, or lab reports is considered cheating. If you use material from other sources such as, but not limited to, the web, books, journals, data sheets, etc. you must reference the source.

Honor code violations will be pursued and prosecuted to the fullest extent.

CLASSROOM ETIQUETTE

Cellphones are to be turned off during class; minimally they must be silenced. Emergency calls may be taken, but must be taken outside of the classroom.

Texting, using your laptop for something other than lecture-related work, etc. is considered a distraction to me and to the other students trying to learn in the class, and will not be tolerated.

OFFICE OF DISABILITY SERVICES (ODS)

If you are a student with a disability and require special accommodations, please contact me and the Office of Disability Services (ODS) as soon as possible. All special accommodations must be arranged through ODS.

Office of Disability Services (ODS): (703) 993 – 2474; http://ods.gmu.edu

OTHER USEFUL CAMPUS RESOURCES

- Writing Center: A114 Robinson Hall; (703) 993 – 1200; http://writingcenter.gmu.edu
- University Libraries: “Ask a Librarian” http://library.gmu.edu/mudge/IM/IMRef.html
- Counseling and Psychological Services (CAPS): (703) 993 – 2380; http://caps.gmu.edu
- The University Catalog: http://catalog.gmu.edu
- University Policies: http://universitypolicy.gmu.edu