

COURSE SYLLABUS

1. **ECE 2430 – Embedded Systems**

2. Three credit hours – three 50 minute classes; Also note ECE 2431, a 2 hr. lab per week.

3. Course Instructor(s)

Dr. J. Peyton Jones

422 Tolentine

610 -519-4216

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Office Hours on Zoom by appointment

4. TEXTBOOK / COURSE MATERIALS:

- The course textbook is: Digital Design & Computer Architecture (ARM Edition), SL Harris & DM Harris.
- 'Blanked out' copies of the course lecture notes are posted on Blackboard.
- Homework assignments are posted on Blackboard
- Solutions to homework assignments are also posted on Blackboard.

5. SPECIFIC COURSE INFORMATION

- Catalog Description
Introduction to logic design and digital computer fundamentals. Topics include computer arithmetic, Boolean algebra and logical design, basic concepts of computer architecture, programming and interfacing microcontrollers.
- ECE 1620; Co-requisites: ECE 2430 and ECE 2431 are co-requisites of each other
- Required for B.S. Electrical Engineering

6. COURSE – SPECIFIC GOALS

- The objective of this course is to introduce the students to embedded systems, focusing both on how to design and use them as well as on the principles on which they work.
- ABET OUTCOMES

Student Outcomes						
1	2	3	4	5	6	7
X						

7. LIST OF TOPICS TO BE COVERED

- Introduction:
 - Why embedded systems and IOT
 - Basic system architecture: CPU, Memory and Peripherals
 - Memory types and hierarchy; Moore's Law

- Peripheral Devices:
 - General Purpose Input Output (GPIO)
 - Output drive: Push-Pull, Open-Drain, High-Z
 - Analog input (A/D conversion), Pulse Width Modulated output.
 - PWM, Servo Motor, and Tone outputs.
 - Serial Communication: UART, SPI and I2C Protocols

- Data Storage and Number Systems
 - Data types, encoding and data storage
 - Binary, 2's Complement Binary, Hex
 - Addition, Subtraction, Carry and overflow

- Introduction to Boolean Expressions and Digital Logic
 - Boolean expressions, Logical operators, Boolean operators
 - Introduction to Boolean Algebra + De Morgan's Theorem
 - Bitwise combinatorial logic and shifting
 - Logic gates and simple logic circuits; half-adder, full-adder, decoder, multiplexer
 - Introduction to sequential logic: Flip-flops: S-R, D-type, J-K
 - Example analysis: Hardware finite state machine

- Interrupts & Finite State Machines
 - GPIO, and Timer Interrupts
 - Interrupt Service Routines
 - Finite State Machines and Sequential Logic
 - volatile, static, enumerated data types

- Cloud Programming:
 - Generating and responding to Cloud-based Events
 - IFTTT, ThingSpeak, NodeRed.

- Assembly Language Programming:
 - Introduction to Assembly Language programming

8. SCHEDULE (TENTATIVE)

The schedule will follow the list of topics, though specific dates cannot be assigned yet.

9. GRADING POLICY

The in-class course ECE 2430 and Lab component ECE 2431 will be taught in a highly integrated manner, with some homeworks amounting to Lab Projects. Written **Homework** assignments will be posted on Blackboard, together with **Solutions**. This work will not be graded, but student learning on each homework will be assessed by means of a 10-20 minute 'in-class' **Quiz**.

Note: To do well in the quiz requires actually doing the homework and using the solutions when you get stuck rather than simply reading the solutions.

Each Lab assignment (including all subsection parts eg. Lab1a-d) is assigned a **2-week** period to be completed, checked off by a lab assistant, and uploaded to BB. Labs that are not completed by the start of the next 2-week period will be deemed 'late' and will receive a **2 point/week** penalty on your final grade. Unexcused lab absences if you are behind and work is 'late' will also receive a **2 point** penalty.

Note:

- Most of the labs are 'portable' so you can develop code outside of formal lab times.
- If there is space, you can makeup labs or get checked off in the other lab section.

For **all** lab work it is considered a **violation of academic integrity** to electronically copy the work of another or to allow your own work to be copied. For some lab assignments (specified in the lab sheets), students may **not** assist each other in any way. Otherwise, students are encouraged to help each other, not by sharing your own solutions but by answering questions or suggesting directions / help to get to the solution – ie by 'teaching' your classmates.

Tentative grade weightings will be as follows:

- Quizzes 80%
- Final Project 20%

10. ASSIGNMENT, QUIZZES and/or LABORATORY REPORT SUBMISSION POLICY

All assignments, quizzes, or program code should be submitted to Blackboard. Quizzes will be posted online at the specified class time, and students must scan and upload their answers (ideally as pdf) to Blackboard within 5 minutes from the end of the quiz.

11. QUIZZES / EXAMINATION POLICY

- All quizzes are closed book, with no additional resources other than that provided for the test.
- The Respondus Lockdown browser with Webcam Monitoring may be used.

12. POLICIES MANDATED BY COLLEGE/UNIVERSITY: ACADEMIC INTEGRITY, STUDENT CODE of CONDUCT, ATTENDANCE, LSS & ODS ACCOMMODATIONS, LEARNER'S STUDIO, etc.

The College of Engineering is committed to creating an environment of academic integrity and ethical decision-making that we hope is reflected in the actions of our students and graduates. As Villanova students, integrity is central to the University mission. As engineers, our code of conduct requires us to place honor and integrity at the forefront of everything we do. As engineering students, it is expected that you will begin to adopt these values and instill them into your work habits. Students violating the academic integrity policy will receive a zero on that assignment or exam and the violation will be reported to the Associate Dean for Academic Affairs.

The University's academic integrity policy can be found here:

<https://www1.villanova.edu/villanova/provost/resources/student/policies/integrity.html>.

The College of Engineering has adopted the following exam guidelines:

- Students must arrive before the start of the exam. Under exceptional circumstances a student may need to arrive late, but he/she can enter the exam no later than 5 minutes after the start of the exam.
- All cell phones must be turned off and stored away until the student exits the exam room.
- The official Villanova class attendance policy must be followed when requesting excuses for absences or lateness to an exam.
- Each student must write and sign the following statement, *"I have neither given nor received any unauthorized assistance in the completion of this exam."*
- Students can work together on homework, but each person must turn in a copy in their own handwriting.

Adherence to the Student Code of Conduct and the CARITAS Commitment

Students are expected to act in a professional and respectful manner to their fellow students, faculty, and staff. Students should become acquainted with and understand the responsibilities set forth in the Student Handbook, especially those in the sections on Policy and Regulations. Adherence to University regulations is expected and required for successful completion of the program of studies. Enforcement within the classroom of policies regarding classroom behavior is the responsibility of the faculty member. All other discipline problems are to be referred to the Dean of Students.

Students, faculty, and staff are expected to comply with the [CARITAS Commitment](#). Students must wear masks, practice social distancing and good hygiene, wipe down their work area upon arrival and departure, and request an excused absence if they are not feeling well.

Online Expectations

To foster a professional environment, please wear appropriate clothes, mute if you are not talking to cut down on background noise, refrain from eating, and select an appropriate setting when we are meeting online.

Students with Disabilities

It is the policy of Villanova to make reasonable academic accommodations for qualified individuals with disabilities. If you are a person with a disability please contact me after class or during office hours to make arrangements.

If you have a non-physical disability you need to register with the Learning Support Office by contacting 610-519-5176 or at learning.support.services@villanova.edu as soon as possible. Registration is needed to receive accommodations.

The Office of Disability Services collaborates with students, faculty, staff, and community members to create diverse learning environments that are usable, equitable, inclusive and sustainable. The ODS provides Villanova University students with physical disabilities the necessary support to successfully complete their education and participate in activities available to all students. If you have a diagnosed disability and plan to utilize academic accommodations, please contact and register with Gregory Hannah, advisor to students with disabilities @ 610-519-3209 or visit the office on the second floor of the Connelly Center.

The Learner's Studio

Villanova's Learners' Studio provides free 1:1 and small group (max of 10 students) content tutoring for over 100 courses on campus (excludes writing, math, and entry level VSB courses). From quick homework clarification questions to prep for final exams, we can help! Our peer tutors are each endorsed by two faculty members and are trained according to CRLA national standards. Pop in as-needed or book a regular weekly session to supercharge your academic success. Sessions can be 30 or 60 minutes in length. We are located in Old Falvey 301.

Walk-ins welcome, or book in advance online:

1. Visit Villanova.mywconline.com
2. Register for an account and select "The Learners' Studio" from the drop-down menu on the sign-in page
3. Use the "limit to" menu to locate your course by code (For example, PHY 2400). This feature will sort the schedule and show you all tutors approved to cover your class
4. White boxes represent available sessions. Click any white box to book
Don't see your class listed? Request a tutor for a missing subject with this link: tutorrequest.villanova.edu

For more information, contact juliana.studer@villanova.edu 610-519-5862.

Electronics Policy

The use of electronic devices, such as phones, laptops, tablets, etc., during class is generally fine, unless you become a disturbance to others.

Students are prohibited from making any audio or visual recordings (including taking photographs) of lectures, discussions, or other classroom activities, unless a student (1) has written permission in advance from the instructor, or (2) is permitted to record under terms and conditions as approved by the University's Office of Disability Services or Learning Support Services. Students who have received approval to record classes as an academic accommodation must provide supporting documentation from the Office of Disability Services or Learning Support Services in advance of any recording. Students may use authorized recordings only for the purposes of individual study in the course, and may not disseminate or share them with a wider audience without explicit permission.

Copyright Policy

The materials used in Villanova University courses ("Course Materials") generally represent the intellectual property of course instructors, third parties and/or the University which may not be disseminated or reproduced in any form for public distribution (e.g., sale, exchange, etc.) without the written permission of the course instructor. Course Materials include all written or electronic documents and materials, including syllabi, current and past examination questions/answers, and presentations such as lectures, videos, PowerPoints, etc., provided by a course instructor. Course Materials may only be used by students enrolled in the course for academic (course-related) purposes.

Published course readings (book chapters, articles, reports, etc.) available in Blackboard are copyrighted material. These works are made available to students through licensed databases or fair use. They are protected by copyright law, and may not be further disseminated or reproduced in any form for distribution (e.g., uploading to websites, sale, exchange, etc.) without permission of the copyright owner.

Follow these links for more information about [intellectual property](#), [copyright](#), and [computer acceptable use](#).

Adherence to the Student Code of Conduct

Students are expected to act in a professional and respectful manner to their fellow students, faculty, and staff. Students should become acquainted with and understand the responsibilities set forth in the Student Handbook, especially those in the sections on Policy and Regulations. Adherence to University regulations is expected and required for successful completion of the program of studies. Enforcement within the classroom of policies regarding classroom behavior is the responsibility of the faculty member. All other discipline problems are to be referred to the Dean of Students.

Professorial Duties

It is important to note that teaching is one of the many duties that professors perform as part of their job responsibilities. In addition to teaching, professors perform research, advise graduate students, edit journals and review journal articles, serve on committees for the university and professional societies, travel to conferences to remain abreast of current developments and to present their results... to name just a few.



VILLANOVA
UNIVERSITY

EMERGENCY PROCEDURES

GENERAL GUIDELINES

- **For general emergencies and to report a crime:**
 - Get to a safe place if possible
 - **Call (610) 519-4444**
- In an emergency evacuation (including but not limited to a fire alarm):**
 - Move quickly and safely to the nearest exit
 - Close doors and windows if time permits
 - Do not use elevators
 - Assist disabled individuals who cannot evacuate themselves by proceeding with them
 - Proceed with them to the nearest fire stairway or safe haven and wait inside with the doors closed until rescue personnel arrive to assist. Immediately get word to rescue personnel of the exact location of the disabled individual
 - Remain a safe distance from the building and be aware of responding emergency vehicles

MEDICAL EMERGENCIES

- - Do not move a seriously injured or ill person unless the situation is life threatening
 - Call Public Safety at (610) 519-4444
 - Give the dispatcher your name, location, and telephone number and as much information as possible regarding the nature of the injury or illness
 - Do not hang up until the dispatcher ends the call
 - Administer first aid if you are trained to do so. Otherwise remain with the victim until Public Safety or medical personnel arrive

SHELTER IN PLACE

- Shelter in place is design to keep you safe while indoors if dangerous environmental conditions exist, such as extreme weather or a hazardous materials release. **If a shelter in place is ordered:**
 - If outside, seek shelter in the nearest building, preferably in an interior room with few windows
 - Close all exterior doors, windows and any other openings to the outside
 - Avoid overcrowding by selecting several rooms if necessary
 - Monitor Nova Alert and email for further instructions
 - Report any emergency or unusual condition to Public Safety
 - Do not leave the building until receiving the "all clear" from a police officer, Public Safety officer, Nova Alert, email or website communication

UTILITY FAILURES AND ELEVATOR EMERGENCIES

- **Report utility failures to Facilities Management by calling (610) 519-4420 during normal business hours. After hours, report utility failures to Public Safety by calling (610) 519-4444.**

ALCOHOL EMERGENCIES

- Consuming too much alcohol can result in serious injury or even death. **Call Public Safety at (610) 519-4444 if a person:**
 - Cannot be roused by shaking or shouting
 - Has cold, clammy or bluish skin
 - Is disoriented, incoherent, or cannot stand, walk or talk
 - Sustained a blow to the head or any injury that caused bleeding
 - Has shallow or irregular breathing
 - Drank alcohol in combination with other drugs

IN AN ACTUAL FIRE

- - Activate the fire alarm system by pulling a fire alarm station on your way out of the building
 - Leave the building via the nearest exit
 - Do not use elevators
 - Feel doors before opening, and close doors and windows as you leave if safe to do so
 - Report the fire to Public Safety by calling (610) 519-4444 once outside
 - If trapped, keep the doors closed and place cloth under them to keep out smoke
 - Signal for help by hanging an object (e.g., such as a jacket or shirt) out window to attract attention

LOCKDOWN

- An imminent threat of violence may be cause for a lockdown of all or part of campus. Some exterior doors will lock automatically. Emergency responders will lock others manually. The goal is to limit exposure of students, faculty and staff to danger by preventing dangerous persons from entering campus buildings. **If a lockdown is ordered:**
 - Stay Inside! Do not leave the building unless an imminently dangerous situation arises inside. If outside, seek shelter in the nearest building
 - Take shelter in a lockable room if possible
 - Close windows, shades and blinds, and avoid being seen from outside the room if possible
 - Monitor Nova Alert and email for updates and further instructions. A description of the actor will be disseminated as soon as possible using these methods
 - Report any emergency or unusual condition to Public Safety
 - Use discretion in admitting anyone into a secure building. Require that all backpacks and other bags be left outside at least 30 feet from the building. Require that the person seeking shelter open all outer garments for visual inspection before allowing entry
 - Once in a secure location, do not leave until receiving the "all clear" from a police officer, Public Safety officer, Nova Alert, email or website communication

Nova Alert is Villanova University's primary emergency communication method. To sign up, go to alert.villanova.edu.