BASIC INFORMATION

Course

Name:	COMP 430 System Fundamentals
Credits:	4
Prerequisites:	None
Term:	Fall 2016
Class Meetings:	Tuesday 1 to 4 PM
Location:	RM. 149 Electrical Engineering Lab
Course Site:	https://mycourses.unh.edu

Instructor

Name:	Raymond Wallace - Adjunct Instructor
Program:	Computing Technology, Division of Science and Technology, UNH Manchester
Office:	N/A
Phone:	N/A
Email:	ray.wallace.unh@gmail.com
Office hours:	by appointment.

How to get in touch with me

There are three ways to get in touch with me:

1. Course-related communication outside class takes place **exclusively** on the **class forum**.
2. For in-person, one-on-one communication, see me **after class** or **by appointment**.
3. If you have personal issues, personal questions, or concerns see me or email me at ray.wallace.unh@gmail.com. I'll reply no later than next weekday (M - F.)

Course Description

The underlying hardware and software infrastructure upon which applications are constructed is collectively described by the term "computer systems." Computer systems broadly span the sub disciplines of operating systems, parallel and distributed systems, communications networks, and computer architecture. The class will present an integrative view of these fundamental concepts in a unified, albeit simplified fashion, providing a common foundation for the different specialized mechanisms and policies appropriate to the particular domain area. Writing Intensive.

The course provides an opportunity for students to become engaged with and understand the development of modern computing systems which have become part of our daily lives. The course details the evolution of computing systems from early electronic/mechanical computing devices to contemporary microcomputer systems. Environmental, governmental and societal influences on computing technology and the effect of computing technology on society are explored.

In addition to detailing the development of modern computing systems, the course provides an opportunity for students to have a hands on experience designing computing based systems. Students will use microcomputer and microcontroller devices to design systems that they encounter routinely.

Most students are well versed in operating computing devices. The course offers the opportunity to see how activities such as pressing a letter on a keyboard becomes a character shown on a display and the intervening computing processes.

Resources

There are many online references available for the Raspberry Pi (RPi) and Arduino computing systems. References will be provided to several online resources during the course.

Textbook

There is no required textbook for the course. We will use many web based resources for the technical and social background material.

Raspberry Pi I/O Programming Using Python
Agus Kurniawan
Agus_Kurniawan_Raspberry_Pi_I_O_Programming_Using_Python
A good, quick introduction to using Python to program the I/O ports on the Raspberry Pi. Inexpensive eBook.

Blown to Bits: Your Life, Liberty, and Happiness After the Digital Explosion
Hal Abelson, Ken Ledeen, Harry Lewis
Chapters available for free download at:
http://www.bitsbook.com/excerpts/

Bebop to the Boolean Boogie, Third Edition: An Unconventional Guide to Electronics
Clive Maxfield
ISBN-10: 1856175073
An easy read. Quirky introduction to many aspects of electronic logic.

Development Platform, Tools, and Resources

List of the home pages for several resources used in the class.
Raspberry Pi: https://www.raspberrypi.org/
Arduino: http://www.arduino.cc/
Fritzing Schematic Generation Software: http://fritzing.org/home/
Python Software Foundation: https://www.python.org/about/gettingstarted/

Computing Services

Because of the highly collaborative nature of the course, which values sharing and openness, we'll be using a variety of services that support these values: collaboration, sharing, and openness. These services are:

- **MyCourses** for the course site, class Discussion Board/Forum and to submit all HW assignment and Project documentation.
- **Applications** as needed (e.g. Google Hangout, Google Drive, Zoom Meeting, etc.)

Tech Consultants

Computing Technology Department has tech consultants who are available to help with software configuration and other technical questions you might have. Several of the tech consultants are familiar with the Raspberry Pi and Arduino platforms and associated software.

Course Site

The course site is at https://mycourses.unh.edu. It is the repository of course materials in digital form: syllabus, schedule, learning units, homework, practice questions and exam practice problems.

Class Forum

The class forum is also at https://mycourses.unh.edu. All outside class participation takes place on the forum. This is the place where we ask and answer questions as part of the learning process.

Student Online Portfolios

All your work is uploaded to your student online portfolio hosted by Canvas. Canvas appends as a prefix your name to any file submitted to meet assignment requirements. The format for each assignment submission will be detailed in the assignment document.

Acknowledgments

This curriculum was developed in co-operation with Mihaela Sabin Ph.D., Associate Professor of Computer Science at University of New Hampshire – Manchester.

Instructional Approach

Learning in this class depends heavily on ***active participation*** and ***open collaboration*** in and outside class with peers and the instructor. The course has 14 sessions with 3-hour class meetings/session and 2 exam sessions. As a guideline, the student is **expected to allocate 6 to 9 hours outside of class to meet the requirements of the course goals.** Class meetings will be driven by an interactive discussion of various aspects of computing systems, questions, discussions, lab exercises, and project work.

Learning activities are structured by **blending *in-person* and *online time*** to engage with the course material:

- The 3-hour class time will be used to prompt and facilitate discussions and presentations, review solutions, and guide lab activities.
- You use the outside class time to study concepts and techniques, apply them to solve problems, give feedback to peers, write Reflections on the topics covered in class, collaborate with peers, work on HW assignments and the Creative Projects.
- Online means of communication and collaboration include a class forum, student online portfolios, and shared learning artifacts. Students are expected to post and will have a section of their grade based on posting to the Discussion Board frequently during the course.
- In-class collaboration consists of group deliberations related to technology and society and peer support during design and fabrication activities. The class will include group and class discussions and presentations.

GOALS and LEARNING OBJECTIVES

Course Goals

Digital computing technology has affected almost every aspect of life around the globe. The course will provide frequent reference to applications made possible by computing related technologies. Through these references to technology applications, System Fundamentals addresses the benefits and risks associated with computing technologies. The hands on activities anchor the conceptual learning by challenging students to translate concepts into concrete achievements through frequent design projects.

The course final project allows students to experience an Engineering Design Project from initial concept presentation, specification sheet design, design review, implementation, fabrication, design and construction documentation, costing and operation demonstration.

The course seeks to broaden participation in computing by attracting students from all majors and from communities with long-standing underrepresentation in computing, i.e., women, persons with disabilities, underrepresented students of color, and underserved students, such as low-income and first generation college students.

Learning Objectives

Upon completion of this course, students should be able to:

1. Demonstrate knowledge of how the interaction of hardware components and low level software/firmware affects the operation of a modern computing system.
2. Discover how an Engineering Design process functions and interacts with many disciplines to yield new, useful and innovative products.
3. Design a simple system that performs a meaningful and useful function using low cost, readily available computing modules (Raspberry Pi and/or Arduino) and related software.
4. Communicate and collaborate with peers of many backgrounds in the creation of computing based systems.
5. Connect computing systems with economic, social, and environmental contexts and with issues of diversity, inclusion, equity, and power.

COURSE ASSIGNMENTS, CREATIVE PROJECTS AND EXPECTATIONS

Portfolios

All your work is uploaded to your student online portfolio in myCourses for this course. You will use myCourses to create and maintain your portfolio. In some instances, portfolio artifacts, such as project proposal, design details, schematics, necessary software, and documentation will be shared with team members. Portfolios will be graded multiple times during the semester.

Homework Assignments

There will be homework assignments, weekly written reflections and Project progress reports. Assignments must be completed and uploaded to your portfolios **before class (no later than 6AM on the day of the class**.) The myCourses submittal portal will identify any assignment submitted after 6:01AM as late. The portal for assignments will lock 2 hrs. before class and will not allow submissions. Contact the instructor regarding late assignments.

Homework assignments require a wide range of learning activities including but not limited to: reading, watching videos, and a variety of learning activities, such as:

- Read and research material related to computing system evolution and operation
- Writing responses and /or essays discussing the impact of technologies covered in class or in required readings.
- Write system feature and operation descriptions
- Design simple circuits using very basic circuit design procedures
- Prepare circuit layout and schematic diagrams using a free software package (Fritzing)
- Prepare Bill of Materials for the design using spreadsheet software (Excel, etc.)
- Solve design and implementation problems
- Prepare presentations for your design
- Setup, configure, and troubleshoot systems and services
- Study and review practice questions, ask questions, and give feedback
- Write weekly Reflections concerning the impact of technologies.

Weekly Reflections

The Reflection consists of your answers to the following items:

1. Describe the technologies presented during class in your own words.
2. Describe several ways these technologies have impacted society.
3. Describe how one of the technologies might evolve and affect society in the future.

All items must be answered in full sentences. Write clearly and check for spelling, grammatical and style errors. Include the item numbers. Give detailed and supportive examples.

Creative Projects

There will be two (2) Creative Projects during the course.

The Project 1 description and goals will be assigned during class in Week 4. Students will use the Raspberry Pi in this project. The design documentation package for Project 1 will be due prior to class in Week 8 **(no later than 6AM on the day of the class.)** Students will demonstrate the Project during class in Week 8.

The Project 2 goals will be assigned during class in Week 9. In Creative Project 2, students will propose the topic for their project. Students will use the Arduino module (and the Raspberry Pi also if desired.) Students will present an 'elevator pitch' of the design concept and a design review of the design with associated

Creative Projects – cont'd

documentation artifacts. Weekly progress reports will be presented during class. The final design documentation package for Project 2 will be due prior to class in Week 16 **(no later than 6AM on the day of the class.)** Demonstration of the Project 2 system will occur in Week 16.

Class Forum Participation and Collaboration with Peers

Full success in this class requires that you participate and contribute to the class forum at https://mycourses.unh.edu on a regular basis. Class forum contributions may be questions, answers, follow-ups, or edits to other contributions. You are also required to collaborate in class with your peers, partner(s) and/or team members while working on the Creative Projects.

Grading Rubric

The Reflection grading rubric has assessment criteria and corresponding scores:

Evaluation	Score	Criteria
Excellent	A	All work products are complete and exceed all the specifications: write-ups are impeccably written, all descriptions are adequately supported by evidence, all solutions are correct, collaboration is reflected by class forum participation (at least one informational post or answer to peer question) and quality of interaction with peer(s) during the class activities.
Good	B	No work products are missing. Work products are complete and fully meet the specifications: write-ups have clarity, include examples, and have no spelling, editing and style errors, most of the claims are adequately supported by specific evidence, most solutions are correct, collaboration is reflected by class forum participation (at least one informational post or answer to peer question) and quality of interaction with peer(s) during the class activities.
Basic	C	No work products are missing. Work products are complete but meet only the basic specifications: write-ups may lack clarity, use general statements and/or have editing and style errors, some claims are not adequately supported by evidence, not all solutions are correct, limited class forum participation and quality of interaction with peer(s) during the class activities.
Minimal or No Work	D or F	Some or all work products are missing and/or submitted late: work products show minimal work, work products are incomplete and/or do not meet the specifications, write-ups are poorly written, most or all of the solutions are incorrect, minimal evidence of class forum participation and quality of interaction with peer(s) during the class activities.

Written Examinations

There will be a **midterm exam (week 7)** and comprehensive **final exam** (week 15.) The final exam will be given the week prior to the last class session so that the Project 2 Demonstrations can be held during the final class session.

GRADING AND EVALUATION OF STUDENT WORK

Final grade is calculated by using the following weights for your work in this class:

- 5 homework assignments including self-evaluations, 5% of final grade each: 25% total
- Creative Project 1@ 15%
    - Design, fabrication and documentation @ 10%
    - Presentation and Interview @ 5%
- Creative Project 2 @ 20%
    - Written concept with specifications and features @ 5%
    - Design, fabrication and documentation @ 10%
    - Presentation and Interview @ 5%
- Mid-term exam and final exam @ 20% each: 40% total

There is a 5% penalty for each unexcused absence (see policy on **Attendance** below).

COURSE POLICIES REGARDING STUDENT BEHAVIOR

Attendance

Attendance is taken every class. You are responsible for attending all classes and expected to abide by the University Policy on Attendance (as stated in the ***UNH Student Rights, Rules, and Responsibilities***).

If you miss a class, you have the responsibility to:

- Send an email to the Instructor about the circumstances for missing the class within a week of the absence.
- Check the course site and class forum and contact peers to find out what you missed.
- Make up the absence by writing a 300 word description of what you have missed and by completing and documenting the in class activity. Post the description and activity document to your online portfolio within a week of the absence.

Except for absences due to serious medical reasons or circumstances beyond your control, no more than two such makeups will be accepted. Each additional absence will lead to a reduction of 5 points from the final grade.

Late submissions and make-up exams

Policy for late submissions and make-up exams is very strict and applies only in exceptional cases of student illness, accident, or emergencies that are properly documented. A late submission or make-up exam may be granted ONLY IF:

- You send an email to the Instructor prior to the deadline AND
- You explain and provide evidence for the circumstances that have prevented you from meeting the class requirement.

Failing to comply with these rules results in no credit for the late submission or missed exam.

Student use of computing devices

In-class use of any computing device is not allowed unless needed for lab activities and with instructor's permission. Use of computing devices for non-class activities is not allowed. You will be asked to leave the class if you fail to comply with these rules. Students with a learning disability that requires the use of a computing device must provide evidence from the Disabilities Services office.

STATEMENT ON ACADEMIC HONESTY

No collaboration is allowed while taking the exams. Cheating on an exam is penalized with failing the course.

Assignment submissions should be entirely your work and may not include work done by others. Collaboration during the learning process is encouraged, but does not include preparing and submitting the final artifacts that are uploaded to your portfolio.
Failing to comply with these rules is considered a violation of academic honesty policy.
See http://www.unh.edu/vpsas/handbook/academic-honesty for more information. There are very serious repercussions if you deviate from the academic honesty policy:

- The penalty for the first occurrence of an instance of academic dishonesty and plagiarism is no credit for the assignment in question. The Associate Dean will be immediately notified of the incident.
- The second attempt is penalized with failing the course.

UNH Manchester Resources:

Disability Accommodations

The University is committed to providing students with documented disabilities equal access to all university programs and facilities. If you think you have a disability requiring accommodations, you must register with the Disability Services Office. The Disability Services Coordinator is Jenessa Zurek (603) 641-4170, jenessa.zurek@unh.edu Room #410H.

The Early Alert System (EAS)

The University is invested in the success of its students. If a faculty member is concerned about your academic behaviors and performance they may choose to utilize the University's Early Alert System. Alerts are geared towards informing students who are not making satisfactory progress and/or are exhibiting behaviors that may lead to academic difficulty, such as poor attendance or participation. The purpose of the alert is to provide you with feedback prior to mid-semester in an effort to encourage you to make decisions, and to seek out support that will facilitate in your academic success. All alerts are emailed to your student email account. Alerts are not part of your academic record. The intention of EAS is to inform you of your professor's concerns, and to introduce you to some helpful resources. If you receive an Early Alert, it is strongly recommended that you contact your professor to discuss the alert and to utilize on-campus resources to proactively work toward academic success. If you have questions or concerns you can contact the Office of Student Development & Involvement, 641-4170, unhm.studentdevelopment@unh.edu

Center for Academic Enrichment

The Center for Academic Enrichment (CAE) is an on-campus resource where students have access to tutoring, workshops and other resources to strengthen academic skills. The CAE also helps maximize efficiency and effectiveness in their academic careers by addressing study strategies, time management, goal setting, motivation and organization among other skills. The CAE is located in the Learning Commons and can be reached at 641-4113. To view tutor schedules and make appointments, visit manchester.unh.edu/cae. For same-day appointments, call the CAE directly at 641-4113.

UNHM Security

Campus security officers are on duty during campus business hours. Campus security issues college ID's, coordinates campus parking and issues parking passes. Campus Security also coordinates the WalkSafe Service. This service is a walking escort service provided free of charge to members and visitors of the University community. They are located at the front entrance desk and can be reached for non-emergencies at 641-4101. The on-campus emergency number is 641-4333.

TENTATIVE COURSE SCHEDULE

This is a **tentative** schedule, subject to change depending on the class pace, student learning needs, and/or unforeseen circumstances, such as school closing due to inclement weather. Check the posts on the **class forum** for up-to-date information.

Class	Presentation & Discussion Topic	Activity Topic	Assignment (due before class)
1	Introductions Course/Class Organization What is a system? What is a computer system? Computing System History	Ohm's Law and Power Calculations Set Up and Test LED circuit Intro to Raspberry PI Setup Raspberry Pi System via NOOBS	None
2	What are the System Functional Blocks? How do System Functional Blocks Interact? Characteristics and differences: Main Frame - Mini Computer - Micro Processor Systems	I/O Port Control (Power, Ohms Law, Serial vs. Parallel, etc.) Program Raspberry Pi using Python Control single LED	Reflection & HW1 – posted in myCourses **Outside Activity: Fritzing Tutorials**
3	Evolution of Processors from minicomputers to microprocessors What are differences between microcontrollers and microprocessors?	I/O Ports (Bit Banging, Control Bits, etc.) Program Raspberry Pi using Python Control LED Intensity using PWM	Reflection & HW2 – posted in myCourses
4	Microcontrollers - SOM/SOCs Intro to Memory Systems	Intro for Project 1 – Definition Project 1 Project Progress – Gantt Chart	Reflection & HW3 – posted in myCourses
5	Memory Systems External Storage (Disk Drives, Flash Drives, SSDs, CF/SD Cards), Input Devices (Keyboard, Mouse, etc.)	Project 1 – Progress Presentation RPi Input via Pushbutton Switch Project 1 Work	Reflection & Project 1 progress
6	Memory Mapping Addressing Review prior to Mid-Term Exam	Project 1 – Progress Presentation Project 1 Work	Reflection & Project 1 progress
7	Mid-Term Exam	None	None

Class	Presentation & Discussion Topic	Activity Topic	Assignment (due before class)
8	Intro to Robotics Sensor Types: Light, voltage, current, temperature/heat, vibration, touch, ranging/proximity (ultrasonic light/IR), sound, acceleration, magnetic, motion, pressure, etc.	Project 1 Demonstration	Reflection & Project 1 Documentation Package
9	Intro to Robotics Actuator Types: Continuous motors, stepper motors, servos, piezo effectors, solenoids, relays, etc.	Intro to Arduino Based Systems Arduino Control via Software Accepting input from sensors	Reflection & HW4 – posted in myCourses
10	Engineering Practices Overview: Unmet Need/Problem Statement Developing a General & Detailed System Specification	Project 2 Definition Controlling motors, relays and other high power peripherals.	Reflection & HW5 – posted in myCourses
11	System Design - Robotics	Project 2 “Elevator Pitch”	Reflection & Project 2 “Elevator Pitch” Documentation
12	System Debugging Techniques	Project 2 - Development Time	Reflection & Project 2 Progress Documentation
13	System Documentation	Project 2 - Development Time	Reflection & Project 2 Progress Documentation
14	Future of micro-computer systems (Wearable computing systems, bio embedded systems, MEMs, autonomous vehicles, drones, other developments)	Project 2 - Development Time	Reflection & Project 2 Progress Documentation
15	Final Exam	None	None
16	Project 2 Demo	None	Project 2 Documentation Package