ECE4574: Large-Scale Software Development for Engineering Systems
SYLLABUS

Fall 2023 ♦ CRN 83752/83753 ♦ 3 credits ♦ M W 2:30–3:45 p.m. ♦ 3 credits ♦ Whittemore 349

Instructor

Dr. Creed Jones Phone: 540-231-9850 Office: 462 Whittemore Hall
E-mail: crjones4@vt.edu (Please, put "4574" in the subject line.)
Office hours: M 1:00 PM – 2:00 PM, T Th 2:30 PM – 4:00 PM, W 10:00 AM – noon
In 462 Whittemore, or via Zoom, ID# 705 806 0713
All course files, lecture videos, assignments and announcements are hosted in Canvas.

Description

Large-scale software implementations of the hierarchy of engineering analysis, design, and decision evaluation. Computer-aided engineering programs with state-of-the-art computer tools and methods. Operator overloading, dynamic polymorphism, graphical user interfaces, generic programming, dynamic link libraries, and multiple threads. Pre: ECE3574. (3H, 3C).

Formal learning objectives

Having successfully completed this course, the student will be able to

- Develop large-scale, event driven programs for engineering systems
- Demonstrate ability to work with frameworks
- Design and implement multi-threaded, runtime modular programs
- Design and implement graphical user interfaces

Prerequisites

ECE3574, Applied Software Design (C- or better)

Reference texts

The following books are recommended but not required. I will be using some material from each but I can't in good conscience require you to purchase them.

- Robert Martin, *Clean Code: A Handbook of Agile Software Craftsmanship*, 1st edition, Pearson, 2008, ISBN-10: 9780132350884, ISBN-13: 978-0132350884
- Ivan Mistrik, *Software Architecture for Big Data and the Cloud*, 1st edition, Morgan Kaufmann, 2017, ISBN-10: 0128054670, ISBN-13: 978-0128054673
- Maurice Herlihy and Nir Shavit, *The Art of Multiprocessor Programming*, 1st edition, Morgan Kaufman, 2012, ISBN-10: 0123973376, ISBN-13: 978-0123973375

Software

We will be using several software development tools and environments this semester. Two of our homework assignments will require you to develop in Qt (as you did in ECE3574). I strongly encourage you to use Qt Creator in the Windows environment, but I will allow you to use another OS if you wish and you are able to find answers to platform-specific questions independently. For our semester project, you will have much freedom to choose your language, environment, framework and development tools.

Course delivery

For nearly all of you, this course will be delivered in person - 2:30 to 3:45 PM on Mondays and Wednesdays in room 349 of Whittemore Hall.

All lectures will be recorded and available for viewing later, but I strongly encourage you to participate in the lectures at the scheduled time! I will keep informal track of your attendance and it may affect your course grade. You are accountable for all material, regardless of any technical issues that may occur in recording and posting videos of the lectures.

Assessment

Homework Assignments

There will be three homework assignments during the course; these are individual assignments! Students may discuss among themselves general approaches to solving homework problems. The final solutions are expected to be the original work of each individual student. Unless I specify otherwise in the assignment, you are welcome to use relevant snippets of code from online sources **as long as you clearly indicate which lines of code you have borrowed and give me the source!** Code from other students or acquaintances may not be used! If you have any questions, please ask me.

All assignments should be submitted in electronic form via Canvas (check the assignment files for more detail). Homework assignments **only** will be accepted up to three days late and will be penalized 10% per day.

Exams

We will have a final exam at the conclusion of the course (on Tuesday, December 13). More information will be provided prior to the exam.

Quizzes

We will have eight quizzes during the course. Each will be fully online, in Canvas, and will consist of around ten questions. You will have twenty minutes to complete the quiz, and it must be taken within the time window assigned (typically four to five hours). No late quizzes will be administered.

Project

A key part of the course is a full-semester project. You will work in teams of three or four to specify, implement, test and demonstrate a full software deliverable for an engineering application. We will use a scrum software methodology to develop this project, and you will have deliverables throughout the semester as shown on the course schedule. You are welcome to choose your own team before August 30; if you have not chosen a team by that date, I will assign you to a team.

Grading

Graded Item	# of Items	Points per Item	Total Points	Percentage	Indiv/Team?
Homework Assignments	3	25	75	18.75%	I
Final Exam	1	100	100	25.00%	I
Quizzes	8	10	80	20.00%	I
Project Topic	1	25	25	6.25%	T
Sprint Reports	4	10	40	10.00%	T
Final Project Presentation	1	30	30	7.50%	T
Final Project Report	1	50	50	12.50%	I
			400	100%	

I use the following mapping from percentage scores to letter grades:

Letter Grade		Range
A	100 %	to 93.0%
A-	< 93.0 %	to 90.0%
B+	< 90.0 %	to 87.0%
B	< 87.0 %	to 83.0%
B-	< 83.0 %	to 80.0%
C+	< 80.0 %	to 77.0%
C	< 77.0 %	to 73.0%
C-	< 73.0 %	to 70.0%
D+	< 70.0 %	to 67.0%
D	< 67.0 %	to 63.0%
D-	< 63.0 %	to 60.0%
F		below 60%

Office hours

I will be having office hours as follows:

M 1:00 PM – 2:00 PM, T Th 2:30 PM – 4:00 PM, W 10:00 AM – noon
In 462 Whittemore, or via Zoom, ID# 705 806 0713

Questions?

You can ask questions:

- During lecture
- On Piazza: You will see Piazza in the navigation bar in Canvas
- By email (please put "4574" in the subject line somewhere to help me sort my email!).
- Drop in on the in-person or Zoom office hours session

Honor code

The Undergraduate Honor Code pledge that each member of the university community agrees to abide by states:

"As a Hokie, I will conduct myself with honor and integrity at all times. I will not lie, cheat, or steal, nor will I accept the actions of those who do."

Students enrolled in this course are responsible for abiding by the Honor Code. A student who has doubts about how the Honor Code applies to any assignment is responsible for obtaining specific guidance from the course instructor before submitting the assignment for evaluation. Ignorance of the rules does not exclude any member of the University community from the requirements and expectations of the Honor Code.

For additional information about the Honor Code, please visit:

https://www.honorsystem.vt.edu/ .

Disabilities

Virginia Tech welcomes students with disabilities into the University's educational programs. The University promotes efforts to provide equal access and a culture of inclusion without altering the essential elements of coursework. If you anticipate or experience academic barriers that may be due to disability, including but not limited to ADHD, chronic or temporary medical conditions, deaf or hard of hearing, learning disability, mental health, or vision impairment, please contact the Services for Students with Disabilities (SSD) office (540-231-3788, ssd@vt.edu, or visit www.ssd.vt.edu). If you have an SSD accommodation letter, please meet with me privately during office hours as early in the semester as possible to deliver your letter and discuss your accommodations. You must give me reasonable notice to implement your accommodations, which is generally 5 business days and 10 business days for final exams.

			ECE4574 FA22 Daily Schedule		
	Module	Lec	Topics	Due	Project
21-Aug	I - SW Development	1	Introduction - SW development methodology		
23-Aug		2	Scrum		
28-Aug		3	Object-oriented design		
30-Aug		4	OO system design and architecture	quiz 1	
4-Sep		*No Class - Labor Day*			
6-Sep	II - Distributed Computing	5	Networks		
11-Sep		6	Frameworks and middleware	quiz 2	Topic Due
13-Sep		7	Middleware, message brokers and MQTT		
18-Sep		8	Web services		Sprint #1
20-Sep		9	Cloud computing	HW1 - quiz 3	
25-Sep		10	Cloud implementation		
27-Sep	III - SW Design	11	UML		
2-Oct		12	Design patterns	quiz 4	
4-Oct			Project Day		
9-Oct		13	Design patterns for engineering calculations	Sprint 1	Sprint #2
11-Oct	IV -SW Architecture	14	Architecting a component; careers	HW2	
16-Oct		15	Architectural issues for engineering systems	quiz 5	
18-Oct		16	Thoughts on large system design		
23-Oct		17	Cloud-based architectures		
25-Oct			Project Day		
30-Oct	V - Events and Threads	18	Event driven programming and messages	Sprint 2	Sprint #3
1-Nov		19	Events, Threads and Java	quiz 6	
6-Nov		20	Multi-threaded programming		
8-Nov		21	Run-time Modular programs	HW3	
13-Nov	VI - Wrapup	22	Developing, testing and debugging code	quiz 7	
15-Nov			Project Day		
20-Nov		*No Class - Thanksgiving Break*			
22-Nov					
27-Nov		23	Advanced Language Features	Sprint 3	
29-Nov			Project presentations	quiz 8	PRESENTATIONS
4-Dec			Project presentations		
6-Dec			Project presentations	Final rpt	
9-Dec	**FINAL EXAM (Tuesday, December 9, 10:05 AM to 12:05 PM)**				