

SFWE 402/502: Software DevSecOps

Course Syllabus



Instructor: Sharon O'Neal

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Office: Engineering Room 255 or via Zoom

Office Hours: TBR (*AZ time zone*)

Appointments can be made outside of normal office hours by contacting the instructor to schedule a time that is mutually convenient

Course Description

This course will allow software engineering students to explore key principles of a *DevSecOps* approach to software development. *Development* (Dev) and *operations* (Ops) is the union of people, process, and technology to continually automate and develop higher quality/more reliable software products faster. *Security* (Sec) is integrated into a typical DevOps pipeline to address potential security issues in code as soon as possible in the software development lifecycle.

As part of this course, students will develop software using continuous integration / continuous deployment (CI/CD) principles in a pipelined environment. Students will also learn how to use DevSecOps practices and a variety of tools that enable CI/CD, provide version control of all software artifacts, automate testing, and provide continuous project monitoring. They will also learn the key attributes of establishing and working in a DevSecOps culture which embraces collaboration, alignment, accountability, and continuous learning/improvement.

This course is accompanied by a required lab that immerses students in a representative software development environment that they will likely encounter in industry. They will be able to use a variety of open-source and commercially available tools to complete assigned labs and develop a team-based semester project that exercises the principles studied throughout the course.

Learning Format:



This course is architected to engage and demonstrate key concepts of the materials covered using collaborative learning strategies. Students will watch pre-recorded lecture materials that have interactive features (i.e. Playposit interactions) integrated into the materials before coming to class.

This course also has an accompanying laboratory component which allows students to utilize several open-source and commercially available software tools such as integrated development environments (IDEs), project planning and tracking tools, (i.e. Trello), CI/CD tools (GitLab, Jenkins, Docker), configuration management tools (Git) and a static code analyzer (SonarCube). These tools will allow students to demonstrate their understanding of the materials covered in the course. Throughout this course, students will form small teams to work on activities and projects that demonstrate the key principles covered in the lectures.

Course Objectives:

During this course, students will:

- 1) Learn what a DevSecOps culture is and how it differs from more traditional software product development and deployment methodologies.
- 2) Learn how/and why inserting security into the software development lifecycle stages early enables the development of more secure code.
- 3) Use DevSecOps processes and techniques to develop software products.
- 4) Use open-source and commercially available tools to create and maintain CI/CD pipelines.
- 5) Work in collaborative teams to develop a software product that solves a real-world challenge or problem utilizing DevSecOps principles and toolchains.
- 6) Use formal configuration management processes to support the DevSecOps software product development activities throughout the software development lifecycle.

Expected Learning Outcomes:

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

- 1) Develop/implement a software product that meets specified requirements in a team setting using DevSecOps processes and tools. *[ABET Student Outcomes 1, 2 and 5]*
- 2) Utilize open-source and commercially available tools to implement DevSecOps processes and create reusable CI/CD pipelines in the development and automated testing of a software product. *[ABET Student Outcome 7]*
- 3) Generate and analyze results of continuous integration automated tests that are part of a CI/CD pipeline. *[ABET Student Outcome 6]*

- 4) Use configuration management tools to implement software configuration management and control processes integral to a DevSecOps environment. *[ABET Student Outcome 1]*
- 5) Describe and demonstrate the ethical and security responsibilities associated with developing and deploying a software product integral to an engineering solution. *[ABET Student Outcomes 4 and 7]*
- 6) Conduct and share the outcome of the semester project using DevSecOps practices with peers and other project stakeholders, similar to what is done in an industry setting. *[ABET Student Outcomes 3 and 6]*
- 7) *Graduate students only* – Analyze and describe the benefits of creating a DevSecOps culture and using DevSecOps processes to develop and deploy software products.

Course Prerequisites:

Advanced standing is required.

ECE 275 is required.

It is also recommended to have completed SFWE 401 prior to taking this course.

Course Format and Teaching Methods:

This course is structured around weekly progress. It will include a combination of lectures, and team activities focused on experiential learning, in-class discussions, and web-based assessments. The expected weekly progress is outlined in the course schedule. At a minimum it is recommended that students keep up with coursework by following the outlined course schedule on D2L. Note the **DUE DATES** on course deliverables are all posted on D2L.

This course also has an accompanying laboratory element where students will be required to use a variety of tools and complete lab assignments that give them practical exposure/experience in employing DevSecOps principles in software development.

Course Communications:

Announcements and important reminders will be regularly posted on D2L. Log in frequently (recommended daily) to check for new announcements, reminders, and information related to the course.

You are encouraged to reach out to your instructor frequently throughout the semester via in-person lectures, email, phone call, text, office hours, or schedule an in-person or Zoom meeting. Every attempt will be made to respond to any questions or concerns that you may have within 24 hours, if possible (often sooner).

Class Attendance / Participation Policy:



The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: <http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>

Participating in this course is vital to the learning process. As such, timely participation in online discussions and/or any team collaboration assignments is absolutely required. Students are expected to attend/watch all lectures and access the course at least twice a week. At a minimum, it is recommended that students keep up with coursework by following the outlined course schedule and notifications that will be posted on D2L. Note: **DUE DATES** for course deliverables will be documented both in the course calendar located on the course D2L Homepage and in the Content section of D2L.

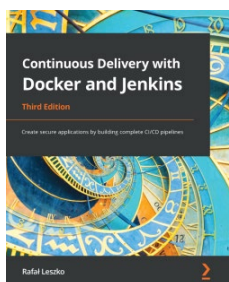
Absences or failure to participate in class may affect a student's final course grade. If you anticipate being absent, are unexpectedly absent, or are unable to participate in class online activities, please contact the instructor as soon as possible. To request a disability-related accommodation to this attendance policy, please contact the Disability Resource Center at (520) 621-3268 or drc-info@email.arizona.edu. If you are experiencing unexpected barriers to your success in your courses, the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of Students Office is in the Robert L. Nugent Building, room 100, or call 520-621-7057.

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, <http://policy.arizona.edu/human-resources/religious-accommodation-policy>.

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: <https://deanofstudents.arizona.edu/absences>

Textbooks:

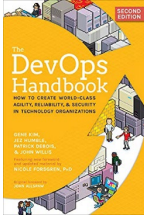
There is one required textbook for this course (*an eBook version may be available online with our UA Library*):



Continuous Delivery with Docker and Jenkins

Author: Rafal Leszko

The following additional book is ***strongly recommended, but optional*** (*an eBook version may be available online with our UA Library*):



The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations

Authors: Gene Kim, Jez Humble, Patrick Debois, and John Willis

Other Supplemental Readings / References: *Additional supplemental materials will be referenced and provided to students via D2L.*

Software Tools Utilized: A variety of tools will be used in this class as part of the DevSecOps toolchain. These tools include open-source Integrated Development Environments (for code development), open-source CI/CD tools such as Jenkins and GitLab, and other tools that will be available through university licenses.

Course Schedule:

The following table provides an outline for the topics and objectives that will be covered during each module for this course. Specific dates will be posted on D2L for any given semester.

Module / Week	Topic	Learning Outcomes
Module 1	Introduction to DevOps	<ul style="list-style-type: none"> Define DevOps principles. Explore benefits of using DevOps. Explain the workflow of a Continuous Integration / Continuous Deployment (CI/CD) pipeline. Compare and contrast DevOps processes and principles to traditional software development processes.
Module 2	Introduction to DevSecOps Tools	<ul style="list-style-type: none"> Explore different types of development tools used to implement a DevSecOps pipeline. <ol style="list-style-type: none"> Using <i>git</i> for configuration management Building and testing software using <i>Gitlab</i>. Using <i>Jenkins</i> to create a CI and CD pipeline. Describe what static code analyzers

		are and how they are used.
Module 3	Securing the DevOps Pipeline	<ul style="list-style-type: none"> • Explain secure SDLC activities. • Integrate security into the DevOps pipeline to achieve DevSecOps. • Describe the DevSecOps Maturity Model.
Module 4	Static vs Dynamic Code Analysis	<ul style="list-style-type: none"> • Describe the difference between static code analysis and dynamic code analysis. • Configure a static code analyzer to analyze code for potential security vulnerabilities • Use a static code analyzer to scan code.
Module 5	Introduction to Docker Containerization	<ul style="list-style-type: none"> • Describe what a Docker is and how it is used. • Download and install Docker. • Create a Docker file. • Run a Docker component.
Module 6	Automated Testing / Continuous Integration	<ul style="list-style-type: none"> • Describe what a continuous integration pipeline is. • Download and install Jenkins. • Create a commit pipeline. • Create an automated test using Jenkins. • Run a unit test using the automated test created.
Module 7	Continuous Delivery	<ul style="list-style-type: none"> • Describe what continuous delivery is. • Make simple modifications to a code base using CI/CD tools and practices. • Configure the commit phase of the CD process.
Module 8	Exercising the DevSecOps Pipeline	<ul style="list-style-type: none"> • Exercise a full CI/CD pipeline to automate the testing and release of the semester project.

D2L Course Management System:



This course uses the University of Arizona's D2L course management system. You are **required** to use D2L with this class and are encouraged to check our D2L class course space daily.

You are also encouraged to have D2L email forwarded to your primary University of Arizona email account. We will use D2L for course assignments, exams, content distribution, and important announcements. The University of Arizona's D2L system is available at: <http://D2L.arizona.edu>.

Course Assignments and Exams:

There will be regular homework assignments on the topics covered in class, with approximately 8 homework assignments and one semester project. There will also be module-based discussion board prompts that each student is required to participate in and will be graded for. There will be one midterm exam and a final exam. All exams will be given as an online, timed exam, administered by a proctor, that will be available during the regularly scheduled exam time. **Note: the instructor will give students ample notice of the format, time, and any resulting stipulations about where and how the exams will be administered.**

Final Examination:

The date and time of the final exam or project, along with links to the Final Exam Regulations can be found at <https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information>, and Final Exam Schedule, <http://www.registrar.arizona.edu/schedules/finals.htm>

The grading distribution for course assignments, class/team participation, semester project, and exams is as follows:

<i>Homework Assignments:</i>	15%
<i>Class / Team Participation:</i>	10%
<i>Lecture Knowledge Checks:</i>	10%
<i>Midterm Exam:</i>	10%
<i>Semester Project (see grade distribution below):</i>	40%
<i>Personal reflection(s) (project related) (~5%)</i>	
<i>Implementation / associated documentation (~25%)</i>	
<i>Project status reviews / presentation of results (~10%)</i>	
 <i>Comprehensive Final Exam:</i>	 15%
 Total	 100%

NOTE: Graduate students will also be required complete an additional term paper that will be factored into the grade for their team project. They will be required to describe the essential elements of setting up a DevSecOps environment and how to create a DevSecOps culture for a student selected industry. They will also describe how this can

impact the overall quality and reliability of software products developed in that environment.

Rubrics will be posted on D2L for all homework and semester project assignments.

Grading Scale and Policies:

The following scale will be used to award the final grades:

Percentage	Letter Grade
90% – 100%	A
80% – 89%	B
70% – 79%	C
60% – 69%	D
<60%	E

Homework is due at the time that it is specified in the course schedule and/or D2L content pages. **Late homework and projects will not be accepted without prior approval by the instructor and will receive 0 points.**

All students will be required to **individually** submit a *Team Evaluation* at the end of the semester for the team-oriented semester project. An individual student's final team project grade will be factored by the average score of all team members' inputs from these evaluations. Every team member is expected to contribute equally to the project. If there are team dynamics that are preventing a collaborative working environment, it is best to inform the instructor ahead of time so that adjustments can be made to facilitate effective teaming and communication amongst the team.

Course Time Zone:

All dates and times mentioned in this course represent Mountain Standard Time (Arizona), which is UTC-7 hours. Arizona does not observe Daylight Savings Time. You can use the following link to get the current local time in Tucson, Arizona: <http://www.timeanddate.com/worldclock/city.html?n=393>

Course Policies:

Make-up exams: A make-up exam may only be given under extraordinary circumstances. The student requesting a make-up exam should contact the instructor well in advance and provide *written* documentation for the reason that he/she will not be able to attend the regularly scheduled exam. It is up to the discretion of the instructor to accept the justification provided by the student.

Requests for incompletes (I) and withdrawal (W) must be made in accordance with University policies which are available at <http://catalog.arizona.edu/2015-16/policies/grade.htm#I> and <http://catalog.arizona.edu/2015-16/policies/grade.htm#W> respectively.

Dispute of Grade Policy:

You can dispute any grade that you receive within two weeks that the grade has been awarded.

Incomplete (I) or Withdrawal (W):

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal> respectively.

Academic Policies and Institutional Resources:

Academic Policies and Procedures:

As a University of Arizona student, you are expected to become familiar with and abide by the university-wide policies and procedures. You can find complete, up-to-date information at: <http://catalog.arizona.edu/policies>

Academic Integrity:

This course has a **zero-tolerance policy** with respect to violations of academic integrity. Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: <http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

Academic Dishonesty occurs whenever any action or attempted action is pursued that creates an unfair academic advantage or disadvantage for student and/or any member or members of the academic community. All forms of academic dishonesty are subject to sanctions under the Code of Academic Integrity. Sanctions include written warning, reduction in grade for work involved, disciplinary probation, loss of credit for work involved, failing grade in the course, suspension, and/or expulsion. Various forms of academic dishonesty include, but are not limited to cheating, fabrication, facilitating academic dishonesty, and/or plagiarism. If you are unclear what constitutes plagiarism, please ask the instructor.

Academic Misconduct is defined as any behaviors not conforming to prevailing standards or rules within the academic community. All forms of academic misconduct are subject to sanctions under the Code of Conduct. Sanctions include restricted access to university property, administrative hold, warning, probation, suspension, and/or expulsion. Various forms of academic misconduct include, but are not limited to disruptive behavior, threatening behavior, and/or the theft or damage of University property. For more specific examples of academic dishonesty, academic misconduct, and how to avoid such behaviors, please visit the following website:

<http://deanofstudents.arizona.edu/tipsforavoidingacademicdishonesty>

The University Libraries have some excellent tips for avoiding plagiarism available at: <http://www.library.arizona.edu/help/tutorials/plagiarism/index.html>.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA email to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student email addresses. This conduct may also constitute copyright infringement.

Classroom Behavior Policy:

To foster a positive learning environment, students and the instructor have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Online Collaboration/Netiquette:

In this course, you can communicate with the instructor and peers through a variety of tools such as discussion forums, Jamboard, email, and other forms of web conferencing. The following guidelines will enable everyone in the course to participate and collaborate in a productive, safe environment.

- Be professional, courteous, and respectful as you would in a physical classroom.
- Online communication lacks the nonverbal cues that provide much of the meaning and nuances in face- to-face conversations. Choose your words carefully, phrase your sentences clearly, and stay on topic.
- It is expected that students may disagree with the research presented or the opinions of their fellow classmates. To disagree is fine but to disparage others' views is unacceptable. All comments should be kept civil and thoughtful. Remember that this course abides by university policies regarding disruptive behavior: <http://policy.arizona.edu/education-and-student-affairs/disruptive-behavior-instructional-setting>
- Compose your messages and posts in a word processing tool and check your spelling and grammar before submitting your post / email.

Threatening Behavior Policy:

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See: <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

UA Nondiscrimination and Anti-harassment Policy:



The University is committed to creating and maintaining an environment free of discrimination, <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Statement of copyrighted materials:

All lecture notes, lectures, study guides and other course materials disseminated by the instructor to the students, whether in class or online, are original materials and reflect intellectual property of the instructor or author of those works (with the exception of other published reference materials – i.e., course textbooks). All readings, study guides, lecture notes and handouts are intended for individual use by students. You may not distribute or reproduce these materials for commercial purposes without the express written consent of the instructor. Students who sell or distribute these materials for any use other than their own are in violation of the University's Intellectual Property Policy (available at <http://ogc.arizona.edu/node/16>). Violations of the instructor's copyright may result in course sanctions and violate the Code of Academic Integrity.

Student Support:

The instructor is available to assist with **content-related** issues. You may, at any time, email the instructor. This course also provides an **Ask the Instructor** discussion forum within the D2L environment. You are encouraged to post content-related questions to this forum at any time, especially for things that will benefit all students. *(It is not recommended that you use this forum for individual questions that are specific to your work or performance in the class.)* This forum will be monitored on a regular basis and the instructor will respond in a timely fashion. It is common for other students to participate in answering questions posted in the **Ask the Instructor** forum. You should feel free to contribute to the solution if you can provide knowledge or guidance related to the question.

The following are guidelines for requesting support:

- **General Course Questions:** Use the **Ask the Instructor** discussion forum for questions regarding course materials or policy.
- **Personal Course Questions:** Email the instructor to discuss grades or personal concern.
- **D2L Support Questions:** Email D2L@email.arizona.edu <mailto:support@eller.arizona.edu>.

Accommodations for Students with Disabilities:

The goal for this class is to enable learning experiences that are as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let the instructor know immediately so that we can discuss options. You are encouraged to contact Disability Resources (520-621-3268) to establish reasonable accommodations. For additional information on Disability Resources and reasonable accommodations, please visit <http://drc.arizona.edu/>.

If you have reasonable accommodations, please plan to meet with the instructor by appointment to discuss accommodations and how course requirements and activities may impact your ability to fully participate.

Students needing special accommodations or special services should contact the Disability Resources Center, 1224 East Lowell Street, Tucson AZ 85721, (520)621-3268, FAX (520)621-9423, email: drc-info@email.arizona.edu, <http://drc.arizona.edu/>. You must register and request that the center or DRC send the instructor official notification of your needs as soon as possible.

Please contact the instructor to discuss accommodations and how this course's requirements may impact your ability to fully participate. The need for accommodations must be documented by the Disability Resources Center.

Library Support:

The University of Arizona Libraries provides the research tools you need at any time. For an abbreviated list of resources directly related to a specific course, select the **Library Tools** link (located in the Tools drop down on the left of the screen within the Course Navigation bar).

Course Grievance Policy:

In case of grievances with a course component or grading, students are encouraged to first try and resolve the issue with the instructors. If you feel the issue is not resolved satisfactorily, please send an email to misonline@eller.arizona.edu.

Course Surveys and Evaluations:

Near the end of each semester / session, students will receive an invitation via email to complete an online course survey associated with this course administered by the Office of Instruction and Assessment thru the UA Student Course Survey (SCS) tool.

Your feedback is very important to the instructor as shown in the diagram below:

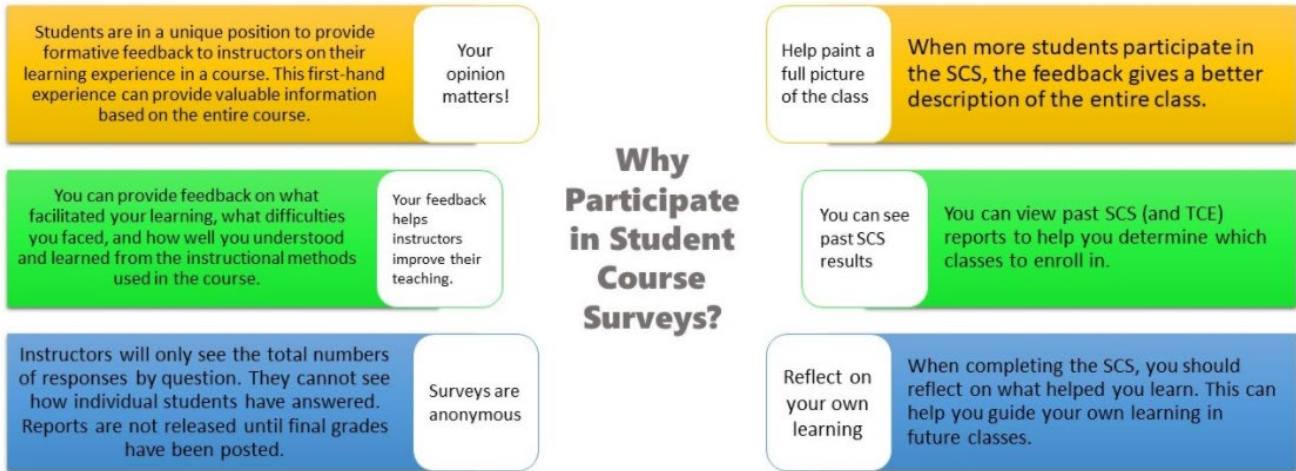


Diagram Source: [whycscropped.jpg \(1280x491\)](http://whycscropped.jpg) (arizona.edu)

Your feedback is extremely valuable and will be used to make changes and enhancements to the course to better meet student needs in the future.

Additional Resources for Students (recommended links):

- Student Assistance and Advocacy information is available at:
 - <http://deanofstudents.arizona.edu/student-assistance/students/student-assistance>
- **Confidentiality of Student Records:** <http://www.registrar.arizona.edu/ferpa/default.htm>

Subject to Change Statement:

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.