Course Syllabus

Jump to Today

Please note that the specifics of this Course Syllabus are subject to change. Instructors will notify students of any changes and students will be responsible for abiding them. Even if you print this syllabus, please check the online version often.

Description

IST 412: The Engineering of Complex Software Systems (3 credits per semester/maximum of 3) - Introduction to the engineering of complex software systems including software system specification, design and implementation, integration and test, and evolution.

This course presents the fundamental concepts of the engineering of complex software systems, including iterative and agile development strategies. The course gives students insight into the full software development cycle, including design, implementation, test and quality assurance, deployment, maintenance, and project estimation and management. IST 412 is an elective course for the Baccalaureate degree program in Information Sciences and Technology. Students completing the Systems Development Option may take this course to fulfill option requirements. Upon completion of this course, students will have a broad understanding of the fundamental concepts of complex system software engineering and be able to apply these concepts to managing and developing a complex software project over the full software development cycle.

Prerequisites

- IST 311 with a C or better

Objectives

At the conclusion of this course, students will be able to:

- Understand and explain the critical issues in complex software development.
- Understand, explain, and use software development lifecycle models including waterfall, spiral, and agile methods.
- Elicit software requirements from stakeholders; run a basic user study; specify, validate, and prioritize functional, non-functional, and user interaction requirements.
- Translate software requirements into an object-oriented system design
- Understand and use test-driven development, including JUnit.
- Understand and use basic project management techniques to control the software development process.
- Understand and use basic software estimation techniques.

- Understand and use basic project risk management techniques.
- Understand and use system architecture and design patterns.
- Understand and use professional software development practices such as refactoring, software coding styles, design-by-contract, and others.
- Understand and use modern software deployment strategies.

Instructor

- Urja Vora (Office Hours: Every Friday in the time-slot of 1:30pm - 2:30pm at my office, E397D in Westgate Building or by appointment)

LA / TA

- Yue You (yxy340@psu.edu)
- Sarah Ricupero (**skr5576@psu.edu (mailto:skr5576@psu.edu)**)

Materials

You are responsible for all the readings, even if material is not covered explicitly in a lesson. Taking notes on the material you are reading and reflecting on both the reading and these notes will help you to understand better the issues, concepts, and techniques that are being presented.

We will be using primarily electronic texts.

Course Tools

The course will make use of several different tools including an Integrated Development Environment (IDE), software modeling and design applications, and other online resources.

Specific instructions for specific tools will be posted to the Canvas Unit where related activities and deliverables appear.

Java Development

You will be using an Integrated Development Environment, preferably Intellij IDEA, for all project development work.

To install IntelliJ IDEA use portal of Jet Brains. The installation is described at **https://www.jetbrains.com/idea/download/ (https://www.jetbrains.com/idea/download/)** for each platform and includes a bundled java version. While the functionality included in the Community Edition is sufficient to some extent, I recommend that you register an account and claim the free academic license for the Ultimate version. Jet Brains has a lot of excellent, professional-quality tools that are popular among professional developers.

With any source code submission make sure to include a README.txt file detailing any usernames and passwords required to log in to the app. You generally should not use external libraries but if you do make sure they are included as part of the project. If the project does not build and run you will receive a zero for the assignment.

Conceptual Design

You will be using the Unified Modeling Language (UML) for part of your conceptual design. There are several software tools available for constructing UML models.

You may choose to use the MS Visio application, which is available through **vLabs (https://www.up.ist.psu.edu/vlabs)** . The course lessons generally use MS Visio for UML demonstrations.

You can also install MS Visio on your own computer through the **Penn State Dreamspark program. (https://www.up.ist.psu.edu/dreamspark/access.php)**

An open source and free tool you can use to create your UML diagrams is **ArgoUML (https://argouml-tigris-org.github.io/tigris/argouml/)** .

Finally, you may also choose to use an online tool for creating your UML models. One that has been tested and is recommended for the course is **draw.io (https://www.draw.io/)** .

You can use any UML modeling tool you like as long as it will produce a figure or file that can be inserted into your MS Word document.

Assignments & Grading

The course will follow an active, problem-based approach to learning. There is a longer-term group project that will provide the opportunity to gain practice with new concepts and skills, and develop and demonstrate a solid understanding of the course material.

- **Course Project:** The main course project will consist of design and development of a complex software system. Participation in the group project involves both individual efforts and group collaboration. You will work on the project exercises in groups of four to six. The instructor will assign group membership during the first few weeks of the course. The purpose of this project is to give you hands-on, in-depth experience with a wide range of techniques, methods, and tools to help manage complex software development projects.
  - **Group Project Performance & Grading**
    - Project deliverables submitted and marked will be assigned a single grade. However, your individual grade for the group project components will reflect the results of group peer evaluations that will be performed over the course of the semester.
    - In extreme cases, students that do not contribute to the group project will be asked to do the work on their own, or with other non-contributors.
  - **Assignment Grading Criteria**

- Correctness (e.g. diagrams use correct syntax; programs compile & run)
- Completeness (e.g. models reflect the domain problem; programs implement requirements)
- Clarity (e.g. diagrams and programs are formatted professionally; both are annotated)

Course Grading Breakdown of Graded Assignments

Module	Points
Module 01	40
Module 02	60
Module 03	80
Module 04	40
Module 05	50
TOTAL	270

Course Grading Scale

The following are minimum cutoffs for each grade:

- 93.00% = A
- 90.00% = A-
- 87.00% = B+
- 83.00% = B
- 80.00% = B-
- 77.00% = C+
- 70.00% = C
- 60.00% = D
- less than 60.00% = F

Course Policies and Expectations

- **Late Submissions** - All work must be completed and turned in before the due date and time.
  - Assignments submitted late will be marked 5% less for every 24 hours.
  - There are no exceptions to the late submission policy.
- Logging into Canvas - Students are expected to login regularly to check for course updates, announcements, emails, discussions, etc.
  - Updates will occur regularly so please make sure to keep up with announcements and updates to the course site.
- Emailing through Canvas - Students are expected to use Canvas for all course email communication.
- Attending virtual meetings - Students are expected to use specified virtual meeting tool(s) for collaboration, meetings, presentations, etc., as needed.

Academic Integrity

Penn State and the College of Information Sciences and Technology are committed to maintaining **Penn State's policy on Academic Integrity (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/47-00-48-00-and-49-00-grades/#49-20)** in this and all other courses. We take academic integrity matters seriously and expect you to become a partner to the University/College standards of academic excellence.

For more information, please review these policies and procedures:

- **Penn State World Campus Academic Integrity Resources (https://student.worldcampus.psu.edu/a-z-index/academic-integrity)**
- **College of IST Academic Integrity Resources (https://ist.psu.edu/current/undergraduate/advising/integrity)**

While utilizing additional sources outside of this class is encouraged for gaining a better understanding of course concepts, seeking explicit answers for graded assignments from outside sources (e.g. Course Hero, Chegg, tutoring services like tutor.com, etc.) is considered CHEATING and will not be tolerated. Sanctions range from failure of the assignment or course to dismissal from the University. Additionally, sharing course content without permission is a violation of copyright and may result in university sanctions and/or legal ramifications. Contact your instructor with questions related to this topic.

University Policies

Review current information regarding various Penn State policies (such as copyright, counseling, psychological services, disability and military accommodations, discrimination, harassment, emergencies, trade names, etc.) on the **University Policies (https://docs.google.com/document/d/1FIQdII2qw3SJOIgQWTWRByCxSbsnY6DcZA0JHzL4yBk/pub)** page.

Penn State takes great pride to foster a diverse and inclusive environment for students, faculty, and staff. Acts of intolerance, discrimination, or harassment due to age, ancestry, color, disability, gender, gender identity, national origin, race, religious belief, sexual orientation, or veteran status are not tolerated and can be reported through Educational Equity via the **Report Bias webpage (http://equity.psu.edu/reportbias/)** (http://equity.psu.edu/reportbias/).

Resources

Find extensive information and links to many Penn State and IST resources (including the Penn State libraries, video conferencing tools, technology and software, writing and research help, and much more) on the **Resources (https://docs.google.com/document/d/1Zsu5Lgaic3kLLiM3co5mxWU5B7lOfu15sppAQvsym6E/pub)** page.

Technical Requirements

Standard World Campus computer technical specifications are assumed for this course. **Please test your computer (https://courses.worldcampus.psu.edu/public/diagnostics/canvas.shtml)** for requirements. In addition, a webcam and a headset with a microphone are REQUIRED for the course. These may be used for virtual meetings, virtual office hours, interactions with classmates and your instructor, and group presentations - which are all conducted with virtual meeting tools. No special software is required.

Schedule

The following schedule outlines the topics covered in this course, along with the associated time frames, readings, activities, and assignments. All due dates reflect Eastern Time (ET). Specifying the time zone ensures that all students have the same deadlines, regardless of where they live.

Course Summary:

Date	Details	Due
Tue Jan 9, 2024	**Class Assignment (08Jan2024)** (https://psu.instructure.com/courses/2312044/assignments/15803100)	due by 11:59pm
Sat Jan 13, 2024	**Class Assignment (12Jan2024)** (https://psu.instructure.com/courses/2312044/assignments/15803119)	due by 11:59pm
Sun Jan 14, 2024	**M01-L02 Requirements Discovery-Elicitation-Stakeholder Analysis** (https://psu.instructure.com/courses/2312044/assignments/15803103)	due by 11:59pm
	Academic Integrity Acknowledgment for Students (https://psu.instructure.com/courses/2312044/assignments/15830533)	due by 11:59pm
	M01-L00 Course Project Brief (https://psu.instructure.com/courses/2312044/assignments/15803133)	due by 11:59pm
	M01-L01 Complex Systems Complex Domains (https://psu.instructure.com/courses/2312044/assignments/15803134)	due by 11:59pm
Wed Jan 17, 2024	**Class Assignment (28Aug2023)** (https://psu.instructure.com/courses/2312044/assignments/15803122)	due by 11:59pm

Date	Details	Due
Fri Jan 19, 2024	Class Assignment (20Jan2023) I (https://psu.instructure.com/courses/2312044/assignments/15803118)	due by 11:59pm
Sun Jan 21, 2024	M01-A01 Stakeholder Analysis (https://psu.instructure.com/courses/2312044/assignments/15803130)	due by 11:59pm
	M01-L03 - Lifecycle Agile Scrum Spiral Design (https://psu.instructure.com/courses/2312044/assignments/15803135)	due by 11:59pm
Tue Jan 23, 2024	Class Assignment (22Jan2024) (https://psu.instructure.com/courses/2312044/assignments/15803107)	due by 11:59pm
Fri Jan 26, 2024	Class Assignment (06Sep2023) II (https://psu.instructure.com/courses/2312044/assignments/15803108)	due by 11:59pm
Sat Jan 27, 2024	Class Assignment (27Jan2023) II (https://psu.instructure.com/courses/2312044/assignments/15803120)	due by 11:59pm
Sun Jan 28, 2024	M01-L04 Requirements Specification Validation Prioritization (https://psu.instructure.com/courses/2312044/assignments/15803104)	due by 11:59pm
	Class Assignment (08Sep2023) (https://psu.instructure.com/courses/2312044/assignments/15803109)	due by 11:59pm
	M01-A02 User Study Design (https://psu.instructure.com/courses/2312044/assignments/15803131)	due by 11:59pm
Mon Jan 29, 2024	Class Assignment (27Jan2023) III (https://psu.instructure.com/courses/2312044/assignments/15803121)	due by 11:59pm
Tue Jan 30, 2024	Class Assignment (30Jan2023) II (https://psu.instructure.com/courses/2312044/assignments/15803124)	due by 11:59pm
	Class Assignment (29Jan2024)	due by 11:59pm

Date	Details	Due
	(https://psu.instructure.com/courses/2312044/assignments/15803111)	
Sun Feb 4, 2024	M01-A03 User Study & Requirements Specification (https://psu.instructure.com/courses/2312044/assignments/15803132)	due by 11:59pm
	M02-A00 Project Use Cases (https://psu.instructure.com/courses/2312044/assignments/15803136)	due by 11:59pm
	M02-L01: Modularized Systems (https://psu.instructure.com/courses/2312044/assignments/15803140)	due by 11:59pm
Mon Feb 5, 2024	Class Assignment (02Feb2024) (https://psu.instructure.com/courses/2312044/assignments/15803117)	due by 11:59pm
Fri Feb 9, 2024	Project Presentation: Requirements Specifications (https://psu.instructure.com/courses/2312044/assignments/15803193)	due by 11am
Sun Feb 11, 2024	Intermediate: Project Module and API Design (https://psu.instructure.com/courses/2312044/assignments/15803129)	due by 11:59pm
	M02-A01 Project Module and API Design (https://psu.instructure.com/courses/2312044/assignments/15803137)	due by 11:59pm
Sun Feb 18, 2024	M02-L02: Software Project Estimation (https://psu.instructure.com/courses/2312044/assignments/15803105)	due by 11:59pm
	M02-A02 Project Function Point Analysis and Estimate (https://psu.instructure.com/courses/2312044/assignments/15803138)	due by 11:59pm
Sun Feb 25, 2024	M02-A03 System Component API Stubs and Automated System Tests (https://psu.instructure.com/courses/2312044/assignments/15803139)	due by 11:59pm
	M02-L03: Software Quality and Test-Driven Development	due by 11:59pm

Date	Details	Due
	(https://psu.instructure.com/courses/2312044/assignments/15803141)	
Sun Mar 3, 2024	M03-L01 Architecture and Design Patterns (https://psu.instructure.com/courses/2312044/assignments/15803106)	due by 11:59pm
	End-of-Two-Months Feedback (https://psu.instructure.com/courses/2312044/assignments/15803097)	due by 11:59pm
	INSTRUCTOR MUST UPDATE: M03 Peer Evaluation (https://psu.instructure.com/courses/2312044/assignments/15803126)	due by 11:59pm
	M03-A01 Project Detailed Design (https://psu.instructure.com/courses/2312044/assignments/15803148)	due by 11:59pm
	M03-A02 Design Pattern Selection (https://psu.instructure.com/courses/2312044/assignments/15803151)	due by 11:59pm
Mon Mar 4, 2024	Class Assignment (16Oct2023) (https://psu.instructure.com/courses/2312044/assignments/15803115)	due by 11:59pm
Sun Mar 10, 2024	M03 Peer Evaluation (https://psu.instructure.com/courses/2312044/assignments/15803142)	due by 11:59pm
Fri Mar 15, 2024	Software Quality and TDD Quiz (https://psu.instructure.com/courses/2312044/assignments/15803099)	due by 11:59pm
	Project Presentation: Design Models and Descriptions (https://psu.instructure.com/courses/2312044/assignments/15803192)	due by 11:59pm
Sun Mar 24, 2024	M03-A03 Gantt and PERT Charts (https://psu.instructure.com/courses/2312044/assignments/15803153)	due by 11:59pm
	M03-L02 Software Project Management: Planning and Scheduling (https://psu.instructure.com/courses/2312044/assignments/15803163)	due by 11:59pm

Date	Details	Due
Thu Mar 28, 2024	Class Assignment (08Nov2023) (https://psu.instructure.com/courses/2312044/assignments/15803102)	due by 11:59pm
	Class Assignment (16Nov2022) (https://psu.instructure.com/courses/2312044/assignments/15803114)	due by 11:59pm
Sat Mar 30, 2024	Class Assignment (18Nov2022) (https://psu.instructure.com/courses/2312044/assignments/15803116)	due by 11:59pm
Fri Apr 5, 2024	Class Assignment (7Apr2023) (https://psu.instructure.com/courses/2312044/assignments/15803125)	due by 11am
Sun Apr 7, 2024	M04-L01 Clean Code Refactoring Technical Debt (https://psu.instructure.com/courses/2312044/assignments/15803174)	due by 11:59pm
	M03-A04 Implemented Design Patterns (https://psu.instructure.com/courses/2312044/assignments/15803156)	due by 11:59pm
	M03-A05 One Implemented Use Case (https://psu.instructure.com/courses/2312044/assignments/15803159)	due by 11:59pm
Tue Apr 9, 2024	Class Assignment (10Apr2023) (https://psu.instructure.com/courses/2312044/assignments/15803110)	due by 11:59pm
Thu Apr 11, 2024	Class Assignment (12Apr2023) I (https://psu.instructure.com/courses/2312044/assignments/15803112)	due by 11:59pm
Fri Apr 12, 2024	Class Assignment (14Apr2023) (https://psu.instructure.com/courses/2312044/assignments/15803113)	due by 11am
Sun Apr 14, 2024	M05-A01 Project Maven Build (https://psu.instructure.com/courses/2312044/assignments/15803188)	due by 11:59pm
	M04-A01 Code Review and Refactoring Plan (https://psu.instructure.com/courses/2312044/assignments/15803165)	due by 11:59pm

Date	Details	Due
	M04-A02 Requirements and Design Walkthrough (https://psu.instructure.com/courses/2312044/assignments/15803168)	due by 11:59pm
	M04-L02 Requirements and Design Inspections and Reflective Practice (https://psu.instructure.com/courses/2312044/assignments/15803177)	due by 11:59pm
Wed Apr 17, 2024	Class Assignment (29Nov2023) (https://psu.instructure.com/courses/2312044/assignments/15803123)	due by 11:59pm
	INSTRUCTOR MUST UPDATE: M05 Peer Evaluation Copy (https://psu.instructure.com/courses/2312044/assignments/15803127)	due by 11:59pm
	M05 Peer Evaluation (https://psu.instructure.com/courses/2312044/assignments/15803179)	due by 11:59pm
Fri Apr 19, 2024	Seminar Presentation (https://psu.instructure.com/courses/2312044/assignments/15803195)	due by 11:59pm
Sun Apr 21, 2024	M04-A03 Two Implemented Use Cases Integrated with First Usecase + Login/Authentication Implementation with Clean, Refactored Code (https://psu.instructure.com/courses/2312044/assignments/15803171)	due by 11:59pm
	M05-L01 Deploying Software Components (https://psu.instructure.com/courses/2312044/assignments/15803190)	due by 11:59pm
	M05-L02 Software Demonstrations (https://psu.instructure.com/courses/2312044/assignments/15803191)	due by 11:59pm
Fri Apr 26, 2024	Project Presentation: Test Cases (https://psu.instructure.com/courses/2312044/assignments/15803194)	due by 11:59pm
Mon Apr 29, 2024	M05-A01 Final Project Implementation	due by 11:59pm

Date	Details	Due
	(https://psu.instructure.com/courses/2312044/assignments/15803186)	
	Design Patterns Quiz (https://psu.instructure.com/courses/2312044/assignments/15803096)	
	Installing IntelliJ (https://psu.instructure.com/courses/2312044/assignments/15803128)	
	M05-A02 Final Project Demonstration (https://psu.instructure.com/courses/2312044/assignments/15803189)	
	Quiz25Sep23 (https://psu.instructure.com/courses/2312044/assignments/15803101)	