MET CS 633 O1

Software Quality, Testing and Security Management

Spring 1, 2025 - SYLLABUS

Course Description:

Theory and practice of quality assurance, testing and security for each step of the software development cycle. Verification vs. validation. Test case design techniques, test coverage criteria, security development and verification practices, and tools for static and dynamic analysis. Standards. Test-driven development. QA for maintenance and legacy applications. From a project management knowledge perspective, this course covers the methods, tools and techniques associated with the following processes -- Plan Quality, Perform Quality Assurance, and Perform Quality Control. 4 credit

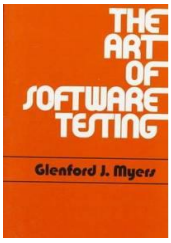
Course Objectives:

Upon successful completion of this course, you will be prepared to:

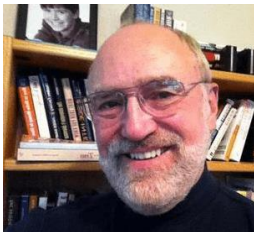
- Manage a Software Quality Assurance function covering all phases of a global product development life cycle
- Play an effective role of a Software Engineering Manager in a context of IEEE CSDP (Certified Software Development Practitioner) with a specific emphasis on organizational policies as guiding principles.
- Solicit, define and scope requirements as part of the product backlog grooming.
- Assess common security threats and establish corresponding deterrents.
- Select an estimation method that is appropriate for a specific phase. Oversee adoption of a consistent methodology to narrow the Cone of Uncertainty.
- Play a role in a peer review verification, request and provide constructive and concise comments.
- Support the Scrum delivery framework and become aware of several agile certification paths.
- Evaluate software development tools (approved, allowed, restricted), while following the Magic Quadrant technique.
- Articulate a strategy for system and unit test leading to continuous integration and delivery.
- Structure a project asset library aiming at single-click navigation to a requested artifact.
- Provide leadership to a process program that is mapped into PMI and/or SEI CMMI as an improvement model.

Course Resources:

There are several books referenced throughout the course. These books are optional. You do not need to purchase them. Most of the course concepts are expounded through the class notes comprised of several hundred pages. You will be also required to search through various on-line resources.

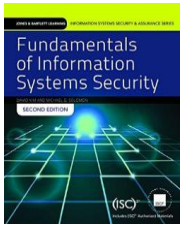


Glenford Myers is an American computer scientist, entrepreneur, and author. He founded two successful high-tech companies, authored eight textbooks in the computer sciences, and made an important contributions in microprocessor architecture. The orange book cover on the left - corresponds to the original 1978 edition. Link below accesses the latest edition. Download the 3rd edition eBook from the BU Library.

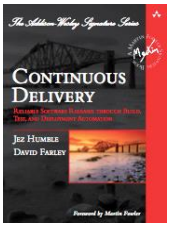


Steve McConnell is a well-known industry practitioner, Chief Software Engineer at Construx. Software Development magazine named Steve one of the three most influential people in software industry along with Bill Gates and Linus Torvalds. Steve's book on estimation is available in electronic form and could be delivered instantly.

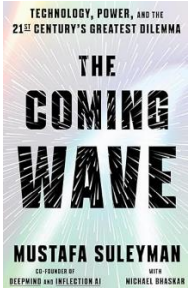
David Platt teaches User Experience Engineering at Harvard University Extension School and at companies all over the world. He's the author of 12 programming books, including Why Software Sucks (Addison-Wesley, 2006) and Introducing Microsoft .NET (Microsoft Press, 2003). Microsoft named him a Software Legend in 2002.



"Fundamentals of Information Systems Security", David Kim and Michael Solomon, ISBN-13: 978-1284031621. David Kim is the president of Security Evolution Inc (SEI) provides consulting services around the world.



Jez Humble is a principle consultant at Thoughtworks helping organizations deliver high quality software fast and reliably. This groundbreaking book sets out the principles and technical practices enabling rapid, incremental software release. It is a part of the sea change that brought about a culture of continuous delivery.



Mustafa Suleyman is an artificial intelligence entrepreneur. He is currently the EVP of Microsoft AI division, including Copilot, Bing and Edge. He is the co-founder and former head of DeepMind, an AI company acquired by Google. After leaving DeepMind in 2022, he co-founded Inflection AI, a machine learning and generative AI company. Suleyman was named by Time among the most influential people in artificial intelligence in 2023 and in 2024.

Instructor:

Alex Elentukh
Email: elentukh@bu.edu
Tel: (617) 335-6135

Office Hours & Questions: You will have ample opportunity for questions during live sessions or through email. In addition, I will be available to stay late after class. Finally, I am available for ad-hoc conference call discussions upon request. Do not be surprised to receive a call from me, as I am always interested to learn what you are thinking.

My name is Alex Elentukh, and I will be your instructor for the course. To give you a little background about myself, during my 25 years professional career I taught various software-engineering courses at Boston and Northeastern University and authored numerous papers on quality assurance and software reliability. Most recently taught the MET CS633, CS473 and CS673. At EMC, as an Agile coach, I introduced the backlog grooming to improve collaboration between product owners and engineering. As an enterprise architect at Fidelity, I managed the regression-intensive verification used by multiple scrums, cutting the field complaint rate by fifty percent. I also held the positions of QA director at two successful start-ups, Jupiter and Reveal.

Here is the list of several recent papers published with students' collaboration,

- A team of students traveled to Jakarta to present the implementation of one of term projects at CITSM 2018 conference.
- The paper "Improving Teaching and Learning Effectiveness of Computer Science Courses" was presented at CSECS 2019 conference in Germany.
- The paper "Empirical Study from Final Exams to Demystify the Notion of An Average Software Engineer" received an award for the best presentation at ICESE 2023 in Athens.
- The paper "People Make Mistakes – A Survey of Common Causes of Software Defects" was presented at CSECS 2023.
- During CSECS 2024 the paper "Building a Chatbot to Adopt an Effective Learning Strategy" was presented in Sofia.

Most importantly, I am here to help - if you have any questions or need anything at all during the course, please do not hesitate reaching out.

Course Grading Information:

Grade Weighting & Grade Conversion:

The following table summarizes the four kinds of graded items along with their weight. These are four avenues for you to learn. These are four angles to illuminate the course content.

DELIVERABLE	WEIGHT
Quizzes	20%
Assignments	20%
Term Project	30%
Final Exam	30%

The following table details the translation of a numerical grade into a letter grade.

LETTER GRADE	NUMERICAL GRADE
A	>=95 - <=100
A-	>=90 - <95
B+	>=85 - <90
B	>=80 - <85
B-	>=77 - <80
C+	>=74 - <77
C	>=70 - <74
C-	>=65 - <70

Class Engagement:

Class Discussions: A large part of the overall learning experience is gained through discussions and participation amongst the class. The intent here is to encourage a meaningful participation during live sessions and through the discussion board. Each module is covered by two live sessions. First session covers new material. Second session details each assignment and every quiz - to reiterate new material. During a live session, when a quiz is introduced, you will be prompted to respond. At this point, it does not matter whether the answer is right or wrong, although your participation is important. Students are also encouraged to post comments toward several predefined topics at blackboard's class discussions. All posts, along with an abundance of references, are propagated from previous classes to supplement and to grow the body of knowledge for the whole course.

Peer Reviews: All in-process artifacts (e.g. requirements and test cases), as well as the final deliverable (code) - are peer reviewed. Providing constructive and concise comments is a part of the defined process elaborated in the class. Each student actively participates in peer reviews, submits a predefined deliverable and incorporates changes suggested by peers.

Attendance Policy: Attendance is **optional** but encouraged at Live Classroom sessions. You are responsible for all material discussed in class. To improve interaction amongst the class, you are recommended to enable the camera.

Quizzes

Quizzes in this course are an important method to learn new material. Quizzes complement other methods, assignments, discussions, and term project. Quizzes offer a slightly different path and angle toward the same course concepts. Do not underestimate the power of repetition, as you have multiple attempts to take a quiz and a mean score among all attempts goes toward the grade. Yes&No answers bear no judgment. They are impersonal, which is quite different from assignments, where, in many cases, there is no right or wrong answer.

Assignments

Assignments encourage you to extrapolate from the course material and from your own experiences. Researching a topic and responding questions about grey-area-scenarios will force you to think independently. You should time box your research. These assignments illustrate key points. Exploring too many details is bound to deviate from the focus on a big picture.

Term Project

The purpose of the term project is to follow key steps of software product development. It is a chance to pilot and adopt the best practices covered in the course. In today's environment, collaboration is imperative as it drives the overall effectiveness of a software project. After participating in a term project in a controlled environment, you will be able to apply your skills later to a real situation. You are encouraged to benefit from dozens of projects completed at previous classes. Here is the testimony from a student. I recently completed my Master's degree, and have very fond memories of CS633 - my final class before graduation. As a Principal Software Developer at Liberty Mutual - CS633 covers a plethora of topics relevant to my everyday work, providing me with the best-practice tools I need to succeed. Most specifically, the term project, which very accurately simulates a real-life product life-cycle, was exceptionally rewarding. My team and I were able to build a cloud-based, production-ready application, all while fine-tuning and reinforcing the learning that coincided in the classroom sessions. I most highly recommend this class, among the many others here at BU Master of Science in Computer Information Systems!

Final Exam:

You will have three hours to complete the final exam; there should be plenty of time. The final exam will be open-book, open-notes.

(1) **Short answers:** A combination of multiple choices/answers based on quizzes from course modules.

(2) **Essays:** Short essays/responses which will focus on in-depth lecture discussions and on practical knowledge gained throughout Term Project.

You should expect no surprises on your final exam, as it includes no questions that are not covered during the class.

The last question on your final exam is as follows. *As one of the goals of this course is for you to adopt at your day job - some techniques we covered in the class. Which of the best practices from the course do you plan to adopt?*

Here is one of the responses. While there are many elements of this course that I expect to directly apply to my current job, there are two that stand out more than others. Those two are peer reviews and estimation techniques. My company performs peer reviews for functional specifications as well as technical designs, but we do not conduct code reviews. I think, if we were to implement a static analysis of team code, we would detect potential defects sooner. We would also have a chance to suggest more uniform coding best practices so there would be a greater consistency of code among developers. It would also aid in cross-training, in which my team is severely lacking.

Here is another response. The tool evaluation matrix and magic quadrant will be extremely valuable to me in the future as I find that the organization I work for tends to acquire a multitude of tools. Their usage needs to be standardized to become more efficient. Thank you for the toolkit you have provided throughout the semester!

Academic Integrity:

Academic conduct in general, and MET College rule in particular, require that all references and uses of the work of others must be clearly cited. All instances of plagiarism must be reported to the College for action. For the full text of the academic conduct code, please check http://www.bu.edu/met/for-students/met-policies-procedures-resources/academic-conduct-code/

Course Map and Schedule:

- The following schedule is tentative, and is a subject to change according to the progress of the class and the feedback from students.
- The course consists of six modules with two live session per module.
- (*) designates an optional activity, which will not contribute to your final grade.
- Refer to the detailed *Description of Term Project*. Regular project submissions correspond to the lecture material for that module. For example, the first module covers requirements. So, the deliverable for the second module is to write project requirements in *Pivotal*. It is advisable to start coding as early as possible. A project team is expected to meet at least weekly. There is a demo expected at a weekly meeting of a project team of a partially-working system with coded parts and prototypes - as early as second module. The last module is dedicated to testing and bug fixing, hence coding should be pretty much done by the module that is previous to last.

Module	Module Topic	Reading References	Discussion Topics Post Comments (*)	Individual Assignments	Quizzes	Term Project	Zoom Session
Module 1 ***DELIVERABLES DUE DATE: Tuesday, Jan 21, 6:00 AM EST***	Definition and scope of Quality Assurance Globalization Trends Requirements Engineering Engineering Management	Module 1 Course Notes Karl Wiegers Pivotal tutorial GitHub tutorial	Introduce yourself and welcome other students Compare Company Policies of Google and GM Document a Policy for your Project	• A1 "Provide alternative definitions" • A2 " Traverse Project Repository" • A3 " Converse with Chatbot for Most Effective Learning Strategy"	Quiz 1	• Register with Pivotal • Create GIT account • Submit initial slides of project report with team's composition, roles, policy, project scope	Tuesday, Jan 14 9:00 pm EST ***Course Lectures*** Thursday, Jan 16 9:00 pm EST ***Assignments & Quizzes***
Module 2 ***DELIVERABLES DUE DATE: Tuesday, Jan 28, 6:00 AM EST***	Software Configuration Management (SCM) Estimation	Module 2 Course Notes Steve McConnell Section4 "Cone" Section 11 "Analogy" Section 12.3 "Story Points	Comment on a paper "The Art of Changing the History". Respond the most common question raised while teaching an estimation class	• A1 " Analyze Git's Branching and Merging " • A2 " Motivation Principle" • A3 "Provide consistent assessment of six requirements processes"	Quiz 2	• Document Personas • Develop Requirements in Pivotal • Start coding • Arrange hosting	Tuesday, Jan 21 9:00 pm EST ***Course Lectures*** Thursday, Jan 23 9:00 pm EST ***Assignments & Quizzes***
Module 3 ***DELIVERABLES DUE DATE: Tuesday, Feb 4, 6:00 AM EST***	Agile Static Testing	Module 3 Notes Scrum Guide Nov 2020	Give a hand to a Moderator in a contentious peer review	• A1 "Maintain time-trends for six scrums" • A2 "Calculate all permutations of the Cost of Delay" • A3 " Optimize Peer Reviews"	Quiz 3	• Provide Estimation record • Compile CI List • Document Tools Connectivity Diagram	Tuesday, Jan 28 9:00 pm EST ***Course Lectures*** Thursday, Jan 30 9:00 pm EST ***Assignments & Quizzes***

Module 4 ***DELIVERABLES DUE DATE:*** ***Tuesday, Feb 11,*** ***6:00 AM EST***	IS Security Elements of Software Design Common Tools Supporting Common Process	Module 4 Course Notes David Pratt David Kim	Should Ed Snowden be pardoned? How to manage a repository of best coding practices	• A1 "Tools for Unit Test" • A2 "Position 22 software tools into 11 categories"	Quiz 4	• Document Selected Use Cases • Converge on a Components Interaction diagram • Document State Transitions	Tuesday, Feb 4 9:00 pm EST ***Course Lectures*** Thursday, Feb 6 9:00 pm EST ***Assignments & Quizzes***
Module 5 ***DELIVERABLES DUE DATE:*** ***Tuesday, Feb 18,*** ***6:00 AM EST***	System Test Unit Test Continuous Delivery	Module 5 Course Notes Glenford Myers Chapter 1 Self Assessment Test MIT courseware Jez Humble Ch 5, Deployment Pipeline	Link two diverse notions from Andy Grove and Jez Humble	• A1 "Data-driven Test Design" • A2 "Review online courseware" • A3 "Essential Test Coverage Based on State Transitions"	Quiz 5	• Transform mock-ups into wireframes • Complete coding • Demo a hosted prototype	Tuesday, Feb 11 9:00 pm EST ***Course Lectures*** Thursday, Feb 13 9:00 pm EST ***Assignments & Quizzes***
Module 6 ***DELIVERABLES DUE DATE:*** ***Tuesday, Feb 25,*** ***6:00 AM EST***	Process Architecture Process Improvement Course review in preparation to Final Exam	Module 6 Course Notes CMMI, version 1.3 ISO 9001 2008 AST Code of Ethics	Adapt & Adopt - outline a path toward an effective institutionalization of a new process	• A1 "Learning Platform" • A2 “Embeddings”	Quiz 6	• Develop test cases in a standard format • Reduce data-driven combinations using Allpairs algorithm	Tuesday, Feb 18 9:00 pm EST ***Course Lectures*** Thursday, Feb 20 9:00 pm EST ***Assignments & Quizzes***
DELIVERABLE DUE DATE: ***Wednesday, Feb 25,*** ***6:00 AM EST*** **Final Exam Period** **Wed, Feb 26 - Sat, Mar 1**	Final Exam three-hours open-book					• Schedule online final presentation of project team • Submit final report for term project	Tuesday, Feb 25 9:00 pm EST ***Q & A*** ***Final exam online is scheduled individually***