

**Western University Faculty of Engineering**  
**Department of Electrical and Computer Engineering**  
**SE 4452A - SOFTWARE TESTING & MAINTENANCE**  
**Course Outline Fall/2026**

**Description:** The course focuses on software testing, verification and validation, and maintenance issues. Topics include review/inspection, testing techniques, levels of testing (unit, integration, system, acceptance, regression, etc.), and testing tools (static and dynamic). Review of software tools/techniques to manage changes in software and to control the evolution of a software project.

**Instructor:**

**Contact Hours: Lectures Location and Time:**

**Antirequisite:** CS 4472A/B

**Prerequisites:** SE 3352A/B

**Restrictions:** Limited to students in 4th year of Software Engineering students and to 3rd- year Software and HBA students.

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

**CEAB Academic Units:** Engineering Science 75%, Engineering Design 25%.

**Required Textbook:** There is no required text. The lecture notes will be mainly based on *Introduction to Software Testing* (Offutt and Ammann) but it is not required. Additional optional textbook is *Software Evolution and Maintenance: A Practitioner's Approach* (Priyadarshi Tripathy, Kshirasagar Naik) and *Software Testing: A Craftsman's Approach, Fourth Edition* (Paul C. Jorgensen). Some other suggested readings will be provided on Owl.

### General Learning Objectives (CEAB Graduate Attributes)

|                  |   |                          |   |                                       |  |
|------------------|---|--------------------------|---|---------------------------------------|--|
| Knowledge Base   |   | Use of Engineering Tools | A | Impact on Society and the Environment |  |
| Problem Analysis |   | Individual and Team Work |   | Ethics and Equity                     |  |
| Investigation    | D | Communication Skills     |   | Economics and Project Management      |  |
| Design           |   | Professionalism          |   | Life-Long Learning                    |  |

| Topics and Specific Learning Outcomes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | CEAB<br>GA<br>Indicators              |
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| <ul style="list-style-type: none"> <li><b>Introduction to Software Quality Management: Engineering &amp; Assurance</b><br/> <u>At the end of this section, students will be able to:</u> <ul style="list-style-type: none"> <li>Identify and develop quality framework and model utilizing industrial best practice samples in terms of quality factors, criteria and objectives as applied to software systems</li> <li>Identify and develop the stages of the quality management cycle for software systems (quality engineering and quality assurance) as applied for the business quality objectives.</li> <li>Identify and utilize quality engineering principles and techniques to engineer quality factors as defined within the adopted quality model</li> </ul> </li> </ul>                                                                                                                                                                                                                                       | <b>IN1,<br/>ET1</b>                   |
| <ul style="list-style-type: none"> <li><b>Software quality control: Review/Inspection and Testing</b><br/> <u>At the end of this section, students will be able to:</u> <ul style="list-style-type: none"> <li>Identify and apply quality control approaches (review-based and test-based) adequate for the nature of the software artifacts (static and dynamic) produced in each software development stage.</li> <li>Utilize software reviews/inspections as quality control processes for static based (written material) software artifacts, including synchronous and asynchronous approaches for                             <ul style="list-style-type: none"> <li>Peer Reviews</li> <li>Walkthroughs</li> <li>Technical Reviews/inspections</li> </ul> </li> <li>Identify and define the testing stages (unit, integration, system and acceptance) and the levels (functional, structural and system) adequate for the software artifacts produced in the corresponding development stage.</li> </ul> </li> </ul> | <b>IN1,<br/>IN2,<br/>ET1,<br/>ET2</b> |

- **Level of Testing: Functional Testing & Structural Testing**

At the end of this section, students will be able to:

- Understand the nature of the functional (Black Box) testing in relationship to the quality objectives as specified by the quality framework.
- Apply the functional testing to the different stages of testing.
- Design and implement functional testing suits using equivalence partitioning, boundary value analysis and decision tables.
- Understand the nature of the structural (White Box) testing in relationship to the quality objectives as the quality framework.
- Define and design the structural testing applicable to the unit and integration testing stages.
- Understand and utilized the concepts of complexity, code coverage and completeness analysis as applied for unit testing.
- Design and implement structural test suits using
  - Flow Graph Testing
    - i. Decision-to Decision Paths
    - ii. Test Coverage Metrics
    - iii. Basis Path Testing
  - Data Flow Testing
    - i. Define/use Testing
    - ii. Slice Based Testing

**IN1,  
IN2,  
IN3,  
ET1,  
ET2,  
ET3**

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| <ul style="list-style-type: none"> <li>• <b>Stages of Testing: Unit, Integration, System &amp; User Acceptance</b><br/> <u>At the end of this section, students will be able to:</u> <ul style="list-style-type: none"> <li>– Understand the nature of the unit testing stage in relationship to the entire software architecture and the required quality objectives.</li> <li>– Apply the unit testing to the individual modules of the architecture confirms to the quality requirements.</li> <li>– Design and implement unit testing settings, environment and supporting functional and structural using software tools.</li> </ul> </li> <li>– Understand the nature of the integration testing stage in relationship to the entire software architecture and the required quality objectives.</li> <li>– Apply the integration testing for the software system at the architecture confirms to the quality requirements using <ul style="list-style-type: none"> <li>○ Based on Functional Decomposition (<i>Functional Dependency</i>) <ul style="list-style-type: none"> <li>i. Big Bang</li> <li>ii. Top-Dow</li> <li>iii. Bottom-Up</li> <li>iv. Sandwich</li> </ul> </li> <li>○ Based on Call Graph (<i>Interaction Dependency</i>) <ul style="list-style-type: none"> <li>i. Pair-wise</li> <li>ii. Neighborhood</li> </ul> </li> <li>○ Based on Paths (<i>Flow Dependency</i>) <ul style="list-style-type: none"> <li>i. Module-Message Paths</li> </ul> </li> </ul> </li> <li>- Design and implement unit testing settings, environment and supporting functional and structural using software tools.</li> </ul> | <p><b>IN1,<br/>IN2,<br/>IN3,<br/>ET1,<br/>ET2,<br/>ET3</b></p> |
| <ul style="list-style-type: none"> <li>– Understand the nature of the system testing stage in relationship to the entire software architecture and the required quality objectives.</li> <li>– Identify the appropriate testing approaches and techniques for each quality factor to the system level of software that confirms to the quality requirements for <ul style="list-style-type: none"> <li>○ Performance Testing</li> <li>○ Security Testing</li> <li>○ Load Testing</li> <li>○ Stress Testing</li> <li>○ Scalability Testing</li> <li>○ Robustness Testing</li> </ul> </li> <li>– Understand the nature of the acceptance testing in relationship to the entire software user-centric and business-centric quality objectives.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                |

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| <ul style="list-style-type: none"> <li>• <b>Traditional Software Change and Regression Testing</b><br/> <u>At the end of this section, students will be able to:</u> <ul style="list-style-type: none"> <li>– Understand the importance and the management of software changes due to fixing a defect, adding functionality, etc. in all related software artifacts in a way they do not affect functionalities/features/behavior that should not be affected.</li> <li>– Understand the importance of applying regression testing and its relationship with unit, integration and system testing.</li> <li>– Apply regression testing using Selecting Modification Traversing Tests, and Dynamic Slice</li> </ul> </li> </ul> | <b>IN1,<br/>IN3,<br/>ET1,<br/>ET2,<br/>ET3</b> |
| <ul style="list-style-type: none"> <li>• <b>Continuous Software Evolution with Continuous Integration and Testing</b><br/> <u>At the end of this section, students will be able to:</u> <ul style="list-style-type: none"> <li>– Understand the evolution of the new trend of continuous and tool-based automated software production and evolution with focus on continuous, development, integration, delivery, deployment and monitoring</li> <li>– Understand the nature and principles of continuous testing in relationship to the entire modern software development with focus on DevOps approach.</li> </ul> </li> </ul>                                                                                              | <b>IN1,<br/>ET1,<br/>ET2</b>                   |

### Evaluation

| Course Component     | Weight |
|----------------------|--------|
| Homework Assignments | 30%    |
| Midterm Test         | 15%    |
| Final Examination    | 55%    |

**Homework Assignments:** Homework assignments will be assigned on Owl throughout the term. Homework assignments have different weights. Homework assignments may be programming-based. All assignments should be submitted as soft copies to the course website at Sakai/OWL. Hard copies are not required. All assignments will be checked for plagiarism.

**Midterm Test:** The midterm will be held during lecture hours. During exams/tests/quizzes all electronic devices must be powered down and stored out of reach. The only exception is a simple scientific non-programmable, which is permitted. Other devices capable of substituting for a simple calculator (e.g. a phone, laptop, iPad), are not permitted.

**Final Examination:** The final examination will be take place during the regular examination period.

### LATE SUBMISSION POLICY:

Advise the instructor if you are having problems completing the assignment on time prior to the due date of the assignment and be prepared to submit an Academic Consideration Request and provide documentation if requested by the instructor at:

<https://www.eng.uwo.ca/undergraduate/academic-consideration-for-absences.html>

If you are granted an extension, establish a due date with the instructor. The approval of the Chair of your Department is not required if assignments are completed prior to the last day of classes. Extensions beyond the end of classes must have the consent of the instructor, the department Chair and the Associate Dean, Undergraduate Studies. Documentation is mandatory.

**ATTENDANCE:** Attendance is mandatory for all lectures.

**FACULTY OF ENGINEERING POLICIES:**

Students must familiarize themselves with the policies of the Faculty of Engineering  
<https://www.eng.uwo.ca/electrical/pdf/2025-UG-Policy-and-Procedures.pdf>