

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING***SE3310a – Theoretical Foundations of Software Engineering*****Course Outline Fall 2024**

COURSE DESCRIPTION: An introduction to the theoretical foundations of Software Engineering including formal languages, automata theory, computability, and computational complexity. This course examines fundamental questions of software engineering including: What is computation? How hard (or easy) is it to compute various types of problems? What are the fundamental limits to what can and cannot be computed?

ACADEMIC CALENDAR:

https://www.westerncalendar.uwo.ca/Courses.cfm?CourseAcadCalendarID=MAIN_017644_1

An investigation into the theoretical foundations of Software Engineering including automata theory, computability, analysis of algorithms and the application of formal specification methods to software specification.

PRE OR COREQUISITES: Registration in third year of Software Engineering program

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.

ANTIREQUISITES: Computer Science 3331A/B, 3340A/B

CEAB ACADEMIC UNITS: Engineering Science 100%.

INSTRUCTOR INFORMATION:

Name: Yimin Yang

Office/Office Hours: TEB 245, Firday 10am to 11:30 am

Phone: 519-661-2111 x87385

Email: yimin.yang@uwo.ca

CONTACT HOURS:

Timetable information is available at <https://draftmyschedule.uwo.ca/>.

Lectures occur weekly starting September 5. Tutorial sessions start September 13.

LECTURE:	3hrs per week during the term
TUTORIAL:	2hrs per week during the term

REQUIRED TEXT: Michael Sipser. Introduction to the Theory of Computation, 3rd Edition, Cengage Learning, 2012.

RECOMMENDED RESOURCES: Anil Maheshwari and Michiel Smid. Introduction to Theory of Computation. 2012.

GENERAL LEARNING OBJECTIVES (CEAB GRADUATE ATTRIBUTES)

Knowledge Base	D	Engineering Tools	Impact on Society	
Problem Analysis	D	Individual & Teamwork	Ethics and Equity	
Investigation	I	Communication	Economics and Project Mgmt.	
Design		Professionalism	Life-Long Learning	

Notation: x represents the content level code as defined by the CEAB. blank = not applicable; I = introduced (introductory); D = developed (intermediate) and A = applied (advanced).

Rating: I – The instructor will introduce the topic at the level required. It is not necessary for the student to have seen the material before. D – There may be a reminder or review, but the student is expected to have seen and been tested on the material before taking the course. A – It is expected that the student can apply the knowledge without prompting (e. g. no review).

COURSE MATERIALS: Weekly content and guides for the tutorial will be available on the course OWL site. The material for this course will be taught in lectures and tutorial sessions; therefore, it is imperative that you attend each lecture and tutorial.

COURSE TOPICS AND SPECIFIC LEARNING OUTCOMES:

The following table summarizes the course learning outcomes along with CEAB GAIs where the GAIs in bold indicate ones to be measured and reported annually.

	CEAB GA Indicators
1. Regular Languages	
a. Construct deterministic finite automata and non-deterministic finite automata to recognize various regular languages	PA1

b. Construct regular expressions to generate various regular languages	PA1
c. Prove a language is not regular (Pumping Lemma)	I1, I2, I3
2. Context-free Languages	
a. Construct pushdown automata to recognize various context-free languages	PA1
b. Construct context-free grammars to generate various context-free languages	PA1
3. Recursively Enumerable Languages	
a. Construct deterministic and non-deterministic Turing machines to recognize various recursively enumerable languages	PA1
4. Undecidability and Computability	
a. Understand the notion of Turing completeness and the difference between Turing recognizable and Turing decidable languages	KB4
b. Prove a language is undecidable (Turing's correspondence)	I1, I2, I3
5. Complexity Theory	
a. Understand the notions of worst-case running time and construct polynomial-time reductions between algorithms.	PA1
b. Understand the theoretic and practical relationships between several important computational complexity classes: P, NP, NP-Complete, NP-Hard, BQP, and BPP	KB4
c. Prove a given problem is in a given complexity class	I1, I2, I3
d. Understand the significance of the greatest open problem in computing: Does P=NP?	KB4
e. Be able state important theoretic and real-world problems in each of these classes	KB4
f. Gain a basic insight into the difference between classical and quantum computers	KB4

EVALUATION:

Name	% Worth	CEAB GAS ASSESSED
Assignment (Total = 5)	25%	KB, I
Mid-Term Examination	25%	PA, KB
Final Examination	50%	PA, KB, I

Note that the dates listed above are **tentative** and may be adjusted if needed. Marks will be assigned on the basis of method of analysis and presentation, correctness of solution, clarity

and neatness.

COURSE POLICIES:

All work submitted must be of professional quality in the requested format. Material that is handed in dirty, illegible, disorganized, or in an unapproved format will be returned to the student for resubmission and the late submission penalty will take effect. An additional penalty of 10% may be deducted for poor grammar, incoherence, or lack of flow in the written reports.

Homework Assignments: There will be 5 assignments worth 5% each, which will be submitted electronically. Specific instructions and due dates will be made available. Email submissions will not be accepted. Assignment due dates will be communicated on the OWL website. These due dates will coincide with a tutorial session where the assignment solutions will be discussed/taken up. In fairness to other students, assignments will not be accepted after this tutorial session begins. Unsubmitted assignments will receive a mark of zero (0). There are no make-up assignments or other extra-credit opportunities for unsubmitted assignments.

Midterm Test: An in-person midterm test will be held during the Tutorial session.

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

It is your responsibility (a) to know the course due dates, (b) to understand the course late submission policy, and (c) to manage your time appropriately, including building resilience in your schedule against unforeseen delays.

Tutorial: Labs will run weekly. There will be 6 x tutorial covering assignments, and around 5 x tutorial covering course content.

Attendance: Any student who, in the opinion of the instructor, is absent too frequently from class, laboratory, or tutorial periods will be reported to the Dean (after due warning has been given). On the recommendation of the department, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.

FINAL EXAMINATION: The final exam will take place during the regular examination period. The final exam will be three hours long, closed book. Only simple, non-programmable calculators are allowed.

Missed Midterm Examinations: If a student misses a midterm examination, the exam will not be rescheduled. The student must follow the Instructions for Students Unable to Write Tests and provide documentation to their department within 24 hours of the missed test. The department will decide whether to allow the reweighting of the test, where reweighting means the marks normally allotted for the midterm will be added to the final exam. If no reasonable justification for missing the test can be found, then the student will receive a mark of zero for the test.

If a student is going to miss the midterm examination for religious reasons, they must inform the instructor in writing within 48 hours of the announcement of the exam date or they will be required to write the exam.

Use of Electronic Devices: Electronic devices are permitted during lectures so far as, in the discretion of the instructor, they do not distract or disrupt the learning of others. Electronic devices are not permitted during exams and tests.

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.

This course employs flexible deadlines for assignments. The assignment deadlines can be found above in the course outline. For each assignment, students are expected to submit the assignment by the deadline listed. Assignment due dates will be communicated on the OWL website. These due dates will coincide with a tutorial session where the assignment solutions will be discussed/taken up. In fairness to other students, assignments will not be accepted after this tutorial session begins. Unsubmitted assignments will receive a mark of zero (0). There are no make-up assignments or other extra-credit opportunities for unsubmitted assignments.

There are a total of 6 assignments in this course, but only the best five assignment scores will be counted towards the final grade.

ABSENCE FROM MANDATORY COURSE COMMITMENTS:

Students must familiarize themselves with the Policy on **Academic Consideration for Absences:**

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

I. Missed/Late Accommodation Policy

1. The Academic Consideration Request Form is available through the STUDENT ABSENCE PORTAL.
2. Documentation must be provided as soon as possible. Requests for academic consideration must include the following components:
 - a. Indication of the course(s) and assessment(s) affected by the request
 - b. Medical note, and
 - c. Additional supporting documentation as relevant
3. Requests for academic consideration without a medical note or other supporting documentation may be accepted once per term, per course.
4. Undocumented absences cannot be used for examinations scheduled by the Office of the Registrar during official examination periods (including take-home final exams and December mid-year exams for full courses) and practical laboratory and performance tests typically scheduled in the last week of the term.

Undocumented absences also cannot be used for the “designated assessment” in each course. When flexibility in assessment exists and is clearly stated on the course outline, both undocumented absences and academic consideration requests with documentation may be denied.

5. Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence.

II. Exam Accommodation

1. If you are unable to write a final examination, report your absence using the Academic Consideration Request Form through [STUDENT ABSENCE PORTAL](#).
2. Be prepared to provide the Undergraduate Services Office with supporting documentation (see next page for information on documentation) the next day, or as soon as possible (in cases where students are hospitalized). **The following circumstances are not considered grounds for missing a final examination or requesting special examinations: common cold, headache, sleeping in, misreading timetable and travel arrangements.**
3. In order to receive permission to write a Special Examination, you must obtain the approval of the Chair of the Department and the Associate Dean and in order to apply you must submit an the Academic Consideration Request Form through [STUDENT ABSENCE PORTAL](#).

PLEASE NOTE: It is the student's responsibility to check the date, time and location of the Special Examination.

III. LATE ASSIGNMENTS

IV. Medical Accommodation

1. Requests for Academic Consideration Request Form through [STUDENT ABSENCE PORTAL](#).
2. Requests for academic consideration must include the following components:
 - a. Self-attestation signed by the student (*This is only accepted for the first/one absence*)
 - b. Medical note. Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence.
 - c. Indication of the course(s) and assessment(s) affected by the request
 - d. Supporting documentation as relevant
3. Requests without supporting documentation are limited to one per term per course.
4. **Students must request academic consideration as soon as possible and no later than 48 hours after the missed assessment.**
5. Once the request and supporting documents have been received and reviewed, appropriate academic consideration, if granted, shall be determined by the instructor in consultation with the academic advisor, in a manner consistent with the course outline.

Academic consideration may include extension of deadlines, waiver of attendance requirements for classes/labs/tutorials, or re-weighting of course requirements. Some forms of academic consideration, such as arranging Special Examinations, assigning a grade of Incomplete, or granting late withdrawals without academic penalty, may only be granted by the Academic Advising office of the Faculty of Registration.

6. **An instructor may deny academic consideration for any assessment that is not required in the calculation of the final grade** (e.g., “8 of 10 quizzes”). Assessment flexibility must be indicated on the course outline.
7. **An instructor may deny academic consideration relating to the timeframe submission of work where there is already flexibility in the submission timeframe** (e.g., 72-hour submission window). This assessment flexibility must be indicated on the course outline.

V. Religious Accommodation

When scheduling unavoidably conflicts with religious holidays, which (a) require an absence from the University or (b) prohibit or require certain activities (i.e., activities that would make it impossible for the student to satisfy the academic requirements scheduled on the day(s) involved), no student will be penalized for absence because of religious reasons, and alternative means will be sought for satisfying the academic requirements involved. If a suitable arrangement cannot be worked out between the student and instructor involved, they should consult the appropriate Department Chair and, if necessary, the student's Dean.

It is the responsibility of such students to inform themselves concerning the work done in classes from which they are absent and to take appropriate action.

VI. Academic Integrity

In the Faculty of Engineering, we encourage students to create a culture of honesty, trust, fairness, respect, responsibility, and courage, befitting the professional degree you are pursuing.

Please visit [Academic Integrity Western Engineering for more information](#)

VII. Academic Offences

Plagiarism means using another's work without giving credit. The university has rules against plagiarism and other scholastic offences. Western Engineering has a zero-tolerance policy on plagiarism. The minimum penalty is zero on the course work and a repeat offence will earn you zero on the course. A third offence may lead to expulsion from the university.

[Scholastic Discipline for Undergraduate Students & Cheating, Plagiarism and Unauthorized Collaboration: What Students Need to Know](#)

Students must write their reports, essays and assignments in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

All required papers may be subject to submission for textual similarity review to commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents on the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between the University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, in the relevant section of the Academic Handbook:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

VIII. Faculty of Engineering AI Policy

The use of generative Artificial intelligence (GenAI) tools won't be discouraged in the Faculty of Engineering. As we pride ourselves on building the future we can't hide from the use of GenAI tools to contribute to the understanding of the course materials. However, the use of GenAI tools in any assignment or contribution during the course will have to be disclosed, as a resource.

GenAI tools use won't be permitted in any type of examination or other assessments where the faculty have prohibited their use. If use of GenAI tools is detected by the instructor in these instances, academic offences penalties might be imposed against the student.

IX. Use of English Policy

In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for improper use of English. Additionally, poorly written work except for the final examination may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

X. Accessibility

Western is committed to achieving barrier free accessibility for persons with disabilities studying, visiting and working at Western. As part of this commitment, there are a variety of services, groups and committees on campus devoted to promoting accessibility and to ensuring that individuals have equitable access to services and facilities. To help provide the best experience to all members of the campus community, please visit the [Accessibility Western University](#) for information on accessibility-related resources available at Western.

Students with disabilities may arrange for academic accommodation at Western. For a more detailed explanation, please visit [Academic Support & Engagement -Academic Accommodation](#).

XI. Inclusivity, Diversity, and Respect

The Faculty of Engineering at Western University is committed to creating equitable and inclusive learning environments that value diverse perspectives and experiences. We recognize that university courses often marginalize students based on social identity characteristics such as, but not limited to, Indigeneity, race, ethnicity, nationality, ability, gender identity, gender expression, sexuality, age, language, religion, and socioeconomic status. Understanding this, we strive to facilitate equitable experiences and inclusion within the classroom by respecting and integrating multiple ways of knowing, being, and doing. Please visit the [Office of Equity, Diversity and Inclusion](#).

XII. Health and Well-Being

- [Health & Wellness Services – Students](#) - Offers appointment-based medical clinic for all registered part-time and full-time students.
- [Mental Health Support](#) - Provides professional and confidential services, free of charge, to students needing assistance to meet their personal, social and academic goals. Services include consultation, referral, groups and workshops, as well as brief, change-oriented psychotherapy.
- [Crisis Support](#) - For immediate assistance, please visit Thames Hall Room 2170 or call 519-661-3030. The crisis clinic operates between 11:00 am - 4:30 pm. For after-hours crisis support, click [here](#).
- [Gender-Based Violence and Survivor Support](#) - Western [is committed to reducing incidents of gender-based and sexual violence](#) and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced gender-based or sexual violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts, [here](#). To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Important Contacts

Engineering Undergraduate Services	SEB 2097	519-661-2130	engugrad@uwo.ca
Electrical and Computer Engineering	TEB 279	519-661-2111 x86264	eceugrad@uwo.ca
Office of the Registrar/Student Central	WSSB 1120	519-661-2100	

Important Links

- [WESTERN ACADEMIC CALENDAR](#)
- [ACADEMIC RIGHTS AND RESPONSIBILITIES](#)
- [ENGINEERING PROGRESSION REQUIREMENTS AND ACADEMIC REGULATIONS](#)
- [UNIVERSITY STUDENTS' COUNCIL \(USC\) - SERVICES](#)
- [IMPORTANT DATES AND DEADLINES](#)
- [ACADEMIC CONSIDERATION FOR MEDICAL ILLNESS - UNDERGRADUATE STUDENTS](#)
- [ACCOMMODATIONS FOR RELIGIOUS HOLIDAYS](#)
- [SCHEDULING OF ASSIGNMENTS, TESTS, AND EXAMINATIONS](#)
- [STUDENT FORMS](#)
- [OFFICE OF THE REGISTRAR](#)
- [RETENTION OF ELECTRONIC VERSION OF COURSE OUTLINES \(SYLLABI\)](#)
- [ACADEMIC APPEALS](#)
- [STUDENT ABSENCE PORTAL](#)