Northeastern University
College of Engineering

INFO 5100 – Application Engineering and Development
Fall 2025

COURSE INFORMATION
Course Number: INFO 5100
Course Title: Application Engineering and Development
Course Prerequisites: None
Credit Hours: 4
Class Schedule: Tuesday, 3:00 pm – 6:20 pm
Course Format: In class on the Oakland campus

INSTRUCTOR INFORMATION
Instructor Name: Sergey K. Aityan, DSc, Ph.D.
Email Address: "Sergey Aityan" <s.aityan@northeastern.edu
Office Hours: by appointment

TEACHING ASSISTANT INFORMATION
TA Name: TBD
Email Address: TBD
Office Hours: In person or online via Zoom or Teams in scheduled sessions and individually by appointment

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COURSE DESCRIPTION
This course is an introduction to the Java Programming language with Object Oriented concepts, and an emphasis on design, engineering, and unit testing. The course covers Java development environment, major Java concepts, principles, structures, and functionality. Hands-on development exercises will explore software solutions to real-world problems. Upon completion of this course, the students will possess a solid foundation to core Java functionality and will be able to make informed decisions regarding Java's suitability to address workplace challenges.

RECOMMENDED MATERIALS AND TEXBOOK
- **Main source:** Sergey Aityan, INFO 5100 lecture slides and notes
- **Java reference source:** https://www.w3schools.com/java/

COURSE LEARNING OUTCOMES
At the completion of this course, the student should be able to:
- Describe the differences between traditional programming and object-oriented programming.
- Explain concepts related to object-oriented programming, including classes, objects, methods, inheritance, polymorphism, interfaces, overloading vs. overriding, and encapsulation.
- Design and develop programs in Java.

- Apply object-oriented principles and approach to design and development of software systems,

INSTRUCTIONAL METHODOLOGIES

This course will combine traditional lecturing with hands-on assignments that reinforce the lecture material. Lectures will focus on concepts and ideas while the assignments will provide practical experience and skills. Students will also have a final project, which allows them to apply their acquired knowledge to interesting topics.

EXAMS

- There will be both a midterm exam and a final exam.
- Each exam includes about eight/ten essay-style questions (no multiple choice) and one or two programming assignments.
- The answers must be written clearly and easy to read, structurally with a clear and logical presentation of the answers.
- Graphs, charts, tables, and other supporting illustrations are required if needed.
- Examples to illustrate the answers are mandatory required for the essay questions.
- The exams are neither "open book" nor "open notes."
- The final exam is comprehensive, i.e. includes the whole course.
- The exams are taken in class and the students must be physically present in class during the exam.
- Telephones and other communication devices must be turned off during the exam.
- Cheating in exam results in immediate termination of the exam, and grade "F" with ZERO points.
- The instructor reserves the right to change the exam format, replace the written exam with a verbal exam or multiple choice if finds appropriate.

HOMEWORK, QUIZZES, ASSIGNMENTS, AND PROJECTS

- There will be home tasks each week during the course to be submitted by next week's class. The home tasks will serve to develop practical skills on the learned material.
- A brief quiz may be given in class to check the students' knowledge learned in the previous class.
- There will be 3 lab assignments required to submit during the course on the assigned day. The lab assignments will test the student's ability to design, develop, and test a complete program from start to finish. Each lab assignment should include a detailed description of the problem and the expected outcome. The details will be defined in each lab assignment.
- All students are required to work in teams on a course project. Each team consists of 4-6 members depending on the overall class size. The teams will present their complete project to the class at the end of the semester in a group presentation that consists of three parts: (1) a complete written report, (2) a live project demo, and (3) a PowerPoint presentation with the problem statement, design ideas, major challenges, and results followed by the class discussion on the project. All team members should participate in the presentation by delivering a certain part of it. The team members absent in class at the time of their presentation will not pass the project assignment.
- All programming assignments should be submitted in the form of files in the GitHub repository:
  - ✓ the source code and compiled files stored in the repository.
  - ✓ a separate file with the actual output and the discussion of the results.

GRADING POLICY

Each answer in assignment including exams labs, homework, and quizzes will be graded by points assigned to the task. The total percentage for each category of activities is calculated as the total collected points divided by the total possible maximum points.

Activity	Percent weights
Quizzes and classroom activities	10%
Home tasks	15%
Lab assignments	15%
Course project	25%
Mid-term exam	15%
Final exam	20%

The final grade for the course will be given as the total weighted score for all activities according to the percentage wrights shown in the table below.

Grade	A	A-	B+	B	B-	C+	C	C-	F
% points	95-100	90-94	87-89	84-86	80-83	77-79	74-76	70-73	0-69

If both grades for the midterm and final exams are "F" the term grade for the course is "F" regardless of the grades for other activities.

NO MAKE-UP WORK

Assignments are to be completed on time during the course. Late assignments will result in a reduced grade. Mid-term and final exams and group presentations cannot be made up unless there was a documented emergency.

COURSE SCHEDULE

#	Date	Topics	Chapters
		Classes	
1	Sep. 9	About the course	
		(a) Computers, software, languages, design, and coding (b) Software vs. application engineering (c) Sense of Object-Oriented Design	Ch. 1
		(a) Tools for Java Development (b) Setting up your development environment (c) Running your first simple Java program	Ch. 2
2	Sep. 16	(a) Setting up your own Java project (b) Classes objects, methods, expressions, and statements (c) Creating your first java project program with an archetype (d) Using comments in Java (e) Discussion on the course project	Ch. 3
		(a) Data types and variables (b) Classes and Objects (c) Terminal input and output	Ch. 4
		Discussion on the course project	
3	Sep. 23	(a) Data Structures (b) Creating and using strings. (c) Arrays and Lists in Java	Ch. 5

		(d) HashMap and HashSet	
		(a) Arithmetic and Logical Operators in Java (b) Java Math (c) Conditional Statements	Ch. 6
		Discussion on Lab 1 assignment	
		Discussion on the course project	
4	Sept. 30	(a) Loops (b) 'for' and 'for-each' loops (c) 'while','do-while' loops (d) Jump statements: break, continue, return	Ch. 7
		(a) Methods in Java (b) Method declaration and modifiers (c) Types of methods (d) Memory allocation for methods calls (e) Method overloading (f) Recursion	Ch. 8
5	Oct. 7	(a) Object-Oriented Design (OOD) and Object-Oriented Programming (OOP) (b) Classes and objects (c) Adding new classes to your program (d) Constructors (e) Modifiers (f) Encapsulation	Ch. 9
		(a) Inheritance (b) Polymorphism (c) Inner classes, abstraction, and interface (d) Abstraction (e) Interface (f) Four pillars of OOD: encapsulation, inheritance, polymorphism, abstraction (g) Packages	Ch.10
		Discussion on Lab 4 assignment	
		Discussion on the course project	
6	Oct. 14	(a) Handling errors and throwing exceptions (b) Threads (c) Lambda expressions	Ch. 11
		Back-end Engineering (a) Data modeling and storage (a) Reading and writing files in Java (b) Using databases in Java and database interaction (c) Relational vs. NoSQL databases (d) Schema design, indexing, normalization (e) Data security and privacy	Ch. 12
		Discussion on the course project	
7	Oct. 21	Midterm Exam	Ch. 1-12
8	Oct. 28	Front-end engineering (a) Application user interface (b) Login and sign-up vs public access (c) Mandatory vs optional data entry	Ch. 13

		Software development life cycle (SDLC)	Ch. 14
		Discussion on Lab 3 assignment	
		Discussion on the course project	
9	Nov. 4	OOD Process (a) Identify objects and classes (b) Define the problem and requirements (c) Identify objects and classes (d) System architecture (e) Specify object interfaces (f) Implementation and testing	Ch. 15
		System Architecture & Design Patterns (a) Layered, client-server, microservices (b) Component-based architecture (c) MVC, MVVM, and other common patterns (d) Trade-offs in architectural decisions	Ch. 16
		Discussion on the course project	
	Nov. 11	Veterans Day – No Classes	
10	Nov. 18	(a) Benefits of OOD: modularity, reusability, maintainability, scalability (b) UML diagrams and tools	Ch. 17
		(a) System development methodologies: Agile, DevOps, CI/CD pipelines (b) Containerization (Docker) and orchestration (Kubernetes) (c) Deployment to cloud platforms (AWS, Azure, GCP) (d) Performance & Optimization: load testing, profiling, database tuning, caching	Ch. 18
		Discussion on Lab 4 assignment Discussion on the course project	
11	Nov. 25	Security in Application Design (a) Security logging, monitoring access and failures (b) Software updates and critical data validation (c) Secure coding practices (d) OWASP Top 10 (e) Data Encryption, HTTPS, secure storage	Ch. 19
		Accessibility & Internationalization (a) WCAG compliance (b) Localization/internationalization techniques (c) Inclusive design principles	Ch. 20
		Preexam Q&A Discussion on the course project	
12	Dec. 2	Comprehensive Final Exam	Chs.1-20
13	Dec. 9	Group presentations of course projects	

CHEATING AND PLAGIARISM

Cheating is the actual or attempted practice of fraudulent or deceptive acts for the purpose of improving one's grade or obtaining course credit. Acts of cheating include, but are not limited to, the following:

(a) plagiarism;

(b) copying or attempting to copy from others during an examination or on an assignment;
(c) communicating test information with another person during an examination;
(d) allowing others to do an assignment or portion of an assignment;
(e) using a commercial term paper service.
Cheating or plagiarism will result in zero points and letter grade F for an assignment, project, or exam and a report of the incident to the Dean of Students, who may place related documentation in a file. Repeated acts of cheating may result in an F in the course and/or disciplinary action.

OTHER COMMENTS
- Please participate. What you put into the class will determine what you get out of it – and what others get out of it.
- Please come on time. Late arrivals disturb everyone else.
- If you miss a class, you are responsible for getting lecture notes/slide printouts on the material covered from a classmate or the instructor.
- Use of cellular phones is prohibited during class or exams. Cellular phones must be turned off or silenced.
- Questions and comments during the class are welcome. Do not hesitate to ask questions – do not leave anything unclear for you.

MODIFICATION OF THE SYLLABUS:
The instructor reserves the right to modify this syllabus at any time during the semester. Announcements of any changes will be made in the classroom.

GENERAL MGEN POLICIES

Attendance Policy
Students registered in MGEN courses (INFO, CSYE, and DAMG) are allowed a maximum of 2 absences per course, with 3 or more absences resulting in an automatic 'F' for that course. Students are expected to inform their instructors of any absences in advance of the class; if a student is sick long-term or experiences a medical issue that prevents class attendance, it is strongly encouraged that they speak with their Academic Advisor (coe-mgen-gradadvising@northeastern.edu) to learn more about the Medical Leave of Absence. Should a student anticipate being unable to attend 3 or more classes, they should discuss their situation with their Academic Advisor to explore other types of leave in accordance with the University's academic and global entry expectations. International students should review the Office of Global Services webpage to understand their visa compliance requirements.
Teaching Assistants (TAs) or Instructional Assistants (IAs) will be present at each class to collect student attendance.

Late Work Policy
Students must submit assignments by the deadline in the time zone noted in the syllabus. Students must communicate with the faculty prior to the deadline if they anticipate work will be submitted late. Work submitted late without prior communication with faculty will not be graded.

End-of-Course Evaluation Surveys
Your feedback regarding your educational experience in this class is particularly important to the College of Engineering. Your comments will make a difference in the future planning and presentation of our curriculum.
At the end of this course, please take the time to complete the evaluation survey at https://neu.evaluationkit.com. Your survey responses are completely anonymous and confidential. For courses 6 weeks in length or shorter, surveys will be open one week prior to the end of the courses; for courses greater than 6 weeks in length, surveys will be open for two weeks. An email will be sent to your Northeastern University Mail account notifying you when surveys are available.

Academic Integrity
A commitment to the principles of academic integrity is essential to the mission of Northeastern University. The promotion of independent and original scholarship ensures that students derive the most from their educational experience and their pursuit of knowledge. Academic dishonesty violates the most fundamental values of an intellectual community and undermines the achievements of the entire University.

As members of the academic community, students must become familiar with their rights and responsibilities. In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, examinations of whatever kind, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Students are responsible for learning the conventions of documentation and acknowledgment of sources in their fields. Northeastern University expects students to complete all examinations, tests, papers, creative projects, and assignments of any kind according to the highest ethical standards, as set forth either explicitly or implicitly in this Code or by the direction of instructors.

Go to http://www.northeastern.edu/osccr/academic-integrity-policy/ to access the full academic integrity policy.

MGEN Student Feedback
Students who would like to provide the MGEN unit with anonymous feedback on this particular course, Teaching Assistants, Instructional Assistants, professors, or to provide general feedback regarding their program, may do so using this survey: https://neu.co1.qualtrics.com/jfe/form/SV_cTIAbH7ZRaaw0Ki

University Health and Counseling Services
As a student enrolled in this course, you are fully responsible for assignments, work, and course materials as outlined in this syllabus and in the classroom. Over the course of the semester if you experience any health issues, please contact UHCS.

For more information, visit https://www.northeastern.edu/uhcs.

Student Accommodations
Northeastern University and the Disability Resource Center (DRC) are committed to providing disability services that enable students who qualify under Section 504 of the Rehabilitation Act and the Americans with Disabilities Act Amendments Act (ADAAA) to participate fully in the activities of the university. To receive accommodations through the DRC, students must provide appropriate documentation that demonstrates a current substantially limiting disability.

For more information, visit https://drc.sites.northeastern.edu.

Library Services
The Northeastern University Library is at the hub of campus intellectual life. Resources include over 900,000 print volumes, 206,500 e-books, and 70,225 electronic journals.

For more information and for education specific resources, visit
https://library.northeastern.edu
Network Campus Library Services: Northeastern University Library Global Campus Portals

24/7 Canvas Technical Help
For immediate technical support for Canvas, call 617-373-4357 or email
help@northeastern.edu
Canvas Student Resources: https://canvas.northeastern.edu/student-resources/
For assistance with my Northeastern e-mail, and basic technical support:
Visit ITS at https://its.northeastern.edu
Email: help@northeastern.edu
ITS Customer Service Desk: 617-373-4357

Diversity and Inclusion
Northeastern University is committed to equal opportunity, affirmative action, diversity, and social justice while building a climate of inclusion on and beyond campus. In the classroom, members of the University community work to cultivate an inclusive environment that denounces discrimination through innovation, collaboration, and an awareness of global perspectives on social justice.
Please visit http://www.northeastern.edu/oidi/ for complete information on Diversity and Inclusion

Title IX
Title IX of the Education Amendments of 1972 protects individuals from sex or gender-based discrimination, including discrimination based on gender-identity, in educational programs and activities that receive federal financial assistance.
Northeastern's Title IX Policy prohibits Prohibited Offenses, which are defined as sexual harassment, sexual assault, relationship or domestic violence, and stalking. The Title IX Policy applies to the entire community, including male, female, transgender students, faculty, and staff.
In case of an emergency, please call 911.
Please visit https://www.northeastern.edu/ouec for a complete list of reporting options and resources both on- and off-campus.