Northeastern University
Software Engineering and Information Systems

CSYE 7200
Fall 2026

Course Information
Course Title: Big Data Systems Engineering with Scala
Course Number: CSYE 7200
Term and Year: Fall 2026
Credit Hour: 4 SH
CRN: 16366
Course Format: Classroom
Meeting Days: Monday and Thursday

Instructor Information
Full Name: Robin Hillyard
Email Address: r.hillyard@northeastern.edu
Office Hours: Thursdays 2—4:30 and, by appointment, any time online

Instructor Biography
Associate Teaching Professor Robin Hillyard has taught at Northeastern University since 2015. Before that, he enjoyed a long and successful career in software development and consulting. He has served in every capacity from Chairman/President on down—in startups and more established companies—and in many industries: financial, healthcare, eCommerce, and computer-aided design. Throughout this time, he was an innovator, especially in the areas of unit testing and agile development. He wrote his first program in 1968, and it worked first time (an accomplishment in those days!). His undergraduate degree was in Engineering Science at the University of Oxford (1st class honours) with a specialty in control engineering. Switching to the "other" place, he received his Ph.D. in Computer Science in 1978 from the University of Cambridge, with a dissertation on dimensions and tolerances in computer-aided design. Always fascinated by the expressiveness of computer languages for solving problems, Dr. Hillyard has become proficient in a wide range of languages, from assembly language, BCPL, Algol68, Fortran, C, Perl, Java, to Scala and many others. A long-time proponent of unit testing, he wrote his first unit test suite (for assembly language) in 1972. Having developed perhaps the world's first object-relational database, he has previously taught relational databases at the Khoury College of Computer Sciences. He has a patent concerning the use of reactive programming for healthcare information systems. Most recently, he has been involved with "big data" on a Hadoop platform using Spark, GraphX, Scala, Elastic Search, and Zeppelin for the recognition of gaps in (health) care. Other classes taught: INFO 6205 (Program Structure and Algorithms), CSYE 7374 (Cryptography).

Teaching Assistant Information
Full Name: TBD
Email Address:

Northeastern University
Software Engineering and Information Systems

Office Hours: See Canvas

Course Prerequisites
None.

Course Description
This course demonstrates the importance of functional programming, particularly Scala and Apache Spark, to the high-performance processing of Big Data. Spark and the challenges of Big Data motivate the course from the very first lecture. We begin by building the necessary functional-programming foundation—referential transparency, strong static typing, and reasoning about programs as expressions—that enables Spark and other Scala-based systems to perform so well in a Big Data context. Scala's role in reactive (concurrent) programming, via actors, is equally important. We compare different languages for their suitability for Big Data. The course is fully Scala 3 native.

A significant part of the class is devoted to a major team project, chosen by the team in either machine learning or reactive programming. Above all, this is a practical class: you will learn many aspects of programming and software engineering that are useful, whatever language you are using. No prior Scala experience is assumed—most students today come in comfortable with Python, and the course draws on that background throughout.

Course Learning Outcomes
- Students will understand why functional programming is essential in a high-performance big data scenario.
- Students will learn how to use the various modules of Apache Spark, including—and especially—the machine learning library.
- Students will learn how to build reactive (concurrent) systems using actors.
- Students will learn how to parse (deserialize) information into features for machine learning or other purposes.
- Students will learn the four pillars of functional programming—referential transparency, functions as objects, strong static typing, and the evaluation model—and how together they make programs easier to reason about, test, and scale.
- Students will gain skills in a programming language (Scala) that is valued highly in the job marketplace.
- Students will learn to apply prior experience in Python or Java towards mastering a statically-typed functional language, understanding where those paradigms agree and where Scala requires a different way of thinking.

Required Tools and Course Textbooks.
• (strongly recommended) Functional Programming in Scala — Pilquist, Bjarnason, and Chiusano, Manning (2nd edition)
• (recommended) Programming in Scala — Odersky, Spoon, and Venners, Artima (4th edition).

Week	Date	In Class Topic	Assignment Due
1	9/10 (Thu)	**Introduction to Scala, Spark, Big Data**	
2	9/14 (Mon)	**A language for Big Data**	
2	9/17 (Thu)	**A language for Big Data**	
3	9/21 (Mon)	**Coding in Scala: functional programming**	
3	9/24 (Thu)	**Coding in Scala: functional programming**	
4	9/28 (Mon)	**Fundamental aspects of Scala**	
4	10/1 (Thu)	**Fundamental aspects of Scala**	
5	10/5 (Mon)	**Exceptional Conditions; containers; methods; intro to for-comprehensions**	
5	10/8 (Thu)	**Exceptional Conditions; containers; methods; intro to for-comprehensions**	
6	10/12 (Mon)	**Functional Composition; Asynchronous Programming**	
6	10/15 (Thu)	**Functional Composition; Asynchronous Programming**	
7	10/19 (Mon)	**(de)-Serialization; implicits; monads; actors**	
7	10/22 (Thu)	**(de)-Serialization; implicits; monads; actors**	
8	10/26 (Mon)	**Spark introduction**	
8	10/29 (Thu)	**Spark introduction**	
9	11/2 (Mon)	**Spark detail and machine learning**	
9	11/5 (Thu)	**Spark detail and machine learning**	
10	11/9 (Mon)	**Advanced topics and Major Team Project**	

10	11/12 (Thu)	**Advanced topics and Major Team Project**	
11	11/16 (Mon)	**Advanced topics and Major Team Project**	
11	11/19 (Thu)	**Advanced topics and Major Team Project**	
12	11/23 (Mon)	**Advanced topics and Major Team Project**	
12	11/26 (Thu)	**No Class — Thanksgiving Break**	
13	11/30 (Mon)	**Advanced topics and Major Team Project**	
13	12/3 (Thu)	**Advanced topics and Major Team Project**	
14	12/7 (Mon)	**Advanced topics and Major Team Project**	
14	12/10 (Thu)	**Advanced topics and Major Team Project — last day of class**	

Assignment Grading

- Attendance – 4%
- Assignments – 22%
- Quizzes – 8%
- Team Project – 25%
- Midterm Exam – 19%
- Final Exam – 22%

Grading Scale

Please note: This is an approximate grading scale.

Percentage Range	Letter Grade	Grade Point Equivalent
92.0–100.0%	A	4.000
87.0–91.9%	A-	3.667
84.0–86.9%	B+	3.333
80.0–83.9%	B	3.000
77.0–79.9%	B-	2.667

74.0–76.9%	C+	2.333
70.0–73.9%	C	2.000
60.0–69.9%	C-	1.667
Below 60%	F	0.000

Incomplete Grades

An incomplete grade may be reported by the instructor when a student has failed to complete a major component of a required course, such as homework, a quiz or final examination, a term paper, or a laboratory project. Students may make up an incomplete grade by satisfying the requirements of the instructor. Be aware that instructors' policies on the granting of incomplete grades may vary and that the final decision on an incomplete grade is up to the instructor. **Instructors may deny requests for an incomplete grade.** If the missing assignment(s) have not been submitted to the instructor within 30 days from the end of the term in which the course was offered, or the agreed upon due date, the grade entered will reflect the student's grade in the course for the work completed and the missing assignments receiving no credit toward the final grade.

Attendance/Late Work Policy
Attendance Policy

In each term, students enrolled in on-ground sections are expected to be on campus and attending class beginning with the first day of classes. Students in online sections are expected to log in and participate in class beginning with the first day of classes.

Students who join a class after the first day of class during the university "add" period, or who are approved for late registration by the instructor and the Graduate School of Engineering, are responsible for all coursework missed prior to enrolling. In the interest of students' success, the college does not support the arrival of students to class after the university "add" deadline. **Enrolled students who do not attend class during the first week of a semester risk being dropped from the course.**

In cases where an enrolled student cannot arrive to campus by the first day of class due to circumstances beyond their control, it is the student's responsibility to contact the instructor for approval and notify the Graduate School of Engineering.

Students registered in SEIS courses (INFO, CSYE, and DAMG) are allowed **a maximum of 2 absences per course,** with 3 or more absences resulting in an 'F' for that course. Course instructors are not expected to make accommodations, and students are expected to inform their instructors of any absences in advance of the class. 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 and

accommodations in accordance with the University's academic and global entry expectations. Students may be asked to share communications about class absences with their Academic Advisor. 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-gradadvising@northeastern.edu) to learn more about the Medical Leave of Absence. 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.

Absence Because of Religious Beliefs

Any student who is unable, because of their religious beliefs, to attend classes or to participate in any examination, study, or work requirement will be provided with an opportunity to make up such examination, study, or work requirement that they may have missed because of such absence on any particular day, provided that such makeup examination or work does not create an unreasonable burden upon the university. Students should make appropriate arrangements with the instructor in advance of the absence, preferably at least two weeks before the religious observance. The University Policy on Instructional Accommodations for Student Religious Observance can be found at: https://policies.northeastern.edu/policy201/

A student seeking an accommodation under this policy must provide a written request to the student's faculty member: (i) within 14 calendar days from the first day of classes of the academic semester in which the student is requesting accommodations and (ii) identifying the specific dates the student requests accommodations.

If a student is requesting religious accommodations for multiple classes, the student must submit a written request to each of their faculty members.

The faculty member will evaluate and respond to all requests to reasonably accommodate a student and may require the student to provide additional information about the request. The faculty member may consult with the Dean for Cultural and Spiritual Life or other appropriate University officials in evaluating the student's accommodation request. The faculty member may deny an accommodation request if it results in the fundamental alteration of the nature or operation of the academic program or course or creates an undue hardship. The faculty member will provide the student with a written decision regarding the accommodation request.

Appeals Procedures: A student may appeal a decision made by the faculty member under this policy by submitting the appeal in writing to the Office of the Dean of the respective school or college of the class the student is seeking accommodations no later than five (5) calendars after the faculty member's decision on the requested accommodation. The decision of the Dean or designee will be final.

Course Evaluations
Student feedback on their learning experience is valuable and helps improve future courses. We encourage all students to complete the course evaluation surveys when they become available.

Surveys are distributed at both the midterm mark and the end of the term via email and are completely anonymous and confidential. Any questions about the surveys can be directed to SEIS-programs@coe.northeastern.edu

SEIS Student Feedback
Students who would like to provide the SEIS 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

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.

The following is a broad overview, but not an all-encompassing definition, of what constitutes a violation of academic integrity:

Cheating: The University defines cheating as using or attempting to use unauthorized materials, information, or study aids in any academic exercise. When completing any academic assignment, a student shall rely on their own mastery of the subject.

Fabrication: The University defines fabrication as falsification, misrepresentation, or invention of any information, data, or citation in an academic exercise.

Plagiarism: The University defines plagiarism as using as one's own the words, ideas, data, code, or other original academic material of another without providing proper citation or attribution. Plagiarism

can apply to any assignment, either final or drafted copies, and it can occur either accidentally or deliberately. Claiming that one has "forgotten" to document ideas or material taken from another source does not exempt one from plagiarizing.

Unauthorized Collaboration: The University defines unauthorized collaboration as instances when students submit individual academic works that are substantially similar to one another. While several students may have the same source material, any analysis, interpretation, or reporting of data required by an assignment must be each individual's independent work unless the instructor has explicitly granted permission for group work.

Participation in Academically Dishonest Activities: The University defines participation in academically dishonest activities as any action taken by a student with the intention of gaining an unfair advantage over other students.

Facilitating Academic Dishonesty: The University defines facilitating academic dishonesty as intentionally or knowingly helping or contributing to the violation of any provision of this policy.

Please visit https://osccr.sites.northeastern.edu/academic-integrity-policy/ to access the full academic integrity policy.

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/Disability Access Services (DAS)

Northeastern University and Disability Access Services (DAS) 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 DAS, students must provide documentation of a disability that demonstrates a current substantial limitation. Accommodations are approved based on a review of the information that is submitted and reviews are done on a case-by-case basis.

If the course is conducted in an on-ground (in-person) format, students are expected to attend class physically as scheduled. Professors are **not required to provide virtual attendance links** unless a student has documented accommodation approved by the **Disability Access Services (DAS) office** and their **Academic Advisor**. If a student requires accommodation for remote participation, they must submit a formal request through the **Disability Office** and coordinate with their **Academic Advisor** prior to the course start date.

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

Office of Global Services
As an F-1, J-1, or Study Permit student, you must meet certain obligations in order to maintain lawful nonimmigrant status. Maintaining status is necessary in order to retain eligibility for the benefits of F-1 or J-1 status, such as employment authorization and program extension, and can be crucial to a successful application for a change or adjustment of nonimmigrant status in the future. Failure to maintain your nonimmigrant status can result in serious problems with immigration and *could lead to deportation from the U.S. or Canada.*

Students must maintain on-ground presence throughout the academic term. At Northeastern, there are four different defined instructional methods: Traditional, Hybrid, Live Cast, and Online. Traditional, Hybrid, and Live Cast courses meet the Visas' on-ground presence requirements. **Online courses do not meet the Visas' on-ground presence requirements.**

Students enrolled in Summer courses should adhere to OGS guidelines on maintaining status during the Summer term.

For more information please visit, https://international.northeastern.edu/ogs/current-students/understanding-visa-requirements/guidelines-on-maintaining-status/

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

Outreach, Engagement, Belonging

Northeastern University is committed to fostering a community of belonging, which is essential to the advancement of Northeastern University's mission of teaching and research. Our university is stronger as a result of the varied backgrounds, experiences, and perspectives that all members of our global community bring to the pursuit of knowledge. Embracing this pluralism is not the work of one office, department, or academic unit. It is a shared responsibility that spans disciplines and boundaries. By harnessing the power of our differences, we will continue to light the path to bold new ideas and life-changing discoveries.

It is my intention that students from all backgrounds and perspectives will be well served by this course, and that the diverse experiences that students bring to this class will be viewed as an asset. I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, socioeconomic background, family education level, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and belonging environment for every other member of the class. Your suggestions are encouraged and appreciated.

Please visit Belonging at Northeastern – Northeastern Provost for complete information.

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.

The Office for University Equity and Compliance (OUEC) leads Northeastern University's efforts in maintaining compliance with all federal, state, and provincial civil rights laws and prohibits discrimination within any of its programs, activities, and services. Please visit https://ouec.northeastern.edu/ for more information and for the link to file a report.