FAU

FLORIDA ATLANTIC UNIVERSITY

NEW COURSE PROPOSAL
Graduate Programs

Department Electrical Engineering and Computer Science

College Engineering and Computer Science
(To obtain a course number, contact erudolph@fau.edu)

UGPC Approval _____

UFS Approval _____

SCNS Submittal _____

Confirmed _____

Banner _____

Catalog _____

Prefix COP **Number** 5377	*(L = Lab Course; C = Combined Lecture/Lab; add if appropriate)* **Lab Code**	**Type of Course** Lecture ▼	**Course Title** Functional Programming with Scala

Credits *(Review Provost Memorandum)* 3 **Effective Date** *(TERM & YEAR)* Fall 2022	**Grading** *(Select One Option)* **Regular** ⦿ **Sat/UnSat** ◯	**Course Description** *(Syllabus must be attached; see Guidelines)* Introduces the foundations of functional programming using the Scala language. Covers theoretical concepts, starting from recursion, typeful programming, algebraic data types, monoids, monads, and combinators. Introduces advanced programming techniques, such as lazy computation, higherorder functions, streams, and pure functional parallelism applicable for parallel applications on multi-core systems.

Prerequisites COP 3530 or COP 3410 *Prerequisites, Corequisites and Registration Controls are enforced for all sections of course.*	**Academic Service Learning (ASL) course** ☐ Academic Service Learning statement must be indicated in syllabus and approval attached to this form.

Corequisites	**Registration Controls** *(For example, Major, College, Level)* Seniors and Graduate Students in Computer Science, Computer Engineering and Artificial Intelligence majors

Minimum qualifications needed to teach course: Member of the FAU graduate faculty and has a terminal degree in the subject area (or a closely related field.)	**List textbook information in syllabus or here** See syllabus.
Faculty Contact/Email/Phone Dr. Ionut Cardei, icardei@fau.edu, 561-297-3401	**List/Attach comments from departments affected by new course**

Approved by		**Date**
Department Chair	_____	3/1/2022
College Curriculum Chair	_____	03/01/2022
College Dean	_____	3/1/2022
UGPC Chair	_____	
UGC Chair	_____	
Graduate College Dean	_____	
UFS President	_____	
Provost	_____	

Email this form and syllabus to UGPC@fau.edu 10 days before the UGPC meeting.

COP 5377
Functional Programming with Scala
Tue. & Thu. 9:30 AM – 10:50 AM
3 credits

Spring 2022
Prof. Ionut Cardei
Office: EE419
Office hours: Tue. & Thu. 11AM-12:30AM
Classroom: CM128
Telephone: 561-297-3401
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Course Description
Introduces the foundations of functional programming using the Scala language. Covers theoretical concepts, starting from recursion, typeful programming, algebraic data types, monoids, monads, and combinators. Introduces advanced programming techniques, such as lazy computation, higher-order functions, streams, and pure functional parallelism applicable for parallel applications on multi-core systems.

Instructional Method
In person.

Prerequisites/Corequisites
Prerequisites: COP 3530 Data Structures and Algorithm Analysis OR COP 3410 Data Structures and Algorithm Analysis with Python

Course Objectives/Student Learning Outcomes

1. Write programs with correct syntax and coding style in the Scala language;

2. design a functional programming-type software architecture;

3. write programs using algebraic data types and polymorphic higher-order functions;

COVID-19 Statement

Due to the surge in COVID-19 cases and the omicron variant, all students regardless of vaccination status are expected to wear masks while indoors in any FAU facilities, including classrooms and laboratories. Students experiencing flu-like symptoms (fever, cough, shortness of breath) or students who have come in contact with confirmed positive cases of COVID-19 should immediately contact FAU Student Health Services (561-297-3512). Symptomatic students will be asked to leave the classroom to support the safety and protection of the university community. For additional information visit . In classes with face-to-face components, quarantined students should notify me immediately as you will not be able to attend class. I will not be able to offer an online version of the class but will make reasonable efforts to assist students in making up the work.

4. design and implement programs using fundamental concepts, such as lazy computation, functional state, functional parallelism, streams, and the IO monad;

5. write programs using standard Scala libraries.

Course Evaluation Method

3 Quizzes (each worth 2%) ....…......... 6 %
5 Homeworks (each worth 11%) .... 55 %
Midterm Exam …...…………………… 14 %
Final Exam …….…………………… 20 %
Discussion ...……................................ 5 %

The quizzes include multiple-choice type tests administered online using Canvas.

The homework problems require programming in Scala and the use of industry standard development tools and libraries.

The Discussion assignment involves posting minimum 10 non-trivial and relevant messages on the Canvas homework discussion board forum.

Course Grading Scale (tentative)

A: 100-95, A-: 94-90, B+: 89-85, B: 84-80, B-:79-75, C+: 74-72, C: 71-68, C- 67-60, D: 59-50, F:49-0

Policy on Makeup Tests, Late Work, and Incompletes

Late work is not acceptable, except for special (e.g. medical) circumstances and with advance notice.

No extra credit assignments will be given. However, some homeworks have extra credit problems.

A student who is passing a course, but has not completed all work due to exceptional circumstances, may, with consent of the instructor, temporarily receive a grade of incomplete ("I"). The assignment of the "I" grade is at the discretion of the instructor, but is allowed only if the student is passing the course.

Classroom Etiquette Policy

Students are encouraged to bring their computers to the lecture and to follow the classroom activities. They should not be engaged in other activities that could disrupt the lecture.

Policy on the Recording of Lectures

Students enrolled in this course may record video or audio of class lectures for their own personal educational use. A class lecture is defined as a formal or methodical oral presentation as part of a university course intended to present information or teach students about a particular subject. Recording class activities other than class lectures, including but not limited to student presentations (whether individually or as part of a group), class discussion (except when incidental to and incorporated within a class lecture), labs, clinical presentations such as patient history, academic exercises involving student participation, test or examination administrations, field trips, and private conversations between students in the class or between a student and the lecturer, is prohibited. Recordings may not be used as a substitute for class participation or class attendance and may not be published or shared without the written consent of the faculty member. Failure to adhere to these requirements may constitute a violation of the University's Student Code of Conduct and/or the Code of Academic Integrity.

Counseling and Psychological Services (CAPS) Center

Life as a university student can be challenging physically, mentally and emotionally. Students who find stress negatively affecting their ability to achieve academic or personal goals may wish to consider utilizing FAU's Counseling and Psychological Services (CAPS) Center. CAPS provides FAU students a range of services – individual counseling, support meetings, and psychiatric services, to name a few – offered to help improve and maintain emotional well-being. For more information, go to http://www.fau.edu/counseling/

Disability Policy

In compliance with the Americans with Disabilities Act Amendments Act (ADAAA), students who require reasonable accommodations due to a disability to properly execute coursework must register with Student Accessibility Services (SAS) and follow all SAS procedures. SAS has offices across three of FAU's campuses – Boca Raton, Davie and Jupiter – however disability services are available for students on all campuses. For more information, please visit the SAS website at www.fau.edu/sas/.

Code of Academic Integrity

Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see University Regulation 4.001.

All work submitted for assignments must be the original work of the individual student. Students are required to work alone on all assignments (homeworks, quizzes, exams). Students are required to participate on the assignment discussion board forums and they are graded based on their forum activity.

Required Texts/Readings

Paul Chiusano and Runar Bjarnason. Functional Programming in Scala, Manning Publications, 2015. ISBN: 978-1617290657. (book link, amazon)

Supplementary/Recommended Readings

1. Optional: Programming in Scala, Third Edition, A comprehensive step-by-step guide by Martin Odersky, Lex Spoon, and Bill Venners, ISBN-13: 978-0981531687 (book link). The first edition is acceptable and freely available online (below).
2. Optional: Programming in Scala, PrePrint Edition (1st Ed.) by Martin Odersky, Lex Spoon, and Bill Venners, online (PDF available online)
3. Additional online articles posted on Canvas.

Course Topical Outline

1. Functional Programming Concepts
2. Scala Basics
3. Functional Data Structures
4. Type Safety, Functional Purity, and Lazy Computations
5. Functional State and Functional Parallelism
6. Algebraic Concepts: Monoids, Monads, Functors
8. Streams and IO

Course Schedule

Week #	Chapter #	Chapter Title	Homework	Quiz	Exams
1	1	What is functional programming?			
2	2	Getting started with functional programming in Scala	Homework 1	Quiz 1	
4	3	Functional Data Structures			
5	4	Handling errors without exceptions	Homework 2	Quiz 2	Midterm Exam
6	5	Strictness and Laziness	Homework 3		
7	6	Purely functional state			
9	7	Purely Functional Parallelism	Homework 4	Quiz 3	
11	8	Property-based Testing			
12	10	Monoids			
13	11	Monads			
14	13	External effects and I/O	Homework 5		Final Exam

Computing Resources and Software

Students are responsible for applying proper backup procedures to preserve their work on homework assignments and the project. Common methods involve copying files periodically and as necessary to USB flash drives, the FAU drives, Google Drive, DropBox, or some other online service.

Students should have access to a PC running Windows, Linux, or Mac OS with internet access.

Students are required to download and install the Scala software. This could take more than 2 GB of disk space.

Students need to install the following programs, in the given order:

1. Java Jevelopment Kit (JDK): download and install the latest version (e.g. Java SE 17.x.x) for your OS from here. Students should be able to run the the java compiler (javac) from the command line, which is cmd.exe on Windows, or a shell on MacOS or Linux.

   Run javac -version on the command line. If the output looks like a version number, then it's OK: for example javac 17.0.1. If the command is not found then make sure the javac program is in the $PATH environment variable. This document describes how to do just that on several operating systems.

2. the Scala Build Tool (sbt): download for your OS from this page and check out the documentation page if you need help. This course won't be using much sbt from the command line, but indirectly, through IntelliJ IDEA.

3. IntelliJ IDEA, Community Edition. This is an IDE (Integrated Development Environment) that works for Scala, Java, and Kotlin. Download and install it from this page.

Computer Requirements / Technical Skills
Computer Requirements
- Operating System
  - A computer that can run Linux, Mac OS, Windows 7 or higher
- Peripherals
  - A backup option should be available to minimize the loss of work. This can be an external hard drive, a USB drive, cloud storage, or your folder on the FAU servers.
- Software
  - Once logged in to Canvas, please visit the links located at the top of each Canvas page for LMS compatibility with your computer. Make sure your Internet browser is compatible and that you have all the recommended plug-ins installed.

Required Technical Skills [in addition to prerequisites]
Word editing and the ability to export documents to the PDF format.