



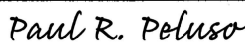

 <b>FLORIDA ATLANTIC UNIVERSITY</b>	<b>NEW COURSE PROPOSAL</b> <b>Graduate Programs</b>		UGPC Approval _____ UFS Approval _____ SCNS Submittal _____ Confirmed _____ Banner Posted _____ Catalog _____
	<b>Department</b>  <b>College</b> <i>(To obtain a course number, contact erudolph@fau.edu)</i>		
<b>Prefix</b> MTG  <b>Number</b> 6329	<i>(L = Lab Course; C = Combined Lecture/Lab; add if appropriate)</i> <b>Lab Code</b>	<b>Type of Course</b> Lecture	<b>Course Title</b> Applied Computational Topology
<b>Credits</b> <i>(Review Provost Memorandum)</i> 3	<b>Grading</b> <i>(Select One Option)</i>  <b>Regular</b> <input checked="" type="radio"/> <b>Sat/UnSat</b> <input type="radio"/>	<b>Course Description</b> <i>(Syllabus must be attached; see Guidelines)</i> An introduction to the computational methods of topology, focusing on topological data analysis, persistence homology, and applications.	
<b>Effective Date</b> <i>(TERM &amp; YEAR)</i>  Fall 2020	<b>Prerequisites</b> MAS 2103 AND (MAD 2502 OR DAT 5768)		<b>Corequisites</b>
		<b>Registration Controls</b> <i>(Major, College, Level)</i>	
<b>Prerequisites, Corequisites and Registration Controls are enforced for all sections of course</b>			
<b>Minimum qualifications needed to teach course:</b> Member of the FAU graduate faculty and has a terminal degree in the subject area (or a closely related field.)		<b>List textbook information in syllabus or here</b> Computational Topology: An Introduction by H. Edelsbrunner and J. Harer, 2010	
<b>Faculty Contact/Email/Phone</b> William Kalies / wkalies@fau.edu / 7-1107		<b>List/Attach comments from departments affected by new course</b> Computer Science / Information Technology & Operations Management / Political Science	

<b>Approved by</b> Department Chair  College Curriculum Chair  2020.03.06 11:46:11 -05'00' College Dean  UGPC Chair  UGC Chair  Graduate College Dean  UFS President _____ Provost _____	<b>Date</b> 2-20-20  _____ March 9, 2020 _____ 03/27/2020 _____ 03/27/2020 _____ _____ _____ _____
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Email this form and syllabus to [UGPC@fau.edu](mailto:UGPC@fau.edu) one week before the UGPC meeting.



## MTG 6329

### Applied Computational Topology

Fall 2020

William Kalies, Ph.D.

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**Course Description:** An introduction to the computational methods of topology, focusing on topological data analysis, persistence homology, and applications.

**Prerequisites:** MAS 2103 AND (MAD 2502 OR CAP 5768)

**Credit Hours:** 3

#### Required Textbook:

1. *Computational Topology: An Introduction*, 1<sup>st</sup> Edition  
**Authors:** H. Edelsbrunner and J. Harer; **ISBN-13:** 978-0-8218-4925-5

#### Reference:

1. *Computational Homology*, 1<sup>st</sup> Edition  
**Authors:** T. Kaczynski, K. Mischaikow, and M. Mrozek; **ISBN-13:** 978-0387408538

**Course Objectives:** In this course, students will

1. Gain understanding of algorithms for computing topological invariants of complexes and their implementation.
2. Gain proficiency in using software packages for computational homology and persistent homology.
3. Gain experience in the application of computational topology, particularly in the context of data analysis.

## Grades:

Homework Assignments	30%
Midterm Exam	30%
Final Project	40%

## Grading Scale:

$\geq 90.00$	A	70.00 - 74.99	C+
85.00 - 89.99	A-	65.00 - 69.99	C
80.00 - 84.99	B+	60.00 - 64.99	D
75.00 - 79.99	B	$\leq 59.99$	F

This syllabus is subject to reasonable change at the discretion of the instructor.

## Course Outline:

- **Week 1:** Graphs and Graph Algorithms
- **Week 2:** Surfaces
- **Week 3:** Complexes
- **Week 4:** Combinatorial Topology: Sperner's Lemma and Winding numbers
- **Week 5:** Homology
- **Week 6:** Computational Homology Algorithms
- **Week 7:** Applications of Homology
- **Week 8:** Midterm Exam
- **Week 9:** Persistent Homology
- **Week 10:** Functional Persistence and Stability
- **Week 11:** Persistent Homology Software
- **Week 12:** Persistence Landscapes and Images
- **Week 13:** Persistent Homology and Data Science
- **Week 14:** Applications
- **Week 15:** Final Project Presentations

## Course Policies:

- **Classroom Etiquette:** University policy on the use of electronic devices states: “In order to enhance and maintain a productive atmosphere for education, personal communication devices, such as cellular telephones and pagers, are to be disabled in class sessions.”
- **University Attendance Policy:** Students are expected to attend all of their scheduled University classes and to satisfy all academic objectives as outlined by the instructor. The effect of absences upon grades is determined by the instructor, and the University reserves the right to deal at any time with individual cases of non-attendance. Students are responsible for arranging to make up work missed because of legitimate class absence, such as illness, family emergencies, military obligation, court-imposed legal obligations or participation in University approved activities. Examples of University-approved reasons for absences include participating on an athletic or scholastic team, musical and theatrical performances and debate activities. It is the student’s responsibility to give the instructor notice prior to any anticipated absences and within a reasonable amount of time after an unanticipated absence, ordinarily by the next scheduled class meeting. Instructors must allow each student who is absent for a University- approved reason the opportunity to make up work missed without any reduction in the student’s final course grade as a direct result of such absence.
- **Academic Integrity:** Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty, including cheating and plagiarism, 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 values on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see [http://www.fau.edu/regulations/chapter4/4.001\\_Code\\_of\\_Academic\\_Integrity.pdf](http://www.fau.edu/regulations/chapter4/4.001_Code_of_Academic_Integrity.pdf)
- **Disability Policy Statement:** In compliance with the Americans with Disabilities Act (ADA), students who require special accommodation due to a disability to properly execute coursework must register with Student Accessibility Services (SAS) and follow all SAS procedures. SAS in Boca Raton, SU 133 (561-297-3880). SAS website: <http://www.fau.edu/sas>
- **Counseling and Psychological Services (CAPS):** 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/>