FAU

FLORIDA ATLANTIC UNIVERSITY

NEW COURSE PROPOSAL
Graduate Programs

Department

College
*(To obtain a course number, contact **erudolph@fau.edu**)*

UGPC Approval _____
UFS Approval _____
SCNS Submittal _____
Confirmed _____
Banner Posted _____
Catalog _____

Prefix MTG **Number** 6329	*(L = Lab Course; C = Combined Lecture/Lab; add if appropriate)* **Lab Code**	**Type of Course** Lecture	**Course Title** Applied Computational Topology

Credits *(Review Provost Memorandum)*
3

Effective Date *(TERM & YEAR)*
Fall 2020

Grading *(Select One Option)*
Regular (●)
Sat/UnSat ( )

Course Description *(Syllabus must be attached; see Guidelines)*
An introduction to the computational methods of topology, focusing on topological data analysis, persistence homology, and applications.

Prerequisites	**Corequisites**	**Registration Controls** *(Major, College, Level)*
MAS 2103 AND (MAD 2502 OR DAT 5768)		

Prerequisites, Corequisites and Registration Controls are enforced for all sections of course

Minimum qualifications needed to teach course:	**List textbook information in syllabus or here**
Member of the FAU graduate faculty and has a terminal degree in the subject area (or a closely related field.)	Computational Topology: An Introduction by H. Edelsbrunner and J. Harer, 2010
Faculty Contact/Email/Phone William Kalies / wkalies@fau.edu / 7-1107	**List/Attach comments from departments affected by new course** Computer Science / Information Technology & Operations Management / Political Science

Approved by	***Date***
Department Chair _____	2-20-20
College Curriculum Chair _____ Christopher Beetle 2020.03.06 11:46:11 -05'00'	
College Dean _____ William David Kalies	March 9, 2020
UGPC Chair _____	
UGC Chair _____	
Graduate College Dean _____	
UFS President _____	
Provost _____	

Email this form and syllabus to UGPC@fau.edu one week before the UGPC meeting.

MTG 6329

Applied Computational Topology

Fall 2020

William Kalies, Ph.D.

Email: wkalies@fau.edu
Office Location: SE 242
Office Hours: TBA
Tel: 561-297-1107

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*, 1st Edition
   Authors: H. Edelsbrunner and J. Harer; **ISBN-13:** 978-0-8218-4925-5

Reference:

1. *Computational Homology*, 1st 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:

>= 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	<= 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

- **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/