FAU

FLORIDA ATLANTIC UNIVERSITY

NEW COURSE PROPOSAL
Graduate Programs

Department Computer & Electrical Eng. & Computer Science

College Engineering and Computer Science

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

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

Prefix EEL

Number 6468

(L = Lab Course; C = Combined Lecture/Lab; add if appropriate)
Lab Code

Type of Course Lecture

Course Title Smart Antennas

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)*

Array signal processing plays a key role in modern mobile communication systems and autonomous robotic platforms. EE 6468 covers the underlying principles and current state-of-the-art of smart antennas and array processing algorithms that can readily raise the Signal-to-Noise Ratio of signals of interest, null-out or suppress interferers, identify active signals and their direction of arrival, and track signal sources as they move in space. Topics covered include deterministic, mean-square optimal and adaptive beamforming, direction-of-arrival estimation, and joint space-time data processing.

Prerequisites
N/A

Corequisites
N/A

Registration Controls *(Major, College, Level)*
Graduate Level

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

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
No required textbook.

Faculty Contact/Email/Phone
Dimitris A Pados/dpados@fau.edu/561-297-2988

List/Attach comments from departments affected by new course

Approved by	***Date***
Department Chair	1/27/20
College Curriculum Chair (Mihaela Cardei)	1/29/20
College Dean	1/30/2020
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.

FAUnewcourseGrad, created Summer 2017

GRADUATE COLLEGE
JAN 30 2020

Department of Computer & Electrical Engineering
and Computer Science
Florida Atlantic University
Course Syllabus

1. Course title/number, number of credit hours	
EEL 6468 Smart Antennas	# of credit hours: 3

2. Course prerequisites, corequisites, and where the course fits in the program of study

No prerequisites.

EEL 6468 is a graduate level course designed to cover the underlying principles and the present state-of-the-art of smart antennas and array processing algorithms. While it is the intention of the instructor to keep EEL 6468 self-sufficient, some basic working knowledge of communications systems, probability theory, and signal processing is assumed.

3. Course logistics

Term: Fall 2020
Class location and time *Tue Th* *02:00 PM 03:20 PM* *Computing Building Boca 128*

4. Instructor contact information

Instructor's name	Dimitris A. Pados, PhD
Office address	Office: 325 Engineering East
Office Hours	Office Hours: W 12:00Noon-2:00PM Th 12Noon - 2:00PM
Contact telephone number	Tel.: (561) 297-2988
Email address	E-mail: dpados@fau.edu

5. TA contact information

TA's name	N/A
Office address	
Office Hours	
Contact telephone number	
Email address	

6. Course description

Array signal processing plays a key role in modern mobile communication systems and autonomous robotic platforms. EE 6468 covers the underlying principles and current state-of-the-art of smart antennas and array processing algorithms that can readily raise the Signal-to-Noise Ratio of signals of interest, null-out or suppress interferers, identify active signals and their direction of arrival, and track signal sources as they move in space. Topics covered include deterministic, mean-square optimal and adaptive beamforming, direction-of-arrival estimation, and joint space-time data processing.

7. Course objectives/student learning outcomes/program outcomes

Course objectives	Students will master the topics of deterministic beamforming, mean-square optimal beamforming, adaptive beamforming and direction-of-arrival estimation. Applications will be developed in the context of space-time processing for wireless communications with examples from code-division-multiple-access (CDMA) systems.
Student learning outcomes & relationship to ABET 1-7 outcomes	N/A

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8. Course evaluation method	
HWs: 30%. Midterm Test: 30%. Final Exam: 40%.	Homework requires use of Matlab or equivalent.
9. Course grading scale	
Grading Scale: 90 and above: "A", 87-89: "A-", 83-86: "B+", 80-82: "B", 77-79 : "B-", 73-76: "C+", 70-72: "C", 67-69: "C-", 63-66: "D+", 60-62: "D", 51-59: "D-", 50 and below; "F."	
10. Policy on makeup tests, late work, and incompletes	
Only on an individual case-by-case basis.	
11. Special course requirements	
Homework assignments may require use of Matlab (or equivalent) for computer analysis and simulation studies.	
12. Classroom etiquette policy	
University policy requires that in order to enhance and maintain a productive atmosphere for education, personal communication devices, such as cellular phones, are to be disabled in class sessions.	
13. Attendance policy statement	
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.	
14. Disability policy statement	
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/.	
15. 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/	
16. Code of Academic Integrity policy statement	

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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. If your college has particular policies relating to cheating and plagiarism, state so here or provide a link to the full policy—but be sure the college policy does not conflict with the University Regulation.

17. Required texts/reading

To reduce costs for our students, we strongly encourage you to explore the adoption of open educational resources (OER), textbooks and other materials that are freely accessible. We also encourage you to clearly state in the syllabus if course materials are available on reserve in the Library.

No required textbook.

18. Supplementary/recommended readings

The following texts can be considered as possible references:
"Detection, Estimation, and Modulation Theory, Part IV, Optimum Array Processing," Harry L. Van Trees, Wiley, ISBN 478-0-471-09390-4.
"Array Signal Processing, Concepts and Techniques," D. H. Johnson and D. E. Dudgeon, Prentice Hall, ISBN 0-13-048513-6.
"Smart Antennas for Wireless Communications," J. C. Liberti, Jr. and T. S. Rappaport, Prentice Hall, ISBN 0-13-719287-8.

19. Course topical outline, including dates for exams/quizzes, papers, completion of reading

Weekly Schedule	Topics
Week 01	Physics and Geometry of Antenna Arrays; the Nyquist Sampling Theorem in Space. **HW-1**
Week 02	Deterministic zero-forcing beamforming; maximum SNR beamforming.
Week 03	Maximum SINR, Minimum MSE, Minimum-Variance-Distortionless-Response (MVRD) beamforming; maximum-likelihood beamforming **HW-2**
Week 04	Adaptive beamforming; recursions and small-sample-support analysis. **HW-3**
Week 05	LMS algorithms.
Week 06	Constant-Modulus algorithm; Recursive-Least-Squares.

	HW-4
Week 07	Antenna-array demodulators; bit-error-rate considerations. **Midterm Exam**
Week 08	Multiuser communications and multiuser detection.
Week 09	Direction-of-arrival estimation. **HW-5**
Week 10	Maximum-likelihood direction-of-arrival estimation.
Week 11	MUSIC and subspace direction-of-arrival methods. **HW-6**
Week 12	CDMA and antenna arrays.
Week 13	Space and time processing; joint space-time processing. **HW-7**
Week 14	Generalized sidelobe cancellers and auxiliary-vector filtering. **HW-5**
Week 15	Course review.
	Final Exam