

 FLORIDA ATLANTIC UNIVERSITY	NEW COURSE PROPOSAL Graduate Programs		UGPC Approval _____ UFS Approval _____ SCNS Submittal _____ Confirmed _____ Banner _____ Catalog _____	
	Department Electrical Engineering and Computer Science College Engineering and Computer Science (To obtain a course number, contact erudolph@fau.edu)			
Prefix CDA Number 5626	(L = Lab Course; C = Combined Lecture/Lab; add if appropriate) Lab Code	Type of Course Lecture	Course Title Introduction to Intelligent Autonomous Robots	
Credits (See Definition of a Credit Hour) 3	Grading (Select One Option) Regular <input checked="" type="radio"/> Sat/UnSat <input type="radio"/>	Course Description (Syllabus must be attached; see Template and Guidelines) In this course we will introduce the fundamental knowledge in robotic perception, planning, and control. Topics include spatial representations and transformations among robot components, kinematics/inverse kinematics, robot perception (computer vision), basic mapping and path planning algorithms, robot control. Students will get hands-on experiences with robotic systems via real robots or simulations using ROS2.		
Effective Date (TERM & YEAR) Fall 2024				
Prerequisites graduate standing <i>Prerequisites, Corequisites and Registration Controls are enforced for all sections of course.</i>		Academic Service Learning (ASL) course <input type="checkbox"/> Academic Service Learning statement must be indicated in syllabus and approval attached to this form.		
		Corequisites	Registration Controls (For example, Major, College, Level)	
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		
Faculty Contact/Email/Phone Michael DeGiorgio / mdegior@fau.edu / 561-297		List/Attach comments from departments affected by new course		

Approved by Department Chair <u>Haei Kalva</u> College Curriculum Chair <u>Masoud Jahandar Lashaki</u> College Dean <u>U. Cardei</u> UGPC Chair _____ UGC Chair _____ Graduate College Dean _____ UFS President _____ Provost _____	Date 3/11/2024 7/29/2024 7/29/2024 _____ _____ _____ _____ _____
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Email this form and syllabus to UGPC@fau.edu 10 days before the UGPC meeting.

CDA 5626

Introduction to Intelligent Autonomous Robots

DAY X – X
3 credits

Semester, Year
Prof. XXXXX YYYYY
Office: XXXXX
Office hours: DAY X-X
Classroom: XXXX
Telephone: 561-297-XXXX
Email: zzzzz@fau.edu



TA name	xxxxxx xxxxxxxxx
Office	xxxxxx
Office hours	DAY xx:xx – xx:xx
Telephone	561-297-xxxx
Email	xxxxxx@fau.edu

Course Description

In this course we will introduce the fundamental knowledge in robotic perception, planning, and control. Topics include spatial representations and transformations among robot components, kinematics/inverse kinematics, robot perception (computer vision), basic mapping and path planning algorithms, robot control. Students will get hands-on experiences with robotic systems via real robots or simulations using ROS2.

Instructional Method

In-Person. There is no remote option for this course.

Prerequisites

Graduate standing

Course Objectives/Student Learning Outcomes

Upon completion of this course the student will be able to:

- Understanding of the mathematics of rigid body pose representation in 3D world, and the transformations among robot components.
- Understanding the camera model and extract spatial information from 2D images. Understanding of the general pipeline of SLAM (simultaneous of localization and mapping).
- Familiarity with using MATLAB/Python to process image data.
- Familiarity with the classical robotic path planning problems and algorithms.
- Hands-on exposure to robot programming using ROS2 via simulator or real robots.

Course Evaluation Method

Assignments: 50%

Spatial representation and coordinate transformation (10%)

Camera calibration (10%), feature extraction and matching (10%)

Camera localization (10%)

Mapping and path planning (10%)

Course project (in groups. Group size depends on the number of enrollments): 50%

Project proposal: 10%

Project report: 25%

Project final presentation: 15%

Bonus points

Organizing the project report in the format of academic (IEEE) conference papers (5%)

Course Grading Scale

Grade	Total (%)
A	[93 – 100]
A-	[90 – 92)
B+	[87 – 89)
B	[83 – 86)
B-	[80 – 82)
C+	[77 – 79)
C	[73 – 76)
C-	[70 – 72)
D+	[67 – 69)
D	[63 – 66)
D-	[60 – 62)
F	[0 – 59)

Policy on Makeup Tests, Late Work, and Incompletes

Late work will not be accepted. All assignments will be posted well in advance, and students may submit assignments early. Any assignment not turned in by the due date will result in a zero.

Incomplete grades are against the policy of the department, and they will only be assigned if there is solid evidence of medical or otherwise serious emergency situation.

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.

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.

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](#).

Required Texts/Readings

No textbooks are required, but the following books can be used as recommended references:

- Introduction to Robotics: Mechanics and Control, by John Craig. ISBN-13: 978-0133489798.
- Hartley and Zisseman, "Multiple View Geometry in Computer Vision", 2nd Edition.

Course Topical Outline

Overview of robotic applications

Spatial descriptions and transformations

Kinematics of manipulators and mobile robots

Robot perception

Camera models: intrinsic and extrinsic parameters

Image feature extraction and matching

Epipolar Geometry and camera pose estimation

Localization using P3P, PnP

Structure-from-motion pipeline

Path planning algorithms for mobile robots

Introduction to ROS2