College of Computing & College of Engineering
CS/AE/ECE 7785: Introduction to Robotics Research
Proposed Syllabus

Catalog Description (25 words or less)

Familiarizes students with the core areas of robotics: mechanics, control, perception, AI, and autonomy. Provides an introduction to the mathematical tools required in robotics research.

Full Course Description and Learning Outcome

This is a required course for graduate students entering the proposed Robotics Ph.D. program. It is designed to provide students with a familiarization of the core areas of robotics, which are:

1. Mechanics
2. Control
3. Perception
4. Artificial Intelligence
5. Autonomy

In addition, it provides an introduction to the mathematical tools required in robotics research.

The desired learning outcome is to provide a strong theoretical foundation for students on the multidisciplinary subject matters found in robotics. This is accomplished by:

- Discussing fundamentals and state of the art in the areas of mechanics, control, perception, artificial intelligence, and autonomy.
- Providing the theoretical and mathematical basis for the core areas found in robotics.

Instructors

This course will be taught by one or more faculty members from the schools participating in the proposed Robotics Ph.D. program.

Course Materials

No single book covers the core areas evenly. Instead, a course packet will be distributed to the students containing excerpts of relevant introductory texts for each of the five core areas.

Course Requirements

The evaluation component includes:

- Five 30-minutes in-class quizzes after each of the core areas are covered
- Group project and presentation to apply theoretical understanding to real-world applications. Acceptable projects include components from the five core areas. A project proposal is due two weeks before the project is started for assessment by the instructors.
- A final examination to evaluate student understanding of course material.

Grading

The grading distribution is as follows:

Quizzes	25%
Course project	25%
Midterm exam	25%
Final exam	25%

Letter grades are calculated on curved numerical scores at the discretion of the instructor.

Course Outline and Assignments

The course is designed to be taught in a Tuesday-Thursday slot, with course periods of 1 hour and twenty minutes each. The following is a proposed outline:

Introduction	Week 1	Introduction Motivation
Mechanics	Weeks 2-4	Mobility and Degrees-of-Freedom Manipulator Kinematics Vehicle Kinematics
Control	Weeks 5-7	Open vs. Closed Loop Control Analog and Discrete Linear Models Optimal and Adaptive Control Methods
Perception	Weeks 8-10	Laser-range Finders and Odometry Computer Vision Localization
Artificial Intelligence	Weeks 11-13	Communication Logic Bayesian Networks
Autonomy	Weeks 13-15	Simultaneous Localization and Mapping Robot Architectures Multi-robot Coordination
Final Exam		