Professor: Marek A. Perkowski, Electrical Engineering.

EE 479/579 Intelligent Robotics II (4).

TEXTBOOKS:

1. The same as for EE 478. No new textbook needed.

COORDINATOR:

Marek A. Perkowski, Professor EE.

GOALS:

- The course introduces techniques of image processing, computer vision, and planning that are used in robotics.
- Combining ideas from computer architecture and AI is emphasized in projects and applications.
- Students learn mobile robots, control, interfacing, planning, and using of various kinds of sensors.
- Understanding of software/hardware tradeoffs is emphasized in a comprehensive group design project that includes both these components.
- Students completing this course have a working knowledge of several advanced and applied concepts of intelligent robotics and are prepared to understand recent research and development results in this area.

PREREQUISITES BY TOPIC:

Senior level standing in EE. It is recommended that EE 478/578 is taken first, or consent of the instructor.

TOPICS:

1. Introduction to humanoid robots. Projects. Robot Theatre (2 hours).
2. Advanced Computer vision hardware and software (2 hours).
3. Pattern Recognition. Constructive Induction, neural nets, fuzzy logic (4 hours).
4. Evolutionary robotics and evolvable hardware (3 hours).
5. Mobile robots ; guidance systems, path planning, collision avoidance - hardware issues and advanced material (4 hours).
6. Task planning, robot languages (3 hours).
7. Predicate calculus, resolution and automatic theorem proving, applications in robotics (4 hours).
8. PROLOG language programming. Search, non-determinism. Rules, constraints. Vision (4 hours).
9. Modern ideas in robotics (probabilistic, advanced learning architectures, knowledge-based, game theory, cognitive) (4 hours).
10. Robot programming (3 hours).

11. Computer architectures for vision and robotics, available solutions and components (4 hours).
12. Robots in health care and manufacturing (5 hours).
13. Discussion of projects and assignments (7 hours).

LAB PROJECTS:

The projects vary from year to year and include: designing and testing specialized computer architectures using Field Programmable Gate Arrays or microcontrollers, writing image processing, path planning, movement/sensor controlling programs, sensor integration. The programs include: image processing, path planning, obstacle avoidance, movement planning, sensor integration. The design projects include specialized computers for solving logic problems, image matching, convolvers, sonar controller, stepper motor controller.

COMPUTER USAGE:

Students use the departmental network of Sun workstations and PC-based computers to solve various problems. Several projects are also related to microcontrollers such a PIC or BASIC STAMP.

ESTIMATED CONTENT:

- Engineering Science: 2 credits or 50%.
- Engineering Design: 2 credits or 50%.

Base of the grade:

- Homeworks: 20 %
- Individual project reports and programming assignments: 40 %
- Oral presentation of student's research in class: 20 %
- Group projects and written group reports: 20 %