# MCS 5403: Robotics Programming, Spring 2009

**Department of Math and Computer Science**
**Lawrence Technological University**

**Day/Time**: MW 5:45-7:00pm
**Credit Hours**: 3
**Prerequisite**: [C++ or Java], Data Structures* & Operating Systems* (*) Official requirement in the catalog
**Location**: M212

**Course Objectives**
Introduction to theories, concepts, algorithms, techniques, practical issues, and tools to program autonomous robotics system with various sensors and actuators

**Instructor**: CJ Chung, Ph.D.

- Offices: M219 (S116D)
- Phone: (248) 204-3504
- Fax: (248) 204-3518 (*this fax number is for the whole building and senders should be sure to place instructor's name on the fax*)
- Dept. Secretary: (248) 204-3560
- Math/CS Drop Box: in front of S120 door. Please put instructor's name and time of submission on your work.
- Email: CHUNG@ltu.edu
- Blackboard at my.ltu.edu: syllabus, lecture notes, assignments, digital drop box, discussion board, Wimba, and others.
- Additional class web pages at http://qbx6.ltu.edu/chung for syllabus and others.
- Office Hours: MW 5:00-5:45pm in M219

**Required Text**: None, but it is strongly recommended to purchase a Lego NXT kit with a battery pack from legoeducation.com; If we agree, then we can purchase a package with multiple NXTs for discount, rather than purchasing individually.

**Recommended Texts**

- The Definitive Guide to Building Java Robots by Scott Preston, Apress, 2006
- Robotics Programming with Java for L2Bot, Chung, 2009
- Autonomous Robots by G. A. Bekey, MIT Press, 2005, 0-262-02578-7
- Any Java text book
- Any Artificial Intelligence text book
- LeJos Java documentations (will be provided by the instructor)
- Introduction to AI Robotics by Murphy
- Introduction to Autonomous Mobile Robots by Sigwart and Nourbakhsh, MIT Press, 2004

- Maximum LEGO NXT (Building Robots with Java Brains), by Brian Bagnall, Variant Press, 2008
- Many others

**Robot Kits, Computers, Tools and Software to be used in class**

- A laptop computer (PC, no Mac)
- L2Bot and Lego NXT (in addition, AIBO, RoboNova, and/or Viper)
- NXTG and LeJos Java (if time permits, C#, LabView, and RobotC)
- Various sensors

**Course Contents**

- Introduction to foundations of Robotics
- Introduction to Artificial Intelligence and Robot Learning
- Introduction to Real-time embedded systems development
    - Characteristics of real-time systems/software
    - Concurrent programming, Message passing systems (JAUS programming), and Modeling Finite State Machines
    - Design methodologies for real-time systems using SDL, Petri-net, and SC.
- Robotics Software Development Paradigms
    - Reactive (Behavior based) Paradigms
    - Feedback PID control
    - Adaptive Control
    - Fuzzy Logic Control
    - Evolutionary Robotics Control
- Introduction to Robot Vision, sensing, and sensor fusion
- Introduction to Robot Locomotion (wheeled, 4 legged, 6 legs, biped)
- Introduction to Robot Self-localization, Navigation, and Mapping
- Introduction to cooperative robotics
- Review Java Programming and Data Structures
- Programming L2Bots and NXTs

**Tentative Schedule**

| **Date** | **Topics** | **Note** |
|---|---|---|
| M 1-12 | First Day of Class | Preliminary programming test |
| M 2-2 | Programming test in rudimentary Java | 15% |
| M 3-9 | No Class | Spring Break |
| W 3-11 | No Class | Spring Break |
| W 3-18 | No Class | We will meet on 3-19* |
| Th 3-19 | Preliminary Robot Demo* | COBO Hall in Detroit, 1pm-5pm |
| W 3-25 | Midterm | 25% |
| M 4-6 | Last day to withdraw | |
| M 4-27 | Final exam | 25% |
| W 4-29 | No Class | We will meet on 5-8* |

| | | |
|---|---|---|
| F 5-8 | Preliminary Robot Demo* | LTU Gym, 5pm-9pm |
| S 5-9 | Final Robot Demo* | Open to the public, Robofest |

**(*) Any problems with the date and time, please let the instructor know in advance. The instructor will arrange alternative ways to make up.**

**Class Format and Grading: Total 200 points**

- Home works and other projects: 95 points
- World Robofest Championship result: 40 points
- Programming (aptitude) test: 15 points
- Midterm: 25 points
- Final: 25 points

This score will be translated into a letter grade based upon the percentages given below. (F will be given to Grad students, if under 69%)

| | | | |
|---|---|---|---|
| **A** | 90-100% | **C** | 70-74% |
| **A-** | 89% | **C-** | 69% |
| **B+** | 85-88% | **D+** | 65-68% |
| **B** | 80-84% | **D** | 60-64% |
| **B-** | 79% | **D-** | 59% |
| **C+** | 75-78% | **F** | 00-58% |

**Class Policies**

- Attendance is essential to doing well in the course. The exam will focus primarily (but not exclusively) on material presented in the lectures.
- If you are unable to attend a meeting (on-line meeting, possibly), it is your responsibility to obtain the material from Bb, classmates, instructor, or from the web.
- Class events may be photographed and/or videotaped. Students are expected to give permission for this material to be printed, published, posted on the websites, and/or televised in the public forum.

**Written Examination Policies**

- There will be no makeup exams.
- Closed books, closed notes by default; and closed neighbors.
- See Policy on Academic Misconduct section below.

**Homework Policies**

- Homework programming assignments must be done, individually.
- Source codes must follow good programming standards such as commenting, indentation, and meaningful names.
- Must be submitted **before** or at the beginning of the class on the due date.

- Read the submission instruction carefully for each homework
- Some home works are for class competitions. Winners will be recognized in various ways.
- See the “Policy on Late homework or project” and “Policy on Academic Misconduct” sections below.

**Class Projects**

Each student is expected to select a project from a list of suggested (group) projects that will be given by the instructor. A student can bring her/his own project, which must be approved by the instructor. Group projects may be possible, depending on the subject, size and scope. See the “Policy on late homework or project” and “Policy on Academic Misconduct” sections below.

**Possible Class Projects**

- Joining the IGVC team as an associate member
- Becoming a Robofest Instructor
- AIBO and/or RoboNova experts
- GuideBot
- Robot Vision with JAUS
- Others

**Policy on the late homework or project**

- Full credit at the beginning of class on the due date
- 10% deduction per day (24 hours)

**Intellectual Property and Copyrights**

All the deliverables may be reused/modified/upgraded by another students and/or instructor later on for educational purposes. The instructor will make sure to give appropriate credits and acknowledgements to the student in that case. The instructor believes that the student has the intellectual property rights of the software student wrote. However, since it is done in a class at LTU, it is also requested that the student should give appropriate credits and acknowledgements to the University as well as the instructor, if the software is used or commercialized after the class.

**Policy on Academic Misconduct**

Each student must comply with the University Academic Honor Code at http://www.ltu.edu/currentstudents/honor_code_offenses.asp

*1/19/09*