CS 115.11A Course Outline as of Fall 2015

CATALOG INFORMATION

Dept and Nbr: CS 115.11A Title: ROBOT DESIGN & PROGR 1
Full Title: Robotic Design and Programming 1
Last Reviewed: 11/18/2010

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	3.00	Lecture Scheduled	3.00	17.5	Lecture Scheduled	52.50
Minimum	3.00	Lab Scheduled	0	4	Lab Scheduled	0
		Contact DHR	0		Contact DHR	0
		Contact Total	3.00		Contact Total	52.50
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 105.00 Total Student Learning Hours: 157.50

Title 5 Category:	AA Degree Applicable
Grading:	Grade or P/NP
Repeatability:	00 - Two Repeats if Grade was D, F, NC, or NP
Also Listed As:	
Formerly:	CIS 115.1A

Catalog Description:
This course introduces students to the design and programming of a variety of robotic systems. Student will design and build a number of mobile robots and will develop a variety of software programs to control them. Topics will include: robot design, software/control systems, structured program techniques, mechanical design, microcontrollers, motors and locomotion, sensors, navigation, and computer vision.

Prerequisites/Corequisites:

Recommended Preparation:
Course Eligibility for ENGL 100 and Course Eligibility for MATH 150A OR Course Eligibility for EMLS 100 (or ESL 100) and Course Eligibility for MATH 150A

Limits on Enrollment:

Schedule of Classes Information:
Description: This course introduces students to the design and programming of a variety of robotic systems. Student will design and build a number of mobile robots and will develop a variety of software programs to control them. Topics will include: robot design, software/control

systems, structured program techniques, mechanical design, microcontrollers, motors and locomotion, sensors, navigation, and computer vision. (Grade or P/NP)
Prerequisites/Corequisites:
Recommended: Course Eligibility for ENGL 100 and Course Eligibility for MATH 150A OR Course Eligibility for EMLS 100 (or ESL 100) and Course Eligibility for MATH 150A
Limits on Enrollment:
Transfer Credit:
Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

AS Degree:	**Area**	Effective:	Inactive:
CSU GE:	**Transfer Area**	Effective:	Inactive:
IGETC:	**Transfer Area**	Effective:	Inactive:

CSU Transfer:	Effective:	Inactive:
UC Transfer:	Effective:	Inactive:

CID:

Certificate/Major Applicable:
Certificate Applicable Course

COURSE CONTENT

Outcomes and Objectives:
Upon completion of this course, students will be able to:
1. Describe the relationship between the various sub-systems of a functioning robot
2. Demonstrate understanding of the fundamentals of mechanical design
3. Design and build a variety of mobile robots
4. Evaluate the pros and cons of various drive and locomotion systems
5. Compare and contrast the different types of robotic control systems
6. Apply software algorithms, sensors, and computer vision to create robotic behaviors
7. Develop a controller to enable a robot to perform an autonomous mission
8. Select chassis, locomotion system, sensors, actuators, and power supply appropriate to the mission

Topics and Scope:

1. Introduction
   a. History of robotics
   b. Robot defined
   c. Types of robots
2. Building the first robot
   a. Building with Lego Technic
   b. Using the microcontroller
   c. A first program
   d. Randomness, emergence and meta-sensing
3. Programming in Interactive C

a. C syntax
b. Data types
c. Constants and variables; variable scope
d. Operators, expressions, and statements
e. Loops and control structures
f. Functions
g. Arrays
h. LCD (Liquid Crystal Display) screen printing
i. Libraries
j. Debugging

4. Mechanical design
   a. Chassis design
   b. Lego geometry and bracing
   c. Sensor placement and orientation
5. Motors and locomotion
   a. Motor types & characteristics
   b. Gears and gear ratios
   c. H-bridges and speed control
   d. Drive and locomotion systems
6. Sensors
   a. Collision sensors
   b. Avoidance sensors
   c. Homing sensors
   d. Navigation sensors
   e. Inertial sensors
   f. Proprioceptive sensors
   g. Sensor data processing
7. Actuators
   a. Grippers
   b. Pan/tilt and scanner systems
   c. Pneumatic actuators
   d. Muscle wire
8. Power supplies
   a. Battery types and characteristics
   b. Battery capacity
   c. Charging characteristics
9. Localization and navigation
   a. Dead reckoning
   b. Odometry
   c. Way points
   d. Beacons
10. Control systems
    a. Open and closed loop
    b. Feedback control
    c. On-off versus proportional control
    d. Sequential control
    e. Reactive control
11. Computer vision
    a. Blob, color, and shape detection
    b. Object and line following
    c. Motion detection
    d. Angle sensing

Assignment:

1. Design and build a number of mobile robots
2. Write, run and debug software control programs
3. Read approximately 25 pages from the textbook per week
4. Maintain an engineering journal
5. Take 3-5 objective exams

Methods of Evaluation/Basis of Grade:

Writing: Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

Maintain an engineering journal	Writing 10 - 20%

Problem Solving: Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Design, build and program mobile robots	Problem solving 40 - 50%

Skill Demonstrations: All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

None	Skill Demonstrations 0 - 0%

Exams: All forms of formal testing, other than skill performance exams.

Multiple choice, True/false, Matching items, Completion, Programming exercises	Exams 40 - 50%

Other: Includes any assessment tools that do not logically fit into the above categories.

None	Other Category 0 - 0%

Representative Textbooks and Materials:
"Robotic Explorations: A Hands-On Introduction to Engineering" by Fred G. Martin - Prentice Hall; 2003 or current version.