United States Naval Academy
Mechanical Engineering Department

Catalog Description: EM451 Design of Robotic Elements **Credit:** 3 (2-2-3)
Designation: Selected Elective, engineering major

This course addresses practical issues concerning the design, fabrication and operation of wheel-driven mobile robots. The objectives of the course are to: (a) Design and fabricate wheel-driven mobile robots to accomplish particular performance objectives, (2) Select typical elements used in robot construction such as electric motors, drive train components, pneumatic components, and sensors, and (3) Develop and test code for a programmable robot controller to incorporate various sensors and enable autonomous operation. The course utilizes a hands-on, project-based approach to learning about robotics. Upon completion of this course, the student should have a better understanding of how typical robots work, how various mechanisms can be designed to achieve prescribed motions, and how microprocessors are used to control robots.

Prerequisites: ~~EM371 Introduction to Design, or permission of instructor~~ None
Corequisites: None
Textbook: None
Course Director: ~~Associate~~ Professor Stephen M. Graham

Course Content:

No.	Topic or Subtopic	hrs.
1	Power and Stability	1
2	Design Challenge #1	4
3	Chassis Design/Steering	1
4	Robot Controller Operation	1
5	Design Challenge #2	6
6	C Programming	2
7	Debugging/Troubleshooting	1
8	Design Challenge #3	12
9	Sensors and their Characterization	2
10	DC Electric Motors	1
11	Drive Trains	1
12	Robot Rampage design challenge	18
13	Pneumatics	1

Assessment Methods:

		YES	NO
A.	Quizzes		X
B.	Homework	~~X~~	X
C.	Exams		X
D.	~~Laboratory~~ Reports	X	~~X~~
E.	Oral Presentations	X	~~X~~
F.	Design Reports/Notebooks	X	
G.	Prototypes/Demonstrations	X	
H.	Projects	X	

I.	Other	X

Course Outcomes[1]

1. Design and fabricate wheel-driven mobile robots to accomplish particular performance objectives (F, G, H).
2. Select typical elements used in robot construction such as electric motors, servo-motors, drive train components, and pneumatic components (F, G, H).
3. Select the appropriate sensor to provide feedback in a robotic system (~~B,~~ F, G, H).
4. Develop and test code for a programmable robot controller to incorporate various sensors and enable autonomous operation (F, G, H).
5. Work with a team to design and build a robotic system (H).

[1] Letters in parenthesis refer to the assessment methods listed in the previous section.

	Course Outcomes									
Program Outcomes	(1)	(2)	(3)	(4)	(5)					
(a)	X	X	X	X						
(b)			X							
(c)	X									
(d)					X					
(e)	X		X	X						
(f)										
(g)					X					
(h)										
(i)										
(j)										
(k)	X			X						

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