COURSE OUTLINE : ENGR 130
D Credit – Degree Applicable
COURSE ID 001477
Cyclical Review: August 2020

COURSE DISCIPLINE : ENGR

COURSE NUMBER : 130

COURSE TITLE (FULL) : Introduction to Robotics

COURSE TITLE (SHORT) : Intro to Robotics

CATALOG DESCRIPTION

ENGR 130 provides an introductory study of the fundamentals of mobile robotics, robotic arms, and the associated engineering concepts. It prepares students for more advanced studies in robotics and related technologies. Students gain experience with fundamental concepts in robot design, sensors and actuators, programming, electronics, and computer aided design and 3D printing. The vast majority of the course experience consists of implementation of and experimentation with these skills through hands-on labs.

Total Lecture Units: 1.00

Total Laboratory Units: 1.00

Total Course Units: 2.00

Total Lecture Hours: 18.00

Total Laboratory Hours: 54.00

Total Laboratory Hours To Be Arranged: 0.00

Total Contact Hours: 72.00

Total Out-of-Class Hours: 36.00

Recommended Preparation: ENGL 100 or ESL 141 and MATH 90 or MATH 90+.

ENTRY STANDARDS

	Subject	Number	Title	Description	Include
1	ENGL	100	Writing Workshop	Read, analyze, and evaluate contemporary articles and stories to identify topic, thesis, support, transitions, conclusion, audience, and tone;	Yes
2	ENGL	100	Writing Workshop	read, analyze, and evaluate contemporary articles and stories for the comprehension of difficult content and the identification of main ideas and (topic-based) evidence;	Yes
3	ENGL	100	Writing Workshop	write an argumentative essay that integrates the ideas of others (i.e., authors) through paraphrasing, summarizing, and quoting with correct citation techniques;	Yes
4	ESL	141	Grammar and Writing IV	Compose a 400 to 450-word thesis-based essay which: (a) summarizes and cites appropriately a reading passage provided as a prompt, (b) includes a clear thesis statement, (c) uses evidence to support the thesis, (d) shows clear organization into an introduction, body, and conclusion, and (e) uses appropriate rhetorical modes such as comparison/contrast, cause/effect, and persuasion in order to support a thesis.	Yes
5	MATH	90	Intermediate Algebra for BSTEM	simplify complex fractions;	Yes
6	MATH	90	Intermediate Algebra for BSTEM	solve rational equations;	Yes
7	MATH	90	Intermediate Algebra for BSTEM	find the equation of a line parallel or perpendicular to a given line;	Yes
8	MATH	90	Intermediate Algebra for BSTEM	solve applied problems;	Yes
9	MATH	90+	Intermediate Algebra for BSTEM with Support	simplify expressions with rational exponents;	Yes

10	MATH	90+	Intermediate Algebra for BSTEM with Support	solve rational equations;	Yes
11	MATH	90+	Intermediate Algebra for BSTEM with Support	find the composition of two functions;	Yes
12	MATH	90+	Intermediate Algebra for BSTEM with Support	solve applied problems;	Yes

EXIT STANDARDS

1 program and operate various types of robots;
2 demonstrate skills of fundamental concepts in robot design;
3 demonstrate basic skills in computer aided drafting and design;
4 effectively build functional electronic circuits;
5 program and operate robotic arm;
6 compose program that will control a mobile robot to complete tasks successfully, including the integration of sensing, sensor-data processing, and robot action.

STUDENT LEARNING OUTCOMES

1 integrate multidisciplinary topics or direct current (DC) circuits, programming and mechanics for robotic interaction with the physical environment;
2 compose code that will control a mobile robot and robotic motion;
3 utilize basic principles of mechanics to design robots.

COURSE CONTENT WITH INSTRUCTIONAL HOURS

	Description	Lecture	Lab	Total Hours
1	Introduction to Robotics in general, software, and hardware	1	0	1
2	Robotics application • Introduction to sensors, actuators, and controls	0	2	2
3	Fundamental Mechanical Aspects of Robotics	4	0	4
4	Speed, power, torque, and DC motors • Gears, gear ratios, and compound gearing • Friction and traction	0	10	10
5	Mechanical Design	4	1	5
6	Drivetrain design • Mechanical design challenge • Introduction to Autodesk Inventor 3D CAD modeling software	0	12	12
7	Programming	4	2	6

8	Robot C language structure and syntax • Motion programming and wait commands • Reading sensors (touch sensors, encoders, ultrasonic sensors) • Program structures - loops, if-then, switch-case	1	12	13
9	Breadboard-Based Robot Assembly	3	3	6
10	Programming • Basic principles of electronic circuits	1	12	13
				72

OUT OF CLASS ASSIGNMENTS

1 homework (e.g. carrying-out calculations related to a robot design, such as torque or gear ratios)
2 individual project (e.g. work on a robot design, possibly in 3D CAD software if available, to be implemented during class)
3 group project (e.g. work on a robot design, possibly in 3D CAD software if available, to be implemented during class)

METHODS OF EVALUATION

1 performance-based assessment of student designed/built robots
2 midterm project presentation
3 instructor evaluation of student portfolio work
4 final project presentation

METHODS OF INSTRUCTION

- [x] Lecture
- [x] Laboratory
- [ ] Studio
- [x] Discussion
- [ ] Multimedia
- [ ] Tutorial
- [ ] Independent Study
- [x] Collaboratory Learning
- [x] Demonstration
- [ ] Field Activities (Trips)
- [ ] Guest Speakers
- [ ] Presentations

TEXTBOOKS

Title	Type	Publisher	Edition	Medium	Author	IBSN	Date
Robotics : Designing the Mechanisms for Automated Machinery.	Required	Burlington : Elsevier Science	2	print or ebook	Ben Zion Sandler	9780080516370	2014
Robotics with the Board of Education Shield-Bot for Arduino	Required	Parallax		Print or free ebook	Andy Lindsay	978-1-928-98261-6	2016