ENGR130 : Introduction to Robotics

General Information

Author:	• Christopher Herwerth
Course Code (CB01) :	ENGR130
Course Title (CB02) :	Introduction to Robotics
Department:	ENGR
Proposal Start:	Spring 2025
TOP Code (CB03) :	(0924.00) Engineering Technology, General (requires Trigonometry)
CIP Code:	(15.0000) Engineering Technologies/Technicians, General.
SAM Code (CB09) :	Possibly Occupational
Distance Education Approved:	No
Will this course be taught asynchronously?:	No
Course Control Number (CB00) :	CCC000620918
Curriculum Committee Approval Date:	06/12/2024
Board of Trustees Approval Date:	10/15/2024
Last Cyclical Review Date:	06/12/2024
Course Description and Course Note:	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.
Justification:	Mandatory Revision
Academic Career:	• Credit
Mode of Delivery:	No value
Author:	• Christopher Herwerth
Course Family:	No value

Academic Senate Discipline

Primary Discipline:	• Engineering Technology
Alternate Discipline:	No value
Alternate Discipline:	No value

Course Development

Basic Skill Status (CB08)

Course is not a basic skills course.

☐ Allow Students to Gain Credit by Exam/Challenge

Course Special Class Status (CB13)

Course is not a special class.

Pre-Collegiate Level (CB21)

Not applicable.

Grading Basis

- Grade with Pass / No-Pass Option

Course Support Course Status (CB26)

Course is not a support course

General Education and C-ID

General Education Status (CB25)

Not Applicable

Transferability

Transferable to CSU only

Transferability Status

Approved

Units and Hours

Summary

Minimum Credit Units (CB07)	2
Maximum Credit Units (CB06)	2
Total Course In-Class (Contact) Hours	72
Total Course Out-of-Class Hours	36
Total Student Learning Hours	108

Credit / Non-Credit Options

Course Type (CB04)

Credit - Degree Applicable

Noncredit Course Category (CB22)

Credit Course.

Noncredit Special Characteristics

No Value

Course Classification Code (CB11)

Credit Course.

☐ Variable Credit Course

Funding Agency Category (CB23)

Not Applicable.

☐ Cooperative Work Experience Education Status (CB10)

Weekly Student Hours

	In Class	Out of Class
Lecture Hours	1	2
Laboratory Hours	3	0
Studio Hours	0	0

Course Student Hours

Course Duration (Weeks)	18
Hours per unit divisor	54
Course In-Class (Contact) Hours	
Lecture	18

Laboratory	54
Studio	0
Total	72

Course Out-of-Class Hours	
Lecture	36
Laboratory	0
Studio	0
Total	36

Time Commitment Notes for Students

No value

Units and Hours - Weekly Specialty Hours

Activity Name	Type	In Class	Out of Class
No Value	No Value	No Value	No Value

Pre-requisites, Co-requisites, Anti-requisites and Advisories

Advisory

ESL141 - Grammar And Writing IV

Objectives
- 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.

OR

Advisory

ENGL101 - Introduction to College Reading and Composition

Objectives
- Read, analyze, and evaluate a variety of primarily non-fiction readings for content, context, and rhetorical merit with consideration of tone, audience, and purpose.

AND

Advisory

MATH100 - College Algebra for STEM

Objectives
- Perform operations on functions.
- Solve equations including: linear, polynomial, radical, rational, absolute value, exponential and logarithmic.

- Model and solve STEM application problems.

Entry Standards

Entry Standards

Course Limitations

Cross Listed or Equivalent Course

Specifications

Methods of Instruction

Methods of Instruction	Lecture

Methods of Instruction	Laboratory

Methods of Instruction	Discussion

Methods of Instruction	Collaborative Learning

Methods of Instruction	Demonstrations

Out of Class Assignments

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

Methods of Evaluation	Rationale
Activity (answering journal prompt, group activity)	Performance-based assessment of student designed/built robots
Presentation (group or individual)	Midterm project presentation
Activity (answering journal prompt, group activity)	Instructor evaluation of student portfolio work
Presentation (group or individual)	Final project presentation

Textbook Rationale

No Value

Textbooks

Author	Title	Publisher	Date	ISBN
Andy Lindsay	Robotics with the Board of Education Shield-Bot for Arduino	Parallax	2020	9781928982531

Other Instructional Materials (i.e. OER, handouts)

No Value

Materials Fee

No value

Learning Outcomes and Objectives

Course Objectives

Program and operate various types of robots.

Demonstrate skills of fundamental concepts in robot design.

Demonstrate basic skills in computer aided drafting and design.

Effectively build functional electronic circuits.

Program and operate a robotic arm.

Compose a program that will control a mobile robot to complete tasks successfully, including the integration of sensing, sensor-data processing, and robot action.

SLOs

Utilize basic principles of mechanics to design robots.   Expected Outcome Performance: 70.0

ILOs Core ILOs	Analyze and solve problems using critical, logical, and creative thinking; ask questions, pursue a line of inquiry, and derive conclusions; cultivate creativity that leads to innovative ideas.
	Demonstrate depth of knowledge in a course, discipline, or vocation by applying practical knowledge, skills, abilities, theories, or methodologies to solve unique problems.
ENGR Civil Engineering	Apply knowledge of mathematics, science and engineering; identify, form and solve engineering problems
	Demonstrate introductory skills using modern engineering tools necessary for engineering practice.
ENGR Engineering Technology - CAD & Design Drafting	Demonstrate skills in the production of working drawings of engineering structures
ENGR Engineering Entrepreneurship Skill Award	Learn hands-on skills and problem solving techniques for businesses related to engineering design, installation, manufacturing, testing, technical sales, maintenance, and other such topics in engineering technology.
	Learn the engineering design process and how technical products are made, assembled, and integrated into complex systems.
ENGR Computer Engineering AS	analyze engineering problems and make appropriate decisions with the supervision of a licensed engineer;
	design a system, component, or process with supervision of a licensed engineer to meet desired needs.
ENGR Electrical Engineering A.S. Degree Major	analyze engineering problems and make appropriate decisions with the supervision of a licensed engineer;
	design a system, component, or process with supervision of a licensed engineer to meet desired needs.
	use science and mathematical skills required for occupational needs;
ENGR Mechanical Engineering - A.S. Degree Major	design a system, component, or process with supervision of a licensed engineering to meet desired needs.
	use science and mathematical skills required for occupational needs;

Integrate multidisciplinary topics or direct current (DC) circuits, programming and mechanics for robotic interaction with the physical environment.   Expected Outcome Performance: 70.0

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	Demonstrate depth of knowledge in a course, discipline, or vocation by applying practical knowledge, skills, abilities, theories, or methodologies to solve unique problems.
ENGR Civil Engineering	Apply knowledge of mathematics, science and engineering; identify, form and solve engineering problems
	Demonstrate introductory skills using modern engineering tools necessary for engineering practice.
ENGR Engineering Entrepreneurship Skill Award	Learn hands-on skills and problem solving techniques for businesses related to engineering design, installation, manufacturing, testing, technical sales, maintenance, and other such topics in engineering technology.
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ENGR Electrical Engineering A.S. Degree Major	design a system, component, or process with supervision of a licensed engineer to meet desired needs.	
	use science and mathematical skills required for occupational needs;	
ENGR Mechanical Engineering - A.S. Degree Major	design a system, component, or process with supervision of a licensed engineering to meet desired needs.	
	use science and mathematical skills required for occupational needs;	

Compose code that will control a mobile robot and robotic motion.   Expected Outcome Performance: 70.0

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	design a system, component, or process with supervision of a licensed engineering to meet desired needs.
	use science and mathematical skills required for occupational needs;
ENGR Computer Engineering AS	analyze engineering problems and make appropriate decisions with the supervision of a licensed engineer;
	use science and mathematical skills required for occupational needs;

Additional SLO Information

Does this proposal include revisions that might improve student attainment of course learning outcomes?

No

Is this proposal submitted in response to learning outcomes assessment data?

No

If yes was selected in either of the above questions for learning outcomes, explain and attach evidence of discussions about learning outcomes.

No Value

SLO Evidence

No Value

Course Content

Lecture Content

Introduction to Robotics in General, Software, and Hardware (1 hour)
- Historic development of robotics
- Technology that enables automation
- Applications and examples of robotics

Fundamental Mechanical Aspects of Robotics (4 hours)
- Basics of motion
- Friction forces
- Relative motion

Mechanical Design (4 hours)
- Structure
- Wheels

Programming (5 hours)
- Algorithm
- Simple code
- Basic principles of electronic circuits

Programming Language Structure and Syntax (1 hour)
- Motion programming and wait commands
- Reading sensors (touch sensors, encoders, ultrasonic sensors)
- Program structures - loops, if-then, switch-case

Breadboard-Based Robot Assembly (3 hours)
- Circuit layout
- Circuit elements

Total Hours: 18

Laboratory/Studio Content

Robotics Application (2 hours)
- Introduction to sensors, actuators, and controls

Speed, Power, Torque, and DC Motors (10 hours)
- Gears, gear ratios, and compound gearing
- Friction and traction

Mechanical Design (1 hour)
- Structure
- Wheels

Drivetrain Design (12 hours)
- Mechanical design challenge
- Introduction to Autodesk Inventor 3D CAD modeling software

Programming Language Structure and Syntax (12 hours)
- Motion programming and wait commands
- Reading sensors (touch sensors, encoders, ultrasonic sensors)
- Program structures - loops, if-then, switch-case

Breadboard-Based Robot Assembly (3 hours)
- Circuit layout
- Circuit elements
- Power source

Programming (14 hours)
- Basic principles of electronic circuits
- Writing code for motion
- Troubleshooting

Total Hours: 54

Additional Information

Is this course proposed for GCC Major or General Education Graduation requirement? If yes, indicate which requirement in the two areas provided below.

No

GCC Major Requirements

No Value

GCC General Education Graduation Requirements

No Value

Repeatability

Not Repeatable

Justification (if repeatable was chosen above)

No Value

Resources

Did you contact your departmental library liaison?

No

If yes, who is your departmental library liason?

No Value

Did you contact the DEIA liaison?

No

Were there any DEIA changes made to this outline?

No Value

If yes, in what areas were these changes made:

No Value

Will any additional resources be needed for this course? (Click all that apply)

No Value

If additional resources are needed, add a brief description and cost in the box provided.

No Value