(9410110) Foundations of Robotics

Version: 2024

Course Attributes

- **Course Number:** 9410110
- **Grade Level:** 3
- **Course Length:** 1 Hours

Course Structure

Foundations of Robotics

The outline below shows the structure of this Course, including all its requirements and optional components.

Parent
9410110 Foundations of Robotics
0 Child Components - 0 Required

Standards and Benchmarks

National Standards:

9410110 Foundations of Robotics

This course provides students with a foundation in content and skills associated with robotics and automation, including artificial intelligence, electronics, physics, and principles of engineering.

CTE-TECED.912.9410110.1 - Demonstrate an understanding of robotics, its history, applications, and evolution.
Demonstrate an understanding of robotics, its history, applications, and evolution.

CTE-TECED.912.9410110.1.1
Explore robotics history through research of the industry.

CTE-TECED.912.9410110.1.2
Compare and contrast various applications of automation and robotics.

CTE-TECED.912.9410110.2 - Describe programming concepts and the forms of applied logic.

Describe programming concepts and the forms of applied logic.

CTE-TECED.912.9410110.2.1

Describe the role of decision logic in robotics.

CTE-TECED.912.9410110.2.2

Understand Boolean logic, its operations and laws, as used in robotics.

CTE-TECED.912.9410110.2.3

Translate data specifications into truth tables and extract logical expressions.

CTE-TECED.912.9410110.2.4

Solve simple Boolean algebra problems.

CTE-TECED.912.9410110.2.5

Discuss Human Computer Interaction (HCI) and describe its role in robotics.

CTE-TECED.912.9410110.3 - Describe the role of sensors in the field of robotics.

Describe the role of sensors in the field of robotics.

CTE-TECED.912.9410110.3.1

Define sensor.

CTE-TECED.912.9410110.3.2

Describe the basic operation common to all sensors.

CTE-TECED.912.9410110.3.3

Describe the types of sensors and ways in which they can be categorized.

CTE-TECED.912.9410110.3.4

Differentiate between digital and analog sensors relative to their use in robotics.

CTE-TECED.912.9410110.4 - Demonstrate an understanding of the foundations of electronics.

Demonstrate an understanding of the foundations of electronics.

CTE-TECED.912.9410110.4.1

Define voltage, current, resistance, inductance, and capacitance.

CTE-TECED.912.9410110.4.2

Describe the difference between alternating and direct current.

CTE-TECED.912.9410110.4.3

Identify and describe the operation of common electronic components.

CTE-TECED.912.9410110.4.4

Compare and contrast series and parallel circuits.

CTE-TECED.912.9410110.4.5

Define Ohm's Law and Kirchhoff's Laws.

CTE-TECED.912.9410110.4.6

Perform basic soldering techniques and breadboard construction.

CTE-TECED.912.9410110.4.7

Analyze simple circuits using common electronic test equipment and tools.

CTE-TECED.912.9410110.4.8

Describe the characteristics of analog and digital signals.

CTE-TECED.912.9410110.4.9

Translate logical expressions into schematic or symbolic representation.

CTE-TECED.912.9410110.4.10

Create basic schematic drawings of electronic circuitry.

CTE-TECED.912.9410110.5 - Describe the operation of DC motors and servos used in robotics.

Describe the operation of DC motors and servos used in robotics.

CTE-TECED.912.9410110.5.1

Describe how DC motors are used in robotics.

CTE-TECED.912.9410110.5.2

Describe how speed and torque are controlled in DC motors.

CTE-TECED.912.9410110.5.3

Describe how servos are used in robotics (e.g., robot arms, legs, steering, et al).

CTE-TECED.912.9410110.5.4

Describe how angle and torque are controlled in a servo motor.

CTE-TECED.912.9410110.5.5

Describe magnetics and its use and implications in robotics.

CTE-TECED.912.9410110.6 - Demonstrate an understanding of engineering design principles.
Demonstrate an understanding of engineering design principles.

CTE-TECED.912.9410110.6.1
Describe the steps involved in the engineering design process and the activities performed in each step.

CTE-TECED.912.9410110.6.2
Describe the role of diagnostics and troubleshooting to the engineering design process.

CTE-TECED.912.9410110.7 - Explain fundamental physics concepts applicable to the field of robotics.
Explain fundamental physics concepts applicable to the field of robotics.

CTE-TECED.912.9410110.7.1
Describe Newton's Laws of Motion (inertia, net force, reaction) and relate their applicability to robotics.

CTE-TECED.912.9410110.7.2
Compare and contrast the forms of energy (e.g., thermal, solar, mechanical, kinetic, potential, et al.) employed in robotics.

CTE-TECED.912.9410110.7.3
Relate the concept of time and rate to its application in robotics.

CTE-TECED.912.9410110.7.4
Relate how material properties (e.g., mass, density, strength, et al) have applicability to robotics.

CTE-TECED.912.9410110.7.5
Name the six simple machines (i.e., lever, inclined plane, wheel and axle, screw, wedge, and pulley) and describe their application to robotics.

CTE-TECED.912.9410110.7.6
Explain and demonstrate how gear ratios are used for increasing or decreasing power or speed.

CTE-TECED.912.9410110.8 - Demonstrate the safe and proper use of electronic and other lab equipment, tools, and materials.
Demonstrate the safe and proper use of electronic and other lab equipment, tools, and materials.

CTE-TECED.912.9410110.8.1
Apply safety rules in the use of electronic instruments and demonstrate proper care and maintenance for the equipment during storage and use.

CTE-TECED.912.9410110.8.2
Use testers to determine the condition of electronic components.

CTE-TECED.912.9410110.8.3
Demonstrate proper soldering applications.

CTE-TECED.912.9410110.8.4

Identify and use common electrical and electronics hand tools.

CTE-TECED.912.9410110.8.5

Follow laboratory safety rules and procedures including use of personal protection gear.

CTE-TECED.912.9410110.8.6

Demonstrate good housekeeping skills within the laboratory.

CTE-TECED.912.9410110.8.7

Identify OSHA color-coding safety standards.

CTE-TECED.912.9410110.8.8

Explain fire prevention and safety precautions and practices for extinguishing fires.

CTE-TECED.912.9410110.8.9

Identify harmful effects/potential dangers of familiar hazardous substances/devices to people and the environment (example: LiPo batteries).

CTE-TECED.912.9410110.9 - Build, program, and configure a robot to perform predefined tasks.

Build, program, and configure a robot to perform predefined tasks.

CTE-TECED.912.9410110.9.1

Design a robot.

CTE-TECED.912.9410110.9.2

Create programs as required using robotic software that will allow the robot to perform a set of tasks.

CTE-TECED.912.9410110.9.3

Configure subsystems to operate the robot.

CTE-TECED.912.9410110.9.4

Create and present a proposal, including drawings, flow charts, and specifications, describing the robot, the tasks and rationale, and the results.

CTE-TECED.912.9410110.10 - Solve problems using critical thinking skills, creativity and innovation.

Solve problems using critical thinking skills, creativity and innovation.

CTE-TECED.912.9410110.10.1

Employ critical thinking skills independently and in teams to solve problems and make decisions.

CTE-TECED.912.9410110.10.2

Employ critical thinking and interpersonal skills to resolve conflicts.

CTE-TECED.912.9410110.10.3
Identify and document workplace performance goals and monitor progress toward those goals.

CTE-TECED.912.9410110.10.4
Conduct technical research to gather information necessary for decision-making.

Related CTE Program

0615030330:   Applied Robotics

This course provides students with a foundation in content and skills associated with robotics and automation, including artificial intelligence, electronics, physics, and principles of engineering.

State Adopted Instructional Materials

[Author(s)], ([Copyright]), [Title] ([Edition] ed.), [Publisher].

CPALMS Educational Resources

Click HERE to access more than [XXXX] CPALMS-approved educational resources aligned to the standards and benchmarks in this CTE program.

(8600550) Introduction to Engineering Design

Version: 2024

Course Attributes

- **Course Number:** 8600550
- **Grade Level:** 3
- **Course Length:** 1 Hours

Course Structure

Introduction to Engineering Design

The outline below shows the structure of this Course, including all its requirements and optional components.

Parent
8600550 Introduction to Engineering Design
0 Child Components - 0 Required

Standards and Benchmarks

National Standards:

8600550 Introduction to Engineering Design

This course exposes students to the design process, research and analysis, teamwork, communication methods, global and human impacts, engineering standards, and technical documentation. Students will employ engineering and scientific concepts in the solution of engineering design problems. In addition, they will learn to use 3D solid modeling design software to design solutions to problems. Students will develop problem-solving skills and apply their knowledge of research and design to create solutions, document the process, and communicate the results.

CTE-TECED.912.8600550.1 - Demonstrate an understanding of the design process and the activities associated with each step.
Demonstrate an understanding of the design process and the activities associated with each step.

CTE-TECED.912.8600550.1.1

Apply engineering notebook standards and protocols.

CTE-TECED.912.8600550.1.2

Identify and apply group brainstorming techniques and the rules associated with brainstorming.

CTE-TECED.912.8600550.1.3

Create and deliver a presentation depicting research on the impact of innovation on the evolution of a product.

CTE-TECED.912.8600550.1.4

Use online and published works to research aspects of design problems.

CTE-TECED.912.8600550.1.5

Describe the design process steps used in developing solutions to problems given real world scenarios.

CTE-TECED.912.8600550.1.6

Explain what a design brief is and what it is used for.

CTE-TECED.912.8600550.2 - Demonstrate skill in sketching and drawing, and describe their importance to engineering design.

Demonstrate skill in sketching and drawing, and describe their importance to engineering design.

CTE-TECED.912.8600550.2.1

Identify, sketch, and explain the function of points, construction lines, object lines, and hidden lines.

CTE-TECED.912.8600550.2.2

Plot points on grid paper to aid in the creation of sketches and drawings.

CTE-TECED.912.8600550.2.3

Explain the concepts of technical sketching and drawing.

CTE-TECED.912.8600550.2.4

Sketch an isometric view of simple geometric solids.

CTE-TECED.912.8600550.2.5

Sketch multiview drawings of simple geometric solids.

CTE-TECED.912.8600550.2.6

Determine the front view for a given object.

CTE-TECED.912.8600550.3 - Create and assemble a CAD model and prototype.

Create and assemble a CAD model and prototype.

CTE-TECED.912.8600550.3.1
Brainstorm and sketch possible solutions to an existing design problem.

CTE-TECED.912.8600550.3.2
Select an approach that meets or satisfies the constraints given in a design brief.

CTE-TECED.912.8600550.3.3
Create simple extruded solid Computer Aided Design (CAD) models from dimensioned sketches.

CTE-TECED.912.8600550.3.4
Generate dimensioned multi-view drawings from simple CAD models.

CTE-TECED.912.8600550.3.5
Measure and Fabricate parts for a functional prototype from the CAD multiview drawings.

CTE-TECED.912.8600550.3.6
Assemble the product using the CAD modeling software.

CTE-TECED.912.8600550.3.7
Test and evaluate the prototype and record results.

CTE-TECED.912.8600550.3.8
Apply geometric and numeric constraints to CAD sketches.

CTE-TECED.912.8600550.3.9
Identify the purpose of packaging in the design of consumer products.

CTE-TECED.912.8600550.4 - Demonstrate an understanding of mathematics and dimensioning associated with CAD design software.
Demonstrate an understanding of mathematics and dimensioning associated with CAD design software.

CTE-TECED.912.8600550.4.1
Identify and explain the various geometric relationships that exist between the elements of two-dimensional shapes and three-dimensional forms.

CTE-TECED.912.8600550.4.2
Identify and define the axes, planes, and sign conventions associated with the Cartesian coordinate system.

CTE-TECED.912.8600550.4.3
Utilize sketch-based, work reference, and placed features to develop solid CAD models from dimensioned drawings.

CTE-TECED.912.8600550.4.4
Explain how a given object's geometry is the result of sequential additive and subtractive processes.

CTE-TECED.912.8600550.4.5
Explain the differences between size and location dimensions.

CTE-TECED.912.8600550.4.6
Differentiate between datum dimensioning and chain dimensioning.

CTE-TECED.912.8600550.4.7
Identify and dimension fillets, rounds, diameters, chamfers, holes, slots, and screw threads in orthographic projection drawings.

CTE-TECED.912.8600550.4.8
Explain the rules that are associated with the application of dimensions to multiview drawings.

CTE-TECED.912.8600550.5 - Demonstrate an understanding of tolerances and their implications on an engineering design.
Demonstrate an understanding of tolerances and their implications on an engineering design.

CTE-TECED.912.8600550.5.1
Identify, sketch, and explain the difference between general tolerances, limit dimensions, unilateral, and bilateral tolerances.

CTE-TECED.912.8600550.5.2
Apply appropriate engineering tolerances to specify the allowable variation, size of individual features, and orientation and location between features of an object.

CTE-TECED.912.8600550.5.3
Differentiate between clearance and interference fits.

CTE-TECED.912.8600550.5.4
Describe the purpose and demonstrate the application of section lines and cutting plane lines in a section view drawing.

CTE-TECED.912.8600550.5.5
Sketch a full and half section view of a given object to communicate its interior features.

CTE-TECED.912.8600550.5.6
Identify algebraic relationships between the dimensional values of a given object.

CTE-TECED.912.8600550.6 - Demonstrate proficiency in designing and assembling parts using CAD software to animate the parts and control design constraints.
Demonstrate proficiency in designing and assembling parts using CAD software to animate the parts and control design constraints.

CTE-TECED.912.8600550.6.1
Apply assembly constraints to individual CAD models to create mechanical systems.

CTE-TECED.912.8600550.6.2
Perform part manipulation during the creation of an assembly model.

CTE-TECED.912.8600550.6.3

Explain how assembly constraints are used to systematically remove the degrees of freedom for a set of components in a given assembly.

CTE-TECED.912.8600550.6.4

Create an exploded model of a given assembly.

CTE-TECED.912.8600550.6.5

Determine ratios and apply algebraic formulas to animate multiple parts within an assembly model.

CTE-TECED.912.8600550.6.6

Create and describe the purpose of the following items: exploded isometric assembly view, balloons, and parts list.

CTE-TECED.912.8600550.7 - Create an advanced modeling project using CAD software.
Create an advanced modeling project using CAD software.

CTE-TECED.912.8600550.7.1

Brainstorm and sketch possible solutions to an existing design problem.

CTE-TECED.912.8600550.7.2

Explain and describe the purpose of decision matrix.

CTE-TECED.912.8600550.7.3

Create a decision making matrix.

CTE-TECED.912.8600550.7.4

Select an approach that meets or satisfies the constraints given in a design brief.

CTE-TECED.912.8600550.7.5

Create solid CAD models of each part from dimensioned sketches using a variety of methods.

CTE-TECED.912.8600550.7.6

Apply geometric numeric and parametric constraints to form CAD modeled parts.

CTE-TECED.912.8600550.7.7

Assemble the product using the CAD modeling software.

CTE-TECED.912.8600550.7.8

Explain what constraints are and why they are included in a design brief.

CTE-TECED.912.8600550.7.9

Describe the difference between a criteria and a constraint.

Create a marketing tool related to the designed solution for the chosen problem, such as a consumer product, a dispensing system, a new form of control system, or extend a product design to meet a new requirement.

CTE-TECED.912.8600550.8 - Take, record, manipulate, and convert measurements using both the standard and metric system of linear measurement.

Take, record, manipulate, and convert measurements using both the standard and metric system of linear measurement.

CTE-TECED.912.8600550.8.1

Using a variety of measuring devices, measure and report quantities accurately and to a precision appropriate for the purpose.

CTE-TECED.912.8600550.8.2

Measure and record linear distances using a dial caliper to a precision of 0.001 inch.

CTE-TECED.912.8600550.8.3

Use appropriate statistical methods and visualization techniques to justify claims based on evidence.

CTE-TECED.912.8600550.8.4

Calculate the mean, mode, median, range, standard deviation of a data set.

CTE-TECED.912.8600550.8.5

Create a histogram of recorded measurements showing data elements or class intervals, and frequency.

CTE-TECED.912.8600550.8.6

Apply mathematical (including graphical) models and interpret the output of models to test ideas or make predictions.

CTE-TECED.912.8600550.9 - Describe the impact of visual design on the success or acceptability of an engineering design.

Describe the impact of visual design on the success or acceptability of an engineering design.

CTE-TECED.912.8600550.8.1

Describe the elements of design.

CTE-TECED.912.8600550.8.2

Identify visual design elements within a given object.

CTE-TECED.912.8600550.8.3

Explain how visual design principles were used to manipulate design elements within a given object.

CTE-TECED.912.8600550.8.4

Explain what aesthetics is, and how it contributes to a design's commercial success.

CTE-TECED.912.8600550.8.5
Identify the purpose of packaging in the design of consumer products.

CTE-TECED.912.8600550.8.6
Identify visual design principles and elements that are present within marketing ads.

CTE-TECED.912.8600550.8.7
Identify the intent of a given marketing ad and demographics of the target consumer group for which it was intended.

CTE-TECED.912.8600550.10 - Demonstrate and understanding of reverse engineering and reverse engineer a product.
Demonstrate and understanding of reverse engineering and reverse engineer a product.

CTE-TECED.912.8600550.9.1
Define reverse engineering and describe its value to engineering design.

CTE-TECED.912.8600550.10.2
Analyze a consumer product using reverse engineering techniques to document visual, functional, and structural aspects of the design.

CTE-TECED.912.8600550.10.3
Describe the life cycle of a product or service.

CTE-TECED.912.8600550.10.4
Understand how different machine elements influence motion of a mechanical system.

CTE-TECED.912.8600550.10.5
Describe different types of materials and their common usage in product design.

CTE-TECED.912.8600550.10.6
Identify material processing methods that are used to manufacture the components of a given commercial product.

CTE-TECED.912.8600550.10.7
Assign a density value to a material, and apply it to a given solid CAD model.

CTE-TECED.912.8600550.10.8
Perform computer analysis to determine mass, volume, and surface area of a given object.

CTE-TECED.912.8600550.10.9
Describe the function of a given manufactured object as a sequence of operations through visual analysis and inspection (prior to dissection).

CTE-TECED.912.8600550.11 - Actively participate on a team driven projects.
Actively participate on a team driven projects.

CTE-TECED.912.8600550.10.1

Define what a team is and explain why teams of people are used to solve problems.

CTE-TECED.912.8600550.10.2

Describe and illustrate group norms and why they are essential to a highly effective team.

CTE-TECED.912.8600550.10.3

Identify group norms that allow a virtual design team to function efficiently.

CTE-TECED.912.8600550.10.4

Establish file management and file revision protocols to ensure the integrity of current information.

CTE-TECED.912.8600550.10.5

Use internet resources, such as email, to communicate with a virtual design team member throughout a design challenge.

CTE-TECED.912.8600550.10.6

Identify strategies for addressing and solving conflicts that occur between team members.

CTE-TECED.912.8600550.10.7

Describe a Gantt chart and explain its purpose.

CTE-TECED.912.8600550.10.8

Create a Gantt chart to manage the various phases of their design challenge.

Related CTE Program

0821010102:   Engineering Pathways

This course exposes students to the design process, research and analysis, teamwork, communication methods, global and human impacts, engineering standards, and technical documentation. Students will employ engineering and scientific concepts in the solution of engineering design problems. In addition, they will learn to use 3D solid modeling design software to design solutions to problems. Students will develop problem-solving skills and apply their knowledge of research and design to create solutions, document the process, and communicate the results.

0821010102:   Engineering Pathways

This course exposes students to the design process, research and analysis, teamwork, communication methods, global and human impacts, engineering standards, and technical documentation. Students will employ engineering and scientific concepts in the solution of engineering design problems. In addition, they will learn to use 3D solid modeling design software to design solutions to problems. Students will develop problem-solving skills and apply their knowledge of research and design to create solutions, document the process, and communicate the results.

State Adopted Instructional Materials

[Author(s)], ([Copyright]), [Title] ([Edition] ed.), [Publisher].

CPALMS Educational Resources

Click HERE to access more than [XXXX] CPALMS-approved educational resources aligned to the standards and benchmarks in this CTE program.