Texas CTE

Robotics II

General requirements. This course is recommended for students in Grades 10-12. Prerequisite: Robotics I. Students shall be awarded one credit for successful completion of this course. R2.A

A **General requirements. This course is recommended for students in Grades 10-12. Prerequisite: Robotics I. Students shall be awarded one credit for successful completion of this course.** R2.A

Introduction. R2.B

1 **Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.** R2.B.1

2 **The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.** R2.B.2

3 **In Robotics II, students will explore artificial intelligence and programming in the robotic and automation industry. Through implementation of the design process, students will transfer academic skills to component designs in a project-based environment. Students will build prototypes and use software to test their designs.** R2.B.3

4 **The mathematical process standards describe ways in which students are expected to engage in the content. The placement of the process standards at the beginning of the knowledge and skills listed for each grade and course is intentional. The process standards weave the other knowledge and skills together so that students may be successful problem solvers and use mathematics efficiently and effectively in daily life. The process standards are integrated at every grade level and course. When possible, students will apply mathematics to problems arising in everyday life, society, and the workplace. Students will use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution. Students will select appropriate tools such as real objects, manipulatives, paper and pencil, and technology and techniques such as mental math, estimation, and number sense to solve problems. Students will effectively communicate**

Skip to main content

mathematical ideas, reasoning, and their implications using multiple representations such as symbols, diagrams, graphs, and language. Students will use mathematical relationships to generate solutions and make connections and predictions. Students will analyze mathematical relationships to connect and communicate mathematical ideas. Students will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication. R2.B.4

5 **Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.** R2.B.5

6 **Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.** R2.B.6

Knowledge and skills. R2.C

1 **The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:** R2.C.1

- a distinguish the differences among an engineering technician, engineering technologist, and engineer; R2.C.1.A
- b identify employment and career opportunities; R2.C.1.B
- c identify industry certifications; R2.C.1.C
- d recognize the principles of teamwork related to engineering and technology; R2.C.1.D
- e identify and use appropriate work habits; R2.C.1.E
- f locate and report on governmental regulations and laws, including health, safety, and labor codes related to engineering; R2.C.1.F
- g discuss ethical issues related to engineering and technology and incorporate proper ethics in submitted projects; R2.C.1.G
- h demonstrate respect for diversity in the workplace; R2.C.1.H
- i demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality; R2.C.1.I
- j demonstrate effective oral and written communication skills using a variety of software applications and media; R2.C.1.J
- k explore robotic engineering careers and preparation programs. R2.C.1.K

2 **The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:** R2.C.2

- a apply mathematics to problems arising in everyday life, society, and the workplace; R2.C.2.A

Skip to main content

b use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution; R2.C.2.B

c select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems; R2.C.2.C

d communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate; R2.C.2.D

e create and use representations to organize, record, and communicate mathematical ideas; R2.C.2.E

f analyze mathematical relationships to connect and communicate mathematical ideas; R2.C.2.F

g display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication. R2.C.2.G

3 **The student learns and contributes productively as an individual and as a member of a project team. The student is expected to:** R2.C.3

a demonstrate an understanding of and discuss how teams function; R2.C.3.A

b apply teamwork to solve problems; R2.C.3.B

c follow directions and decisions of responsible individuals of the project team; R2.C.3.C

d participate in establishing team procedures and team norms; R2.C.3.D

e work cooperatively with others to set and accomplish goals in both competitive and noncompetitive situations. R2.C.3.E

4 **The student develops skills of project management. The student is expected to:** R2.C.4

a implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project; R2.C.4.A

b develop a project schedule and complete work according to established criteria; R2.C.4.B

c participate in the organization and operation of a real or simulated engineering project; R2.C.4.C

d translate and employ a Project Management Plan for production of a product. R2.C.4.D

5 **The student practices safe and proper work habits. The student is expected to:** R2.C.5

Skip to main content

master relevant safety tests; R2.C.5.A

comply with safety guidelines as described in various manuals, instructions, and regulations; R2.C.5.B

c identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations; R2.C.5.C

d dispose of hazardous materials and wastes appropriately; R2.C.5.D

e comply with established guidelines for working in a lab environment; R2.C.5.E

f handle and store tools and materials correctly; R2.C.5.F

g employ established inventory control and organization procedures; R2.C.5.G

h describe the results of negligent or improper maintenance. R2.C.5.H

---

6 **The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:** R2.C.6

a demonstrate the use of computers to manipulate a robotic or automated system and associated subsystems; R2.C.6.A

b troubleshoot and maintain systems and subsystems to ensure safe and proper function and precision operation; R2.C.6.B

c implement feedback control loops used to provide information; R2.C.6.C

d implement different types of sensors used in robotic or automated systems and their operations. R2.C.6.D

---

7 **The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:** R2.C.7

a apply the concepts of acceleration and velocity as they relate to robotic and automated systems; R2.C.7.A

b describe the term degrees of freedom and apply it to the design of joints used in robotic and automated systems; R2.C.7.B

c describe angular momentum and integrate it in the design of robotic joint motion, stability, and mobility; R2.C.7.C

d use the impulse-momentum theory in the design of robotic and automated systems; R2.C.7.D

e explain translational, rotational, and oscillatory motion in the design of robotic and automated systems; R2.C.7.E

f apply the operation of direct current (DC) motors, including control, speed, and torque; R2.C.7.F

g apply the operation of servo motors, including control, angle, and torque; R2.C.7.G

h interpret sensor feedback and calculate threshold values; R2.C.7.H

i apply measurement and geometry to calculate robot navigation; R2.C.7.I

j implement movement control using encoders; R2.C.7.J

k implement path planning using geometry and multiple sensor feedback. R2.C.7.K

Skip to main content

'**he student creates a program to control a robotic or automated system. The tudent is expected to:** R.2.C.8

a use coding languages and proper syntax; R.2.C.8.A

b use programming best practices for commenting and documentation; R.2.C.8.B

c describe how and why logic is used to control the flow of the program; R.2.C.8.C

d create a program flowchart and write the pseudocode for a program to perform an operation; R.2.C.8.D

e create algorithms for evaluating a condition and performing an appropriate action using decisions; R.2.C.8.E

f create algorithms that loop through a series of actions for a specified increment and for as long as a given condition exists; R.2.C.8.F

g create algorithms that evaluate sensor data as variables to provide feedback control; R.2.C.8.G

h use output commands and variables; R.2.C.8.H

i use selection programming structures such as jumps, loops, switch, and case; R.2.C.8.I

j implement subroutines and functions. R.2.C.8.J

9 **The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:** R2.C.9

a demonstrate knowledge of robotic or automated system arm construction; R2.C.9.A

b demonstrate an understanding and apply the concepts of torque, gear ratio, stability, and weight of payload in a robotic or automated system arm operation; R2.C.9.B

c demonstrate an understanding and apply the concepts of linkages and gearing in end effectors and their use in a robotic or an automated arm system. R2.C.9.C

10 **The student uses engineering design methodologies. The student is expected to:** R2.C.10

a implement the design process; R2.C.10.

b demonstrate critical thinking, identify the system constraints, and make fact-based decisions; R2.C.10.B

c apply formal testing and reiteration strategies to develop or improve a product; R2.C.10.C

d apply and defend decision-making strategies when developing solutions; R2.C.10.D

e identify and improve quality-control issues in engineering design and production; R2.C.10.E

f apply Six Sigma to analyze the quality of products and how it affects engineering decisions; R2.C.10.F

Skip to main content

g use an engineering notebook to document the project design process as a legal document; R2.C.10.G

h create and interpret industry standard system schematics R2.C.10.H

11 The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to: R2.C.11

a use and maintain tools and laboratory equipment in a safe manner to construct and repair systems; R2.C.11.A

b use precision measuring instruments to analyze systems and prototypes; R2.C.11.B

c implement a system to identify and track all components of the robotic or automated system and all elements involved with the operation, construction, and manipulative functions; R2.C.11.C

d use multiple software applications to simulate robot behavior and present concepts. R2.C.11.D

12 The student produces a product using the appropriate tools, materials, and techniques. The student is expected to: R2.C.12

a use the design process to design a robotic or automated system that meets pre-established criteria and constraints; R2.C.12.A

b identify and use appropriate tools, equipment, machines, and materials to produce the prototype; R2.C.12.

c implement sensors in the robotic or automated system; R2.C.12.C

d construct the robotic or automated system; R2.C.12.D

e use the design process to evaluate and formally test the design; R2.C.12.E

f refine the design of the robotic or automated system to ensure quality, efficiency, and manufacturability of the final robotic or automated system; R2.C.12.F

g present the final product using a variety of media. R2.C.12.G