Indiana Department of Education
Academic Standards Course Framework

Robotics Design and Innovation

Robotics Design and Innovation allows students to design, program, and test innovative technological designs related to robotic systems. Topics involve mechanics, pneumatics, control technologies, computer fundamentals, and programmable control technologies. Students design, build, and optimize robots to perform a variety of predesignated tasks. Individuals or small teams may choose to participate in organized robotic competitions or develop their own events during the course. Students will investigate all aspects of the industries related to robotics design and innovation and explore collegiate programs of study.

- DOE Code: 4728
- Recommended Grade Level: 9-12
- Recommended Prerequisites: None
- Credits: 1 or 2 semesters, 1 credit per semester, 2 credits maximum
- Counts as a Directed Elective or Elective for all diplomas

Career and Technical Student Organizations

Career and Technical Student Organizations are considered a powerful instructional tool when integrated into Career and Technical Education programs. They enhance the knowledge and skills students learn in a course by allowing a student to participate in a unique program of career and leadership development. Students should be encouraged to participate in a Career and Technical Student Organization, such as the **Technology Student Association (TSA).**

Domain 1: Safety and Impact

Core Standard 1   **Students will exhibit appropriate safety practices while working with tools and equipment.**

RDI-1.1   Demonstrate relevant safety practices when using tools and equipment as determined by task, materials, environment, and protective attire.

RDI-1.2   Identify safety factors that impact robot design and function.

RDI-1.3   Apply corrective action to eliminate hazards.

RDI-1.4   Demonstrate proper use requirements for manual, electrical, and pneumatic tools.

Core Standard 2   **Students will examine the impact of robotics on society.**

RDI-2.1   Investigate the evolution of robotics and the impact on society and commerce throughout history.

RDI-2.2   Evaluate ethical principles governing robot design.

RDI-2.3   Examine how local, state, federal, and industrial regulations affect the construction and activity of robots.

RDI-2.4   Investigate how innovations in robotics impacts industrial, commercial, and societal change.

Domain 2: Mechanical Systems and Electrical Layout

Students will design, build, and test a robot with all of the mechanical and electrical components necessary to complete a predetermined task.

Core Standard 3 **Students will apply a design process to solve a predetermined task.**

RDI-3.1 Analyze what tasks the robot will perform.

RDI-3.2 Prioritize the tasks the robot will perform.

RDI-3.3 Evaluate which mechanisms and systems will best perform each task.

RDI-3.4 Assess the effect that a change in one part of a system is likely to have on the system as a whole.

RDI-3.5 Document the design process.

Core Standard 4 **Students will build a gearbox that best fits the required task.**

RDI-4.1 Determine how much weight a motor will lift.

RDI-4.2 Calculate how much current a component draws.

RDI-4.3 Compare and contrast how gear ratios affect speed and torque.

Core Standard 5 **Students will research, design, and fabricate a drivetrain.**

RDI-5.1 Analyze mobility methods for optimal performance.

RDI-5.2 Investigate techniques to transmit speed and torque.

Core Standard 6 **Students will investigate different types of sensors, manipulators, storage systems, linkages, and elevators.**

RDI-6.1 Compare and contrast various methods of manipulating objects of different sizes and shapes.

RDI-6.2 Generate methods of storing and transporting objects from one point to another.

RDI-6.3 Evaluate optimal use of sensors to carry out a specific task.

Domain 3: Programming and Control

Core Standard 7 **Students will program a robot to complete a predetermined task.**

RDI-7.1 Interpret various programming languages.

RDI-7.2 Evaluate and design multi-step programs.

RDI-7.3 Outline programming diagrams specific to applications.

RDI-7.4 Formulate machine order of operations.

RDI-7.5 Differentiate between different types of path control systems.

RDI-7.6 Identify robot coordinate systems.

RDI-7.7 Examine the use of programming software to operate a robot autonomously including GPS, sensors, and vision.

RDI-7.8 Troubleshoot programs and systems.

Domain 4: Communications

Core Standard 8   **Students will document the design process.**

RDI-8.1   Outline requirements and objectives in a design brief for a robot.
RDI-8.2   Analyze required deadlines to see if goals were completed on time.
RDI-8.3   Communicate required deadlines and progress.
RDI-8.4   Maintain documentation of design choices, progress, & outcomes.
RDI-8.5   Develop an electronic record to communicate daily progress.

Core Standard 9   **Students will effectively communicate team objectives, design choices, & team progress to their peers & community.**

RDI-9.1   Devise organizational structure for the group that defines each necessary role.
RDI-9.2   Create an initial presentation outlining the team's priorities for design.
RDI-9.3   Collaborate with industry professionals.
RDI-9.4   Generate a summary of the design process leading to the completed product that can be shared with the class and industry professionals that support the design review.
RDI-9.5   Produce constructive feedback on peer group presentations.
RDI-9.6   Critique peer effectiveness on defined group roles.

Domain 5: College and Career Readiness

Core Standard 10   **Students will explore careers related to automation and robotics.**

RDI-10.1   Analyze educational and skill requirements for positions related to automation and robotics.
RDI-10.2   Investigate careers related to automation and robotics including career-ready jobs and those positions requiring post-secondary education.
RDI-10.3   Identify jobs that align with pathways linked to production, engineering, technology, and business.
RDI-10.4   Identify course requirements, certifications, and career prospects for collegiate programs related to robotics.
RDI-10.5   Analyze employment trends and projected wages for careers in all aspects of the industries related to automation and robotics.