FIRST EDUCATION

Intro to Engineering & Robotics | Course Overview

Year-Long Course Outline with CTE Competencies

Equipment Requirements – XRP robot, *FIRST* Tech Challenge Starter Bot, *FIRST* Robotics Competition Kit Bot

Course Description

This year-long introductory course engages students in hands-on engineering through mechanical design, electronics, programming, and problem-solving activities using authentic *FIRST* robotics platforms. Students develop foundational skills in CAD, prototyping, data collection, and mechanical systems while learning the full engineering design process—from defining problems to testing and iterating solutions.

The course is designed for maximum flexibility and can be implemented with XRP, *FIRST* Tech Challenge, or *FIRST* Robotics Competition hardware, allowing educators to tailor the experience to their classroom resources.

Course Outcomes

COMPETENCY	STUDENT OUTCOMES
Demonstrate Safe and Effective Use of Engineering Tools and Environments	Students will apply proper safety practices, follow lab protocols, and use measurement and hand tools accurately while working in engineering and prototyping environments.
Apply the Engineering Design Process to Solve Problems	Students will identify problems, define criteria and constraints, brainstorm solutions, create prototypes, test designs, and iterate based on data and evaluation.
Communicate Using Technical Documentation and Engineering Standards	Students will produce sketches, engineering drawings, CAD models, design logs, reports, presentations, and documentation that follow industry standards for clarity and accuracy.
Demonstrate Knowledge of Materials, Mechanical Systems and Basic Engineering Principles	Students will explain the properties of common engineering materials, mechanical advantages, linkages, gears, and foundational concepts used in mechanical design.
Apply Computer Science Skills to Program Robotic Systems	Students will use program-specific IDE to develop code to control their robot. They will learn to work with code libraries, analyze sample code, and apply program structure and flow to complete robotics tasks. Students will also incorporate sensor data, PID control, and debugging techniques to improve robot performance.
Construct and Test Basic Circuits, Sensors and Introductory Automation Systems	Students will design and build simple electrical circuits, operate sensors, collect data, and use microcontrollers to automate basic engineering tasks.
Analyze Data to Inform Engineering Decisions	Students will collect, interpret, and visualize data from tests, sensors, experiments, or prototypes, using this information to evaluate performance and justify design choices.
Collaborate Effectively in Engineering Teams	Students will demonstrate teamwork skills including communication, conflict resolution, delegation, project management, and shared responsibility in group engineering tasks.
Present Engineering Designs and Defend Decisions Using Evidence	Students will deliver verbal, written, and visual presentations that explain a design's purpose, constraints, operation, test outcomes, and recommended improvements using sound engineering reasoning.

Industry Certifications

- Onshape: Certified Associate
- Autodesk: Certified Associate CAD for Mechanical Design-Fusion
- OSHA: 10 Hour Safety Training
- Python Institute: PCEP – Certified Entry-Level Python Programmer

FIRST Training learning content that can be used to implement this course.

XRP Trainings	Engineering Explorations Course	*FIRST* Robotics Competition Trainings	*FIRST* Tech Challenge Skill Builders
XRP Engineering Design Process	Unit 1: Welcome to *FIRST*	Module 1: Intro to *FIRST* Robotics Competition	Chassis and Drive Systems Lesson and Challenges
XRP Creating Movement	Unit 2: Build a Bot	Module 2: How does *FIRST* Robotics Competitions Work?	Intakes Lesson and Challenges
XRP Advanced Gears and Movement	Unit 3: Make it Move	Module 3: Intro to CAD and 3D Printing	Programming Lesson and Challenges
XRP Programming Drivetrain	Unit 4: Programming Autonomous Robots	Module 4: Fabrication Tools and Safety	
XRP Programming Sensors	Unit 5: Build and Program Manipulators	Module 5: Rapid Prototyping	
	Unit 6: The Ball Game		

Standards Alignments

Organization	Aligned Standards
NGSS	HS-ETS1-1, HS-ETS1-2, HS-ETS1-3, HS-ETS1-4, HS-PS2-1, HS-PS2-2, HS-PS3-3
ISTE	1.1.a, 1.1.c, 1.5.a, 1.5.b, 1.5.c, 1.6.a, 1.6.b, 1.7.b
ITEEA (STEL)	1I, 2O, 3J, 4H, 5G, 6E, 7H, 7I, 8H, 9J
NIMS	Measurement Materials & Safety (MMS), Job Planning Benchwork & Layout, Quality & Continuous Improvement, Maintenance Awareness, Workforce Readiness
NBEA	Information Technology I.A, Communication III.A, Management III.A, Career Development I.B
ACTE-CRP	CRP1, CRP2, CRP4, CRP5, CRP6, CRP7, CRP8, CRP9, CRP11, CRP12