

Industry 4.0 and Robotics Fundamentals Course Outline

The prerequisites for this course include the Engineering Explorations course or combination of Introduction to Programming and Introduction to CAD courses. Equipment requirements include the XRP robot or FTC Control System, 3D Printer or other fabrication tools.

In this course, students will develop an industrial style robot and learn knowledge that aligns to the [SME Robotics Fundamentals and Manufacturing Certification](#). Students will design a class factory which makes promotional materials for your school. Groups in the class will utilize robots to automate the production process using manufacturing techniques and manufacturing style robots.

Lesson		Time
Engineering Design Process, Teamwork and Project Management	<ul style="list-style-type: none"> a) Students will be tasked with their engineering challenge for the course designing and building a smart factory with industrial robots. b) Students will learn about working collaboratively in teams through Engineering Design Process and Project Management. c) Students will develop design criteria and constraints for their challenge. d) Students will document process and project management with an engineering notebook. 	5 hours
Industry 4.0 Principles	<ul style="list-style-type: none"> a) Students will get an introduction to industry 4.0 principles and the design of a smart factory. b) Students will learn how to utilize Internet of things technology to increase data connectivity and transmission on their robot. c) Students will brainstorm how they can include the principles of a smart factory and industry 4.0 into their class factory. 	5 hours
Industrial Robots Overview	<ul style="list-style-type: none"> a) Students will learn about the parts of an industrial robot and how it is a critical part of manufacturing including robot applications. b) Students will learn about types of automation and manufacturing productions and processes. c) Students will learn about robot safety design, process, and procedures. 	10 hours
Robot Types	<ul style="list-style-type: none"> a) Students will learn about different types of robots used in manufacturing (collaborative, mobile/autonomous/stationary). b) Students will determine which types of robots might successfully help them execute their class factory. c) Students will implement the types of robots into their design plan. 	10 hours
Robot Hardware and Software	<ul style="list-style-type: none"> a) Students will learn about the parts of a manufacturing robot including body, joints, arms, encoders, and end effectors. b) Students will determine motor and drive systems/actuators. c) Students will analyze different robot sensors. d) Students will discover different payloads, potentiometers, conveyors, and their applications. e) Students will learn how the hardware and software combine to make an operator interface. 	15 hours

Robot Design and Fabrication	<ul style="list-style-type: none"> a) Students will apply their knowledge of types of robots, robot hardware, and robot software to design their class factory. b) Students will choose the best type of robot that can complete the task required in the factory. c) Students will fabricate the design using either a 3D printer or other manufacturing techniques depending on the task. d) Students will build basic robot with the needed robot components, hardware, and software. 	30 hours
Robot Programming and Operations	<ul style="list-style-type: none"> a) Students will read and interpret prints and drawings. b) Students will understand robot coordinate systems and how they relate to the robot operations and execution. c) Students will understand the basics of control systems and open and closed loop programming. d) Students will understand how to utilize commands, input/output monitor instructions, device configuration, arrays, robot motion, singularity, online and offline programming. e) Students will determine how the robot can provide real-time feedback and make decisions increasing its smart technology. 	30 hours
Adding Programming and Operations to Manufacturing Robot	<ul style="list-style-type: none"> a) Students will determine the best process of robot programming and operation to improve their manufacturing robot. b) Students will integrate their robot design and improve it through testing and iteration. 	30 hours
Improving through Iteration	<ul style="list-style-type: none"> a) Students will continue to collaborate and improve their manufacturing facility through iteration and testing, improving their robot programming and control components as well as their mechanical design. 	20 hours
Exam Preparation	<ul style="list-style-type: none"> a) Students will review the body of knowledge for the SME Robotics Fundamentals Certification Exam. b) Students will take a practice exam and determine what knowledge they will need to study for the exam. c) Students will continue to identify knowledge needed and apply the knowledge on their robots. d) Students will take the SME Robotics Fundamentals Certification Exam. 	20 hours

