

Robotics I, Semester B

Course Overview

Robotics I, Semester B is a one-semester course that addresses more advanced concepts related to robotics. This course begins by describing the importance of project management in the success of a project. You will describe the steps of the engineering design process. You will identify the use of software to control robots. You will create a robotic arm. You will describe the ethics and laws related to robotics. You will create a robot using programming. This course covers how to test and maintain a robotic system. This course also covers how to create and present a proposal for a robot.

Course Goals

By the end of this course, you will:

- Describe the importance of project management steps in the success of a project.
- Create a plan and schedule for a project.
- Identify and explain the steps of the engineering design process.
- Explain the use of software to control robots.
- Create a motorized robotic arm.
- Describe basic control methods and elements of feedback control systems.
- Describe ethics and laws related to robotics.
- Describe the tools and software needed to build a prototype.
- Design, construct, program, and test a robot.
- Describe the maintenance of a robot.
- Create and present a proposal for a robot.

Prerequisite Skills

Robotics I, Semester B has a prerequisite course, Robotics I Semester A.

General Skills

To participate in this course, you should be able to do the following:

- Complete basic operations with word-processing, spreadsheet, and presentation software.
- Perform online research using various search engines and library databases.
- Communicate through email and discussion boards.

For a complete list of general skills that are required for participation in online courses, refer to the Prerequisites section of the Student Orientation document, found at the beginning of this course.

Credit Value

Robotics I, Semester B is a 0.5-credit course.

Course Materials

- Notebook
- Computer with Internet connection and speakers or headphones
- Microsoft Word or equivalent
- Microsoft PowerPoint or equivalent
- Microsoft Excel or equivalent
- Scanner
- Camera
- Materials listed in Appendix B (Appendix C provides a detailed breakdown of these materials by activity.)

Note: Your course teacher will provide directions on necessary materials, based on the teacher's specific activity plans and recommendations provided in the Robotics Teacher's Guide.

Course Pacing Guide

This course description and pacing guide is intended to help you stay on schedule with your work. Note that your course teacher may modify the schedule to meet the specific needs of your class.

Course Components and Grading Rubric

The table gives a breakdown of the weight for each component in the course. Weight represents the percentage of the total score coming from each activity.

Course Components	Count	Weight
Pretest. <i>Pretests are optional assessments, typically designed for credit recovery use. If a student shows mastery of a lesson's objective, the student may be automatically exempted from that lesson in the upcoming unit. Typically, teachers do not choose to employ exemptive pretests for first-time credit courses. Pretests are not included as a component of the student's final grade.</i>	4	0%
Module. <i>Each module in this course contains an interactive tutorial and an associated mastery test. Tutorials may include one or more Lesson Activities that constitute tasks associated with the tutorial. The module score comes from a student's score on the mastery test.</i>	12	20%
Discussion. <i>Online discussions allow for higher-order thinking about terminal objectives. An online threaded discussion mirrors the educational experience of a classroom discussion. Teachers can initiate a discussion by asking a complex, open-ended question. Students can engage in the discussion by responding both to the question and to the thoughts of others. Each unit in a course has one predefined discussion topic; teachers may add more discussion topics.</i>	4	20%
Unit Activity. <i>Unit Activities are at the end a unit and constitute one or more small tasks. Their purpose is to deepen understanding of key unit concepts and tie them together. Each Unit Activity includes a simple rubric. The teacher versions include both a rubric and modeled sample answers. Unit Activities are teacher graded.</i>	4	20%
Posttest. <i>The posttest appears at the end of the unit and mirrors the pretest in structure, content, and complexity.</i>	4	20%
End of Semester Test. <i>The end of semester test (EOS) appears at the end of the course. Students are delivered a few items from every tutorial in the course in order to assess the major course objectives.</i>	1	20%
Total	29	100%

**Teachers may manually adjust these weights if desired, per district grading requirements.*

Unit 1: Project Management and Designing Robots

Summary

In this unit, you will describe project management steps such as initiating, planning, executing, monitoring and controlling, and closing a project. You will describe the importance of a good project plan. You will create a plan and schedule for a project. You will describe how to control and track a project schedule. Finally, you will explain the importance of design and describe the steps of the engineering design process.

Day	Activity/Objective	Type
1 day: 1	Syllabus and Student Orientation <i>Review the Student Orientation and Course Syllabus at the beginning of this course.</i>	Course Orientation
4 days: 2–5	Project Management <i>Describe various steps in project management.</i>	Lesson
5 days: 6–10	Planning and Scheduling <i>Create a plan and schedule for a project.</i>	Lesson
6 days: 11–16	Robotic Design and Documentation <i>Describe the steps of the engineering design process and apply them to robotic applications.</i>	Lesson
6 days: 17–22	Unit Activity and Discussion—Unit 1	Unit Activity / Discussion
1 day: 23	Posttest—Unit 1	Assessment

Unit 2: Advanced Concepts of Robotics

Summary

In this unit, you will describe the use of computers to manipulate a robot and associated subsystems. You will explain the use of software to simulate robotic behavior. You will describe the components of a robotic arm. You will also describe robotic arm construction and stability. You will create a simple robotic arm. Finally, you will explain the basic control methods and describe the elements of feedback control systems.

Day	Activity/Objective	Type
5 days: 24–28	Programming Robots <i>Describe the software used to control robots.</i>	Lesson
5 days: 29–33	Robotic Arms and Manipulators <i>Explain the functioning of robotic arms.</i>	Lesson
6 days: 34–39	Robot Control System <i>Explain how robots execute intended sequence of actions without errors.</i>	Lesson
6 days: 40–45	Unit Activity and Discussion—Unit 2	Unit Activity / Discussion
1 day: 46	Posttest—Unit 2	Assessment

Unit 3: Constructing a Prototype

Summary

In this unit, you will describe the ethics and laws related to robots. You will also describe the levels of danger associated with robots and the ways to prevent these dangers. Additionally, you will describe the advantages of creating a prototype. You will also describe tools and software required to create a prototype. Finally, you will plan, design, and build a robot.

Day	Activity/Objective	Type
4 days: 47–50	Ethics and Laws <i>Describe ethics and laws related to robotics.</i>	Lesson
4 days: 51–54	Tools and Software <i>Identify the tools and software required to build a prototype.</i>	Lesson
6 days: 55–60	Build a Prototype <i>Build a robot or automated system that can perform a specific operation.</i>	Lesson
7 days: 61–67	Unit Activity and Discussion—Unit 3	Unit Activity / Discussion
1 day: 68	Posttest—Unit 3	Assessment

Unit 4: Robot Testing and Maintenance

Summary

In this unit, you will identify quality control issues. You will also evaluate and refine the robot design. You will test a robot. You will explain the maintenance of a robot and describe the maintenance issues related to robots. Finally, you will create a proposal for a robot.

Day	Activity/Objective	Type
4 days: 69–72	Test a Robot <i>Apply testing strategies to test and refine the robot.</i>	Lesson
4 days: 73–76	Robot Maintenance <i>Describe the maintenance of a robot.</i>	Lesson
5 days: 77–81	Proposal for a Robot <i>Create and present a proposal for a robot.</i>	Lesson
6 days: 82–87	Unit Activity and Discussion—Unit 4	Unit Activity / Discussion
1 day: 88	Posttest—Unit 4	Assessment
1 day: 89	Semester Review	
1 day: 90	End-of-Semester Test	Assessment

Course Map

You will achieve course level objectives by completing each lesson's instruction, assignments, and assessments. For a detailed look at how the materials meet these objectives, review the [course map for Semester B](#).

Appendix A: Safety Notes and Disclaimer

Lesson Activities and Unit Activities that includes a robotics lab component highlight key safety guidelines using the safety icon (⚠️), which appears directly in the activity. In addition to adhering to those guidelines, you must ensure that you follow these general safety practices:

- Work slowly and safely at all times, and abide by the safety notes and icons.
- Pay attention and be alert at all times. Limit any distractions.
- If you don't understand something, ask a teacher or an adult before proceeding.
- Follow the procedures.
- Follow good housekeeping practices. Keep your work area clean.
- Report any problems or complications to an adult.

NOTE: Edmentum assumes no liability for personal injury, property damage, equipment damage, or financial loss resulting from the instruction included in this course.

Appendix B: Course Lab Materials (Semesters A and B)

Required Household Materials

- cardboard
- paper
- half-liter plastic bottle
- masking tape
- sharpie
- paper clips
- drawing pins
- tennis ball
- tape
- knife
- string
- scissors
- glue gun
- marker
- drinking straws
- elastic bands
- plastic sheets
- presentation software
- word processing software
- spreadsheet software

Additional Required Materials

The italicized materials below are available in the suggested “minimum equipment” kit identified in the Robotics Course Teacher Guide.

- steel rod (about 5 to 6 inch in length and 1/4 inch in diameter)
- 1.5V DC bulb
- 1.5V DC bulb holder
- 2 insulated wires (20 inch length)
- 1.5 V DC switch
- multimeter
- resistors (1Ω, 10Ω, 1KΩ, 10KΩ, 2 220 Ω)
- breadboard
- breadboard wires
- 2 battery clips
- 2 LEDs
- 200 grams iron fillings
- small funnel
- plastic test tube
- cylindrical magnet that fits into the plastic test tube
- NE555 IC
- 100μF capacitor
- 9V battery
- wire stripper
- gears of varying sizes, 2 cm to 12 cm diameter
- 4 1.5V AA batteries

Minimum contents for major projects (Available in suggested kit identified in the Teacher Guide.)

- *chassis*
- *wheels*
- *2 6P6C RJ25 cables*
- *4 brass stud M4*25*
- *battery holder*
- *2 motors*
- *Velcro*
- *USB cable*
- *8 M3 nuts*
- *Arduino Uno microcontroller*
- *light sensor*
- *battery shell*
- *mini caster wheel*
- *screw driver*
- *screws*
- *ultrasonic sensor*

Appendix C: Lab Materials by Activity (Semester B)

The italicized materials below are available in the suggested “minimum equipment” kit identified in the Robotics Course Teacher Guide.

Unit	Lesson/Unit Activity Name	Task	Equipment List
1	Lesson B1.2: Planning and Scheduling	Lesson Activity: Creating a Schedule	spreadsheet software
2	Unit Activity 2: Advanced Concepts of Robotics	Creating a Motorized Robotic Arm	- one piece of plastic 400 mm x 400 mm x 1.2 mm (thick) - twelve gears of varying sizes, 2 cm to 12 cm diameter 9V battery - cardboard - battery clips to attach the wires to the battery - wires <i>two motors</i>
3	Lesson B3.2: Tools and Software	Lesson Activity: Creating a Prototype	- cardboard - drinking straws - scissors - elastic bands - glue gun
3	Unit Activity 3: Constructing a Prototype	Creating a Robot	You created a robot in Semester A using the minimum equipment kit. In this activity, you will connect this robot to the computer and write programming code to control the robot.
4	Lesson B4.1: Test a Robot	Lesson Activity: Social media	(No materials needed)
4	Unit Activity 4: Robot Testing and Maintenance	Task: Robot Testing and Maintenance	You created and programmed a robot in previous unit activities. In this activity, you will test the robot programmed in unit activity 3. You will describe how to maintain this robot.