

Robotics I Semester A

Course Overview

Robotics I, Semester A is a one-semester course that explains various concepts related to robotics. This course begins by describing the evolution and applications of robotics. This course helps you identify career opportunities and important employability skills in robotics. You will explain the importance of teamwork and describe the skills needed to work in a team. You will describe Newton's laws of motion and their applications in robotics. You will describe basic concepts of electricity, electronic circuits, Boolean algebra, magnetics, and their applicability to robotics. You will apply safety procedures and construct a simple robot.

Course Goals

By the end of this course, you will:

- Describe the evolution and applications of robotics.
- Identify career options in the field of robotics.
- Explain the importance of teamwork in the field of robotics.
- Describe Newton's laws of motion and their applicability to robotics.
- Explain the basic concepts of electricity and their application in robotics.
- Describe Boolean logic and construct truth tables.
- Describe the use of sensors in robotics.
- Describe the use of motors and gears in the movement of robots.
- Describe and apply safety procedures and practices when working with robots.
- Construct a simple robot.

General Skills

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

- Complete basic operations with word-processing software such as Microsoft Word and presentation software such as Microsoft PowerPoint.
- 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 A 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
- Scanner
- Camera
- materials listed in Appendix B (Appendix C provides a detailed breakdown of these materials by activity.)

Note: Your course instructor will provide directions on necessary materials, based on the instructor'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 instructor may modify the schedule to meet the specific needs of your class.

Unit 1: History and Careers

Summary

In this unit, you will describe the key milestones in the evolution of robotics and the future of robotics. You will identify courses, certifications, and job roles available in the field of robotics. Additionally, you will describe appropriate workplace etiquette and develop workplace performance goals. Finally, you will explain the characteristics of an effective team and identify leadership qualities required to build strong relationships among team members.

Day	Activity/Objective	Type
1 day:	Syllabus and Student Orientation	Course Orientation

Day	Activity/Objective	Type
1	<i>Review the Student Orientation and Course Syllabus at the beginning of this course.</i>	
4 days: 2–5	Introduction to Robotics <i>Describe the evolution and applications of robotics.</i>	Lesson
4 days: 6–9	Careers in Robotics <i>Identify career options in the field of robotics and educational qualifications required to enter the field of robotics.</i>	Lesson
4 days: 10–13	Employability Skills <i>Describe the skills required for a career in robotics.</i>	Lesson
4 days: 14–17	Teamwork <i>Explain the importance of teamwork in the field of robotics.</i>	Lesson
1 day: 18	Para Jumble	Game
5 days: 19–23	Unit Activity and Discussion—Unit 1	Unit Activity/ Discussion
1 day: 24	Posttest—Unit 1	Assessment

Unit 2: Foundations of Robotics

Summary

In this unit, you will describe the role and utility of six simple machines in robot creation. You will compare different forms of energy and also describe Newton’s three laws of motion. You will explain the basic concepts of electricity and their applications in robotics. Additionally, you will build a basic circuit on a breadboard and describe common electronic components. You will also explain the basic laws of Boolean algebra and construct truth tables and logical expressions. Finally, you will describe how magnetic fields are used for good controllability of robots and the use of magnetically actuated micro-robots in the healthcare industry.

Day	Activity/Objective	Type
4 days: 25–28	Six Simple Machines <i>Describe six simple machines and their applicability to robotics.</i>	Lesson
4 days: 29–32	Newton’s Laws of Motion <i>Describe Newton’s laws of motion and their applicability to</i>	Lesson

Day	Activity/Objective	Type
	<i>robotics.</i>	
4 days: 33–36	Electricity <i>Explain the basic concepts of electricity and their application in robotics.</i>	Lesson
4 days: 37–40	Electronic Circuits <i>Describe the operation of common electronic components and build a circuit on breadboard.</i>	Lesson
4 days: 41–44	Boolean Algebra <i>Describe Boolean logic and construct truth tables.</i>	Lesson
3 days: 45–47	Magnetics <i>Describe magnetics and its applicability to robotics.</i>	Lesson
1 day: 48	Space Jumble	Game
5 days: 49–53	Unit Activity and Discussion—Unit 2	Unit Activity/ Discussion
1 day: 54	Posttest—Unit 2	Assessment

Unit 3: Robotics Sensors and Motors

Summary

In this unit, you will describe different types of sensors and distinguish between active and passive sensors. You will also describe the use of gears in robotics and explain how a DC motor works. Finally, you will describe the purpose and use of servos in robotics and explain how angle and torque are controlled in a servo motor.

Day	Activity/Objective	Type
3 days: 55–57	Robotic Sensors <i>Describe the use of sensors in robotics.</i>	Lesson
3 days: 58–60	DC Motors <i>Describe the use of motors and gears in the movement of robots.</i>	Lesson
4 days: 61–64	Servo Motors <i>Describe the use of servos in the movement of robots.</i>	Lesson
1 day: 65	Para Jumble	Game

Day	Activity/Objective	Type
3 days: 66–68	Unit Activity and Discussion—Unit 3	Unit Activity/ Discussion
1 day: 69	Posttest—Unit 3	Assessment

Unit 4: Constructing a Robot

Summary

In this unit, you will apply safety guidelines based on the manuals and instruction guides. You will identify governmental and organizational regulations for health and safety at the workplace. You will also list and describe various tools needed in the construction of robots. Finally, you will plan, design, and construct a robot.

Day	Activity/Objective	Type
4 days: 70–73	Safety <i>Describe and apply safety procedures and practices when working with robots.</i>	Lesson
4 days: 74–77	Tools and Components <i>Describe various tools and components required to build robots.</i>	Lesson
4 days: 78–81	Build a Robot <i>Construct a simple robot.</i>	Lesson
1 day: 82	Thwack-A-Mole	Game
5 days: 83–87	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

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 (1 Ω , 10 Ω , 1K Ω , 10K Ω , 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
- 100 μ F 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 A)

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	Unit Activity: History and Careers	Task: Careers and Skills	presentation software
2	Lesson 2.1: Six Simple Machines	Lesson Activity: Simple and Compound Machines (Part C)	<ul style="list-style-type: none"> • cardboard • string • rod
2	Lesson 2.3: Electricity	Lesson Activity: Building a Simple Circuit	<ul style="list-style-type: none"> • 1.5V DC bulb • 1.5V DC bulb holder • 2 insulated wires • 1.5 V DC switch • batteries • <i>battery holder</i>
		Lesson Activity: Ohm's Law	<ul style="list-style-type: none"> • 2 insulated wires • multimeter • resistors (1Ω, 10Ω) • DC switch • batteries
2	Lesson 2.4: Electronic Circuits	Lesson Activity: Breadboard Creation	<ul style="list-style-type: none"> • breadboard • breadboard wires • 9V battery • battery clip • 1 LED • 1kΩ resistor
2	Lesson 2.6: Magnetism	Lesson Activity: Magnetic Lines of Force	<ul style="list-style-type: none"> • half-liter plastic bottle • iron fillings • plastic test tube whose length is almost equal to the bottle and that easily fits into the bottle's mouth • masking tape • funnel • cylindrical magnet that fits into the plastic test tube

Unit	Lesson/Unit Activity Name	Task	Equipment List
2	Unit Activity: Foundations of Robotics	Task 1: Newton's Laws	<ul style="list-style-type: none"> • sharpie • paper • drawing pins • tennis ball
		Task 2: Breadboarding a Circuit	<ul style="list-style-type: none"> • NE555 IC • 100μF capacitor • LEDs (2) (any color) • 220Ω resistors (2) • 1KΩ resistor • 10KΩ resistor • 9V battery • wires • breadboard
3	Lesson 3.2: DC Motors	Lesson Activity: Building a Motor	<ul style="list-style-type: none"> • insulated wire • tape • marker • paper clips • magnet • battery
4	Lesson 4.3: Build a Robot	Lesson Activity: Building a Robot	(No materials needed)

Unit	Lesson/Unit Activity Name	Task	Equipment List
4	Unit Activity: Constructing a Robot	Task: Constructing a Robot	<ul style="list-style-type: none"> • 4 1.5V AA batteries • <i>chassis</i> • <i>wheels</i> • <i>2 6P6C RJ25 cables</i> • <i>4 brass stud M4*25</i> • <i>battery holder</i> • <i>2 motors</i> • <i>Velcro</i> • <i>USB cable</i> • <i>8 M3 nuts</i> • <i>Arduino Uno microcontroller</i> • <i>light sensor</i> • <i>battery shell</i> • <i>mini caster wheel</i> • <i>screw driver</i> • <i>screws</i> • <i>ultrasonic sensor</i>