Robotics Engineering

Lesson Summary:

The field of robotics engineering is a sub field of mechanical engineering. Robotics engineers design robots and develop new applications for them for use in a wide range of industries. With new possibilities for robotics due to advances in the computer sciences, robotics engineering is growing rapidly. From production line robots to experimental robotics for the medical, military, and automotive industries, the future of robotics engineering will certainly offer a range of opportunities for professionals entering the field .

This three-day lesson introduces the topic of robotics engineering as a career choice. On Day One, students will take a pre-assessment of their knowledge of robotics engineering. They will complete a viewing log based on a thirteen-minute video interview with a robotics engineer from Motoman Corporation in Dayton, Ohio. On Day Two of the lesson, students will draw on a homework research assignment to create five-minute group presentations on emerging technologies in the field of robotics engineering. The lesson culminates with group presentations the following day.

Estimated Duration: Three days, 55 minutes each, for instruction and group presentations

Ohio Academic Content Standards
Grade

6

Content Area/Discipline:	Technology
Standard:	Design
Benchmark: B	Recognize the role of engineering design and of testing the design process.
Indicator: 3	Describe what an engineer does (e.g., analyze information found on engineering society Web site).
Content Area/Discipline:	Science
Standard:	Science and Society
Benchmark: C	Give examples of how thinking scientifically is helpful in everyday life.
Indicator: 4	Describe how the pursuit of scientific knowledge is beneficial for every career and in everyday life.

Grade 7

Content Area/Discipline:	Technology
Standard:	Design
Benchmark: B	Recognize the role of engineering design and of testing the design process.
Indicator: 2	Describe the relationship between engineering, science, mathematics.
Content Area/Discipline:	Science
Standard:	Scientific Ways of Knowing
Benchmark: C	Give examples of how thinking scientifically is helpful in daily life.
Indicator: 3	Describe how the work of science requires a variety of human abilities and qualities that are helpful in daily life (e.g., reasoning, creativity, skepticism, and openness.)

Grade 8

Content Area/Discipline:	Technology
Standard:	Design
Benchmark: B	Recognize the role of engineering design and of testing in the design process.
Indicator: 1	Summarize the role of engineering design.
Indicator: 2	Describe the relationship between engineering, science, and mathematics.
Content Area/Discipline:	Science
Standard:	Science and Technology
Benchmark: A	Find examples of how technological advances, influenced by scientific knowledge, affect the quality of life.
Indicator: 1	Examine how science and technology have advanced through the contributions of many different people, cultures, and times in history.

Grade 9

Content Area/Discipline:	Technology
Standard:	Design
Benchmark: B	Recognize the role of teamwork in engineering design and prototyping in the design process.
Indicator: 5	Describe how engineering design is influenced by personal characteristics such as creativity, resourcefulness, and the ability to visualize and think abstractly.
Content Area/Discipline:	Science
Standard:	Scientific Ways of Knowing
Benchmark: B	Recognize the role of teamwork in engineering design and prototype design and of prototyping in the design process.
Indicator: 8	Describe how engineering design is influenced by personal characteristics, such as creativity**,** resourceful ness, and the ability to visualize and think abstractly.

Vocabulary

Actuator:	a mechanical device for moving or controlling something
Algorithm:	a procedure for solving a problem, especially in mathematics or computing
Assembly Line:	an arrangement of machines, equipment, and workers in which work passes from operation to operation in direct line until the product is assembled
Automation:	an apparatus, a process, or a system operate automatically
Design:	to create, fashion, or execute according to a plan
Kinematics:	a science that deals with motion apart from considerations of mass and force
Mechatronics:	combination of mechanical engineering, electronic engineering, and software engineering
Prototype:	an orignal model for a new design
Robot:	a device that automatically performs complicated, often repetitive tasks
Service Robot:	assists human beings, typically by performing a job that is dirty, dull, distant or dangerous. Service robots typically are autonomous and/or operated by a build in control system, with manual override options
Industrial Robotics:	the study, design, and use of robot systems for manufacturing
Robotics:	a technology dealing with the design, construction, and operation of robots in automation

Procedure

Day One

1) Welcome students to Engineering Your Future: An Introduction to the World of Engineering.

2) Distribute the pre-assessment **Student Survey** to all students and have them hand in after completed.

3) Distribute copies of the **Viewing Log.** Have students complete the **Assumptions** column based on their understanding of the robotics engineering field.

4) Introduce the topic of Robotics Engineering as a field of Mechanical Engineering. Then, play the Robotics Engineering video from the series and direct students to complete the **What I Learned** column while viewing. After viewing the video, give students additional time to complete the **Viewing Log**. While students are viewing the video, take time to look over the Student Surveys in order to help guide the class discussion following the video.

5) Hold a short discussion of the video interview. What are the challenges of a career in Robotics Engineering, as described by the engineer? What did you find most interesting or surprising about the field of robotics engineering? What were some of the assumptions you had about robotics engineering that have changed after viewing the video interview?

6) Explain to students that cutting edge research is currently being conducted in robotics engineering for application in a number of industries: military, medical, manufacturing, automotive, and space exploration to name a few.

7) Describe how many of the newest developments in technology have come out of University research facilities. Universities like Berkeley and MIT have college engineering programs as well as departments devoted to research and development . Advise students that they will be working in groups to find out more about these new developments in the field of robotics engineering and will be presenting their findings in a class presentation.

8) **Home work assignment**: After the discussion, assign five cooperative groups to do short, five-minute presentations. Students will research the latest robotics engineering projects currently being developed by the MIT Field and Space Robotics Laboratory and the Center for Information Technology Research at Berkeley. **NOTE: Students will need internet access, either at home, in the computer lab, or at the library to conduct their research.**

Procedure

Day One

9) Once group assignments have been made, assign the following research topics:

Self Transforming Robotic Planetary Explorers
http://scripts.mit.edu/~robots/robots/projects/old_projects/niac/index.html

High Speed Rough Terrain Vehicle
http://scripts.mit.edu/~robots/robots/projects/old_projects/darpa/index.html

Microbots for large Scale Planetary and Sub-Surface Exploration
http://scripts.mit.edu/~robots/robots/projects/microbots/index.html

Space Robotics System
http://scripts.mit.edu/~robots/robots/projects/jaxa/index.html

Robotic Fly
http://www.berkeley.edu/news/media/releases/2002/06/fearing/home.html

10) Distribute the **Robotics Research Road Map.** This worksheet will help guide students' research. Each group member should bring their completed Research Road Map to the next class meeting to work on their group presentations.

Day Two

1) Allow students to continue working in cooperative groups to complete their presentations. **Note: this day will require work in a computer lab or library with computer access.**

2) Encourage students to use PowerPoint for their presentations and to include images of their research topic. If not using PowerPoint, students should create handouts or overheads.

Day Three

1) Each group will present their findings for their assigned topic. Remind students that they have five minutes to present. After each presentation allow time for each group to answer questions from their classmates.

2) Use the group observation form to evaluate the presentations and collect the completed Research Road Maps from each group member.

3) If there is not enough class time for all of the groups, allow the remaining groups to present their topics in the following class period.

Student Survey

Name _____ **Date** _____

Class _____ **Period** _____

Directions: Answer the following questions. Make a complete statement for each question.

1) What is a robotics engineer?

2) What two disciplines work closely together in robotics engineering?

3) How is robotics used in manufacturing?

4) What types of technologies do robotics engineers work on?

5) What do students need to study to become a robotics engineer?

6) In what ways have robots improved the safety and health for workers in manufacturing industries?

7) What comes to mind when you think of a robot?

8) What are the two categories of robots?

Student Viewing Log

Name _____ **Date** _____

Class _____ **Period** _____

Directions: Record your assumptions about the field of Robotics Engineering. While view the video list the new information you learned in the appropriate column.

robotics engineering	assumptions	what i learned
What functions are performed by robots in manufacturing?		
Why are robots used for certain tasks in the manufacturing industry?		
What two disciplines work closely together in the field of robotics?		
What are the two categories of robots?		
What types of courses do you need to take to pursue a career in robotics?		
What are the “three D’s” in manufacturing?		

Research Road Map

Robotics Engineering

Group Members:

Research Topic:

Date:
Class:
Period:

Directions: Answer the following questions to help create your presentation for your assigned topic.

1) Create a summary of the research topic under development by describing the project, its purpose, and the design features of the final product.

2) How is the project innovative?

3) What are the practical problems addressed by the project?

4) Identify the field or industry this project will impact.

5) Who were the sponsors of the research and why?

6) How is this innovation an improvement on the previous technology?

7) For what will this new development be used?

8) Thinking back to the Engineering Your Future Video, which of the "three D's" (dangerous, dirty, degrading) will this project alleviate?

Group Observation Form

Robotics Engineering

Group Members:

Research Topic:

Date:
Class:
Period:

Directions: Please check the appropriate responses for each group's level of understanding about Civil Engineering.

Observed Questions	Clearly Understands	Understands	Does Not Understand
Innovation and application of project.			
Practical problem addressed by the proposed project.			
Field or industry the project is being created for.			
Who were the sponsors of the research and why?			
How is this innovation an improvement on previous technology?			
Purpose and function of the final product?			