Chapter 1 Answer Key

GUIDED NOTES

Key Terms

1. Robotics: The field where engineering, computer science, and technology come together to design and build machines that can do tasks on their own.
2. Sensors: Parts of robots that collect information from the environment, similar to human senses.
3. Processors: The “brain” of the robot that takes information from sensors and decides what the robot should do next.
4. Actuators: The “muscles” of the robot that create movement by turning energy into motion.
5. Algorithms: Step-by-step instructions (like a recipe) that tell the robot how to respond to different situations.

Main Concept Overview

1. Robots gather information about their surroundings using ***sensors.***
2. Most robots are ***specialized*** machines designed for specific tasks rather than looking like humans.
3. Actuators help robots move by turning ***energy*** into motion.
4. ***Programming*** is how we give robots specific directions to follow.
5. Robots follow step-by-step ***instructions*** called algorithms to decide what to do next.

Matching Section

C 1. Industrial Robots	A. Help you learn programming and engineering skills
E 2. Service Robots	B. Explore places humans cannot easily go
A 3. Educational Robots	C. Work in factories building products
B 4. Research Robots	D. System that converts one form of energy to motion
D 5. Actuator	E. Assist humans in daily life tasks

True/False Questions

F 1. Most robots look like humans. (False - most robots are designed based on their function, not human appearance)
T 2. The processor acts as the “brain” of a robot. (True)
F 3. Robots can think for themselves without human programming. (False - robots need precise instructions to follow)
T 4. Block-based coding is often used to introduce beginners to programming. (True)
F 5. Robotics skills are only useful if you want to become a robotics engineer. (False - these skills are valuable in many careers)

Fill in the Table

Robot Component	What It Does
Sensors	Collect information from the environment (like robot’s “senses”)
Processors	Act as the robot’s “brain” and decide what the robot should do based on sensor information
Actuators	Create movement by turning energy into motion (like robot’s “muscles”)

Robot Component	What It Does
Programming	Gives robots precise step-by-step instructions to follow

Critical Thinking Questions

1. Why are most robots designed based on their function rather than to look like humans?

Sample Answer: Most robots are designed based on their function rather than human appearance because their purpose is to perform specific tasks efficiently. For example, industrial robots have mechanical arms that can move in many directions to assemble products, and robot vacuum cleaners are flat and round to easily move under furniture. Making robots human-shaped would often make them less effective at their specialized jobs.

2. How might learning robotics now help you in the future, even if you don't become a robotics engineer?

Sample Answer: Learning robotics teaches valuable skills like programming, problem-solving, critical thinking, and teamwork that are useful in many careers. As technology becomes more common in everyday life, understanding how robots and automated systems work will be helpful for using new technologies, troubleshooting problems, and adapting to a changing workplace where robots may become common tools.

What Is Robotics?

S L E C H F P W X N G U Z I Q M Z Y G Q G S V B
I N D U S T R I A L R O B O T S I L R X J Z C V
N B U F W R N A A N Q D F J V U I S S W O V H L
O Z C M D G C L T N P S O Q X J Z W F Q Y K L R
N K A S W G Y S A U M M F B C E I W C W U Y Q Z
C P T U H L I R W I D V G Y P R O C E S S O R S
W V I J R D V J E D V O N H W X F F L R E J N R
M B O A D G Y N T S U O J N D R H Q I C A P N X
Q I N W O X R K J R E F I D V F E I Z A L O U Z
S F A S O A Y N S B N A B X F G E E S C L H U I
Z I L E T F N H B P T C R R O B O T I C S N S Q
Z S R T F Q N E Q B L W X C N C O P F M Z E N U
V K O D I H A E G Q O A C C H A I R A M S I U S
O K B A I G U G S Y G O C W V R W Q Y O Q E M L
M Z O J V T H O J R A H H T K B O J U O D W I M
H T T V Q S X G W P T M U P U S S B N P K T D L
Q Z S Z W H L G I H U X M K S A V O O L E Q V T
D J H G Z H Y O L G K A A U E O T B F T G K E X
D Q F O G K M I K Y G K N D N G W O D W S O T K
A U A L G O R I T H M S O N S D J H R A R T J V
L I N H Y N J W D L D M I Y O V E K M S D S B X
C C W G L P Y M L C U S D H R R K L H C A N S L
J W P Z I H N P H L Z N Y T S A V H D W L R Q L
H C R T B D R N R A P D P R O G R A M M I N G E

Research Robots
Industrial Robots
Educational Robots
Sensors
Robotics
Programming
Processors
Humanoid
Algorithms
Actuators

What Is Robotics?

Across

2. Parts of a robot that collect information from the environment, similar to how human eyes see and ears hear.
6. The "muscles" of a robot that create movement by turning energy into motion, such as motors and hydraulic systems.
7. Advanced robots used by scientists to explore places humans cannot easily go, like deep ocean, other planets, or disaster areas. ____ Robots
9. Step-by-step instructions, similar to a recipe, that tell a robot exactly how to respond in different situations.
10. Powerful robots that work in factories building cars, packing products, or assembling electronics with precision. ____ Robots

Down

1. The field where engineering, computer science, and technology combine to design and build machines that can do tasks on their own.
3. The "brain" of a robot that takes information from sensors and decides what the robot should do next.
4. Robots designed to help students learn programming, engineering, and problem-solving skills through hands-on activities. ____ Robotos
5. The process of giving robots precise instructions to follow by creating step-by-step directions for different situations.
8. A type of robot designed to look and move like a human, though most robots have designs based on their function rather than human appearance.

Chapter 1 Lecture Notes, Schedule & Resources

Example Lecture Outline

Introduction
- Robotics combines engineering, computer science, and technology to create self-operating machines
- Robots are vital in manufacturing, healthcare, education, and exploration
- Understanding robotics prepares students for a technology-rich future

Key Components of Robots

Sensory Systems
- Sensors collect environmental information (light, sound, touch, distance)
- Examples: cameras, microphones, touch sensors, ultrasonic sensors

Processing Systems
- Processors function as the robot's "brain"
- Take sensor input and make decisions based on programming
- Follow algorithms to determine actions

Movement Systems
- Actuators create physical movement
- Motors, hydraulics, pneumatics convert energy to motion
- Design determines movement capabilities

Programming
- Block-based coding for beginners
- Text-based languages for complex robots
- Programming coordinates all components

Real-World Applications
- Industrial robots in manufacturing
- Service robots for everyday assistance
- Educational robots for STEM learning
- Research robots exploring dangerous areas

Impact and Implications
- Robots as tools that complement human abilities
- Skills gained: programming, problem-solving, teamwork

Discussion Prompts

- "How might robots change jobs in the next 10 years?"
- "If you could design a robot to solve one school problem, what would it do?"
- "What tasks do robots do well vs. humans?"
- "How could robots help people with disabilities or the elderly?"

Hands-On Activities

1. Robot Mimicry Game
- **Materials:** Paper, pencils
- **Instructions:**
  1. Pair students as “programmer” and “robot”
  2. Programmer writes step-by-step instructions for a simple task (e.g., navigate classroom, stack blocks)
  3. “Robot” follows instructions exactly as written, highlighting gaps in logic
  4. Discuss communication challenges and importance of precise instructions
- **Expected Outcome:** Students understand programming challenges and algorithmic thinking
- **Assessment:** Evaluate clarity of written instructions and accuracy of task completion

2. Paper Robot Design
- **Materials:** Paper, pencils, markers, scissors, tape
- **Instructions:**
  1. Students design a robot for a specific real-world problem
  2. Draw and label robot parts (sensors, processors, actuators)
  3. Explain how their robot would work in detail
  4. Present designs to class for peer feedback
- **Expected Outcome:** Application of robot component concepts to practical situations

3. Sensor Stations
- **Materials:** Flashlights, bells/sounds, objects with different textures
- **Instructions:**
  1. Create stations representing different senses (visual, audio, tactile)
  2. Students record what information each “sensor” provides
  3. Discuss how robots would use this information for decision-making
  4. Identify limitations of current sensor technology
- **Safety:** Ensure sound levels are appropriate; no extremely bright lights
- **Assessment:** Check for understanding of how sensors gather and utilize environmental data

Interesting Facts

- First industrial robot (Unimate) installed at GM in 1961
- Some robots perform surgery with more precision than human hands
- Swarm robotics involves many simple robots working together like insects
- The smallest functioning robots are nanobots, invisible to the human eye

Common Misconceptions

- Robots don’t need to look humanoid to be useful or advanced
- Most robots are specialized for specific tasks, not general-purpose
- Programming a robot is often more challenging than building it

Industry Trends

- Collaborative robots (cobots) designed to work safely alongside humans
- Increased use of robots in healthcare, especially during health crises