

## Introduction

This document provides a comprehensive overview of the required knowledge and skills for different educational levels within robotics. It serves as a guideline for educational institutions in developing their curricula, tailored to the current and future needs of the industry. We use a star system ranging from 1 to 7 to indicate the mastery level of each competency. VMBO students (preparatory secondary vocational education) reach levels of 1 or 2 stars, while higher levels are reserved for MBO and HBO. New knowledge and skills not covered in previous levels are displayed in bold.

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## Basic Robotics Assistant (VMBO)

**Working Title:** Basic Robotics Assistant

**Educational Level:** VMBO (Preparatory Secondary Vocational Education)

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## Task Description

A Basic Robotics Assistant at the VMBO level has simple tasks that prepare them for further studies in robotics. These tasks include:

1. **Basic operation of robots:** Turning robots on and off. (★☆☆☆☆☆)
2. **Performing simple tasks:** Such as pick-and-place operations. (★☆☆☆☆☆)
3. **Supporting installations:** Assisting in the installation of new robots. (★☆☆☆☆☆)
4. **Checking basic functions:** Performing functional checks to ensure robots are working correctly. (★☆☆☆☆☆)
5. **Assisting in programming:** Helping with basic programming tasks using visual tools like Blockly. (★☆☆☆☆☆)
6. **Monitoring safety:** Ensuring all safety protocols are followed. (★☆☆☆☆☆)
7. **Inventory management:** Managing basic supplies like sensors and cables. (★☆☆☆☆☆)
8. **Data logging:** Recording basic operational data for further analysis. (★☆☆☆☆☆)
9. **Maintaining workspace:** Keeping the workplace clean and organized. (★☆☆☆☆☆)
10. **Documenting work activities:** Maintaining simple logs and records. (★☆☆☆☆☆)
11. **Assisting in quality checks:** Helping check the quality of completed robotics tasks. (★☆☆☆☆☆)
12. **Providing basic support:** Assisting technicians and engineers in simple robotics projects. (★☆☆☆☆☆)
13. **Following standard procedures:** Ensuring all tasks are performed according to established procedures. (★☆☆☆☆☆)
14. **Basic troubleshooting tasks:** Identifying and reporting simple malfunctions. (★☆☆☆☆☆)
15. **Collaborating with team members:** Communicating effectively and working collaboratively in a team. (★☆☆☆☆☆)

## Required Knowledge

A Basic Robotics Assistant should possess a broad knowledge base to perform their tasks effectively. This includes:

1. **Basic principles of robotics (★☆☆☆☆☆)**
2. **Safety procedures and protocols (★☆☆☆☆☆)**
3. **Structured programming with visual tools (★☆☆☆☆☆)**
4. **Functional operation of different types of robots (★☆☆☆☆☆)**
5. **Basic maintenance procedures (★☆☆☆☆☆)**
6. **Use of hand tools (★☆☆☆☆☆)**
7. **Basic concepts of electricity and electronics (★☆☆☆☆☆)**
8. **Logbook methods and data recording (★☆☆☆☆☆)**
9. **Inventory management and logistics (★☆☆☆☆☆)**
10. **Basic computer usage and robotics software (★☆☆☆☆☆)**
11. **Principles of mechanical movement (★☆☆☆☆☆)**
12. **Fundamentals of automation (★☆☆☆☆☆)**
13. **Use of sensors and actuators (★☆☆☆☆☆)**
14. **Basic knowledge of networks and communication (★☆☆☆☆☆)**
15. **Role and functions of a robot in production environments (★☆☆☆☆☆)**
16. **Basic troubleshooting techniques (★☆☆☆☆☆)**
17. **Functioning of motors and drives (★☆☆☆☆☆)**
18. **Ergonomics and safe working practices (★☆☆☆☆☆)**
19. **Working with instructions and diagrams (★☆☆☆☆☆)**
20. **Environmental and sustainability guidelines in technology (★☆☆☆☆☆)**
21. **Quality control principles (★☆☆☆☆☆)**
22. **Principles of data logging software (★☆☆☆☆☆)**
23. **Basic knowledge of pneumatics and hydraulics (★☆☆☆☆☆)**
24. **Properties of materials (★☆☆☆☆☆)**
25. **Application of preventive maintenance (★☆☆☆☆☆)**

### **Skills**

The following skills are essential for a Basic Robotics Assistant:

1. **Operating robot systems (★☆☆☆☆☆)**
2. **Structured programming with visual tools (★☆☆☆☆☆)**
3. **Performing simple maintenance (★☆☆☆☆☆)**

4. **Problem-solving ability for basic issues** (★☆☆☆☆☆)
5. **Communication skills** (★☆☆☆☆☆)
6. **Teamwork and collaboration** (★☆☆☆☆☆)
7. **Accuracy and attention to detail** (★☆☆☆☆☆)
8. **Following safety protocols** (★☆☆☆☆☆)
9. **Keeping logbooks** (★☆☆☆☆☆)
10. **Material management and inventory control** (★☆☆☆☆☆)
11. **Basic troubleshooting** (★☆☆☆☆☆)
12. **Providing support during installations** (★☆☆☆☆☆)
13. **Assisting in quality checks** (★☆☆☆☆☆)
14. **Basic computer skills** (★☆☆☆☆☆)
15. **Data logging and reporting** (★☆☆☆☆☆)
16. **Preparing workspaces** (★☆☆☆☆☆)
17. **Basic knowledge of reading electrical diagrams** (★☆☆☆☆☆)
18. **Use of measuring instruments** (★☆☆☆☆☆)
19. **Basic knowledge of mechanical systems** (★☆☆☆☆☆)
20. **Preparing and tidying work environments** (★☆☆☆☆☆)

### **Final Objectives**

Upon completion, individuals in all profiles are capable of performing a wide range of basic robotics tasks within a controlled environment. They possess the fundamental knowledge and skills needed to operate and maintain robots, program them using visual tools, and solve basic malfunctions (troubleshooting). They can work safely according to established protocols and collaborate effectively with other team members and technicians. The goal of this profile is to prepare students for entry-level positions in the robotics industry and provide them with a solid foundation for further development and specialization in technical fields.

### **Distinctive Features**

What sets this profile apart from other educational levels is the focus on basic skills and fundamental knowledge that are directly applicable in practice. Unlike higher-educated profiles, the Basic Robotics Assistant focuses on performing simple, routine tasks and providing support to more experienced technicians. This profile offers accessible entry into the world of robotics and lays the groundwork for further growth and development within this rapidly evolving field.

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### **Practice-Oriented Robotics Assistant (Practical HAVO)**

**Working Title:** Practice-Oriented Robotics Assistant

**Educational Level:** Practical HAVO (Higher General Secondary Education)

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### **Task Description**

A Practice-Oriented Robotics Assistant at the HAVO level has tasks that prepare them for further studies in robotics or technology. These tasks include:

1. **Operating robot systems:** Turning robots on and off and executing basic commands. (★★☆☆☆☆)
2. **Performing simple robot programming:** Carrying out basic programming tasks using visual programming languages. (★★☆☆☆☆)
3. **Checking basic functions:** Inspecting and testing robots to ensure they function correctly. (★★☆☆☆☆)
4. **Assisting in installations:** Supporting the installation and configuration of robots. (★★☆☆☆☆)
5. **Basic troubleshooting:** Identifying and reporting simple malfunctions and issues. (★★☆☆☆☆)
6. **Maintaining robots:** Basic maintenance and cleaning of robots and workspaces. (★★☆☆☆☆)
7. **Ensuring safety:** Making sure all safety procedures are followed. (★★☆☆☆☆)
8. **Inventory management:** Managing basic supplies like sensors and spare parts. (★★☆☆☆☆)
9. **Data logging:** Recording operational data for analysis. (★★☆☆☆☆)
10. **Supporting technicians:** Providing basic support to technicians and engineers in robotics projects. (★★☆☆☆☆)
11. **Organizing workspace:** Keeping the workplace clean and organized. (★★☆☆☆☆)
12. **Documenting work activities:** Maintaining simple logs and records. (★★☆☆☆☆)
13. **Assisting in quality checks:** Helping check the quality of completed robotics tasks. (★★☆☆☆☆)
14. **Automating simple tasks:** Automating small tasks using robotics. (★★☆☆☆☆)
15. **Collaborating with team members:** Communicating effectively and working collaboratively in a team. (★★☆☆☆☆)

### Required Knowledge

A Practice-Oriented Robotics Assistant should possess a broad knowledge base to perform their tasks effectively. This includes:

1. **Basic principles of robotics** (★☆☆☆☆)
2. **Safety procedures and protocols** (★☆☆☆☆)
3. **Structured programming with visual tools** (★☆☆☆☆)
4. **Functional operation of different types of robots** (★☆☆☆☆)
5. **Basic maintenance procedures** (★☆☆☆☆)
6. **Use of hand tools** (★☆☆☆☆)
7. **Basic concepts of electricity and electronics** (★☆☆☆☆)

8. **Logbook methods and data recording (★☆☆☆☆☆)**
9. **Inventory management and logistics (★☆☆☆☆☆)**
10. **Basic computer usage and robotics software (★☆☆☆☆☆)**
11. **Principles of mechanical movement (★☆☆☆☆☆)**
12. **Fundamentals of automation (★☆☆☆☆☆)**
13. **Use of sensors and actuators (★☆☆☆☆☆)**
14. **Basic knowledge of networks and communication (★☆☆☆☆☆)**
15. **Role and functions of a robot in production environments (★☆☆☆☆☆)**
16. **Basic troubleshooting techniques (★☆☆☆☆☆)**
17. **Functioning of motors and drives (★☆☆☆☆☆)**
18. **Ergonomics and safe working practices (★☆☆☆☆☆)**
19. **Working with instructions and diagrams (★☆☆☆☆☆)**
20. **Environmental and sustainability guidelines in technology (★☆☆☆☆☆)**
21. **Quality control principles (★☆☆☆☆☆)**
22. **Principles of data logging software (★☆☆☆☆☆)**
23. **Basic knowledge of pneumatics and hydraulics (★☆☆☆☆☆)**
24. **Properties of materials (★☆☆☆☆☆)**
25. **Application of preventive maintenance (★☆☆☆☆☆)**

### **Skills**

The following skills are essential for a Practice-Oriented Robotics Assistant:

1. **Operating robot systems (★★☆☆☆☆)**
2. **Structured programming with visual tools (★★☆☆☆☆)**
3. **Performing simple maintenance (★★☆☆☆☆)**
4. **Problem-solving ability for basic issues (★★☆☆☆☆)**
5. **Communication skills (★★☆☆☆☆)**
6. **Teamwork and collaboration (★★☆☆☆☆)**
7. **Accuracy and attention to detail (★★☆☆☆☆)**
8. **Following safety protocols (★★☆☆☆☆)**
9. **Keeping logbooks (★★☆☆☆☆)**
10. **Material management and inventory control (★★☆☆☆☆)**
11. **Basic troubleshooting (★★☆☆☆☆)**

12. **Providing support during installations** (★★☆☆☆☆)
13. **Assisting in quality checks** (★★☆☆☆☆)
14. **Basic computer skills** (★★☆☆☆☆)
15. **Data logging and reporting** (★★☆☆☆☆)
16. **Preparing workspaces** (★★☆☆☆☆)
17. **Basic knowledge of reading electrical diagrams** (★★☆☆☆☆)
18. **Use of measuring instruments** (★★☆☆☆☆)
19. **Basic knowledge of mechanical systems** (★★☆☆☆☆)
20. **Preparing and tidying work environments** (★★☆☆☆☆)

### Final Objectives

Upon completion, individuals in all profiles are capable of performing a wide range of basic robotics tasks within a controlled environment. They possess the fundamental knowledge and skills needed to operate and maintain robots, program them using visual tools, and solve basic malfunctions (troubleshooting). They can work safely according to established protocols and collaborate effectively with other team members and technicians. The goal of this profile is to prepare students for further studies and transition to MBO or HBO, providing them with a solid foundation for a career in technology and the robotics industry.

### Distinctive Features

What sets this profile apart from other educational levels is the focus on practical skills and fundamental knowledge that are directly applicable. Unlike VMBO, the Practice-Oriented Robotics Assistant offers a slightly higher level of complexity and prepares students for further studies in robotics or technology. This profile lays a strong foundation for further growth and development within this rapidly evolving field.

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## Assistant Robotics Technician (MBO-2)

**Working Title:** Assistant Robotics Technician

**Educational Level:** MBO-2 (Basic Vocational Training)

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### Task Description

An Assistant Robotics Technician at MBO-2 level has various tasks that prepare them for a role in the robotics industry. These tasks include:

1. **Operating robot systems:** Turning robots on and off and executing basic commands. (★★★☆☆☆)
2. **Performing simple robot programming:** Carrying out basic programming tasks using visual programming languages. (★★★☆☆☆)
3. **Checking basic functions:** Inspecting and testing robots to ensure they function correctly. (★★★☆☆☆)
4. **Assisting in installations:** Supporting the installation and configuration of robots and automation systems. (★★★☆☆☆)

5. **Basic troubleshooting:** Identifying and reporting simple malfunctions and issues. (★★★☆☆☆☆)
6. **Maintaining robots:** Performing basic maintenance and cleaning of robots and workspaces. (★★★☆☆☆☆)
7. **Ensuring safety:** Making sure all safety procedures are followed. (★★★☆☆☆☆)
8. **Inventory management:** Managing basic supplies like sensors and spare parts. (★★★☆☆☆☆)
9. **Data logging:** Recording operational data for analysis and reporting. (★★★☆☆☆☆)
10. **Supporting technicians:** Providing basic support to technicians and engineers in robotics projects. (★★★☆☆☆☆)
11. **Organizing workspace:** Keeping the workplace clean and organized. (★★★☆☆☆☆)
12. **Documenting work activities:** Maintaining simple logs and records. (★★★☆☆☆☆)
13. **Assisting in quality checks:** Helping check the quality of completed robotics tasks. (★★★☆☆☆☆)
14. **Automating simple tasks:** Automating small tasks using robotics. (★★★☆☆☆☆)
15. **Assembling and disassembling:** Assisting in assembling and disassembling robot components. (★★★☆☆☆☆)
16. **Learning and applying technical instructions:** Following and applying technical manuals and instructions. (★★★☆☆☆☆)
17. **Using measuring equipment:** Using basic measuring instruments to check robotics systems. (★★★☆☆☆☆)
18. **Calibrating sensors:** Calibrating sensors and performing basic checks. (★★★☆☆☆☆)
19. **Conducting inspections:** Performing visual inspections of robots and components. (★★★☆☆☆☆)
20. **Assisting in system testing:** Supporting the testing and commissioning of robot systems. (★★★☆☆☆☆)

### Required Knowledge

An Assistant Robotics Technician should possess a broad knowledge base to perform their tasks effectively. This includes:

1. **Basic principles of robotics** (★★☆☆☆☆☆)
2. **Safety procedures and protocols** (★★☆☆☆☆☆)
3. **Structured programming with visual tools** (★★☆☆☆☆☆)
4. **Functional operation of different types of robots** (★★☆☆☆☆☆)
5. **Basic maintenance procedures** (★★☆☆☆☆☆)
6. **Use of hand tools** (★★☆☆☆☆☆)
7. **Basic concepts of electricity and electronics** (★★☆☆☆☆☆)

8. **Logbook methods and data recording (★★☆☆☆☆)**
9. **Inventory management and logistics (★★☆☆☆☆)**
10. **Basic computer usage and robotics software (★★☆☆☆☆)**
11. **Principles of mechanical movement (★★☆☆☆☆)**
12. **Fundamentals of automation (★★☆☆☆☆)**
13. **Use of sensors and actuators (★★☆☆☆☆)**
14. **Basic knowledge of networks and communication (★★☆☆☆☆)**
15. **Role and functions of a robot in production environments (★★☆☆☆☆)**
16. **Basic troubleshooting techniques (★★☆☆☆☆)**
17. **Functioning of motors and drives (★★☆☆☆☆)**
18. **Ergonomics and safe working practices (★★☆☆☆☆)**
19. **Working with instructions and diagrams (★★☆☆☆☆)**
20. **Environmental and sustainability guidelines in technology (★★☆☆☆☆)**
21. **Quality control principles (★★☆☆☆☆)**
22. **Principles of data logging software (★★☆☆☆☆)**
23. **Basic knowledge of pneumatics and hydraulics (★★☆☆☆☆)**
24. **Properties of materials (★★☆☆☆☆)**
25. **Application of preventive maintenance (★★☆☆☆☆)**

### **Skills**

The following skills are essential for an Assistant Robotics Technician:

1. **Operating robot systems (★★★☆☆☆)**
2. **Structured programming with visual tools (★★★☆☆☆)**
3. **Performing simple maintenance (★★★☆☆☆)**
4. **Problem-solving ability for basic issues (★★★☆☆☆)**
5. **Communication skills (★★★☆☆☆)**
6. **Teamwork and collaboration (★★★☆☆☆)**
7. **Accuracy and attention to detail (★★★☆☆☆)**
8. **Following safety protocols (★★★☆☆☆)**
9. **Keeping logbooks (★★★☆☆☆)**
10. **Material management and inventory control (★★★☆☆☆)**
11. **Basic troubleshooting (★★★☆☆☆)**



12. **Providing support during installations** (★★★★☆☆)
13. **Assisting in quality checks** (★★★★☆☆)
14. **Basic computer skills** (★★★★☆☆)
15. **Data logging and reporting** (★★★★☆☆)
16. **Preparing workspaces** (★★★★☆☆)
17. **Basic knowledge of reading electrical diagrams** (★★★★☆☆)
18. **Use of measuring instruments** (★★★★☆☆)
19. **Basic knowledge of mechanical systems** (★★★★☆☆)
20. **Preparing and tidying work environments** (★★★★☆☆)

### Final Objectives

Upon completion, individuals in all profiles are capable of performing a wide range of basic robotics tasks within a controlled environment. They possess the fundamental knowledge and skills needed to operate and maintain robots, program them using visual tools, and solve basic malfunctions (troubleshooting). They can work safely according to established protocols and collaborate effectively with other team members and technicians. The goal of this profile is to prepare students for entry-level positions in the robotics industry and provide them with a solid foundation for further development and specialization in technical fields.

### Distinctive Features

What sets this profile apart from other educational levels is the focus on developing technical skills and enhancing problem-solving abilities. Unlike the Practice-Oriented Robotics Assistant, the Assistant Robotics Technician delves deeper into technical aspects and prepares students for specific roles within the robotics industry. This profile lays a strong foundation for further growth and specialization within this dynamic field.

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## Robotics All-Rounder (MBO-3)

**Working Title:** Robotics All-Rounder

**Educational Level:** MBO-3 (Vocational Training)

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### Task Description

A Robotics All-Rounder at MBO-3 level has various tasks that prepare them for a significant role in the robotics industry. These tasks include:

1. **Operating robot systems:** Starting up, shutting down, and monitoring robots during operations. (★★★★☆☆)
2. **Performing robot programming:** Carrying out advanced programming tasks using both visual and simple textual programming languages. (★★★★☆☆)
3. **Checking system functionality:** Performing checks and tests to ensure robots are functioning correctly. (★★★★☆☆)
4. **Supporting installations:** Assisting in the installation and configuration of robots and automation systems. (★★★★☆☆)

5. **Troubleshooting:** Diagnosing and resolving malfunctions and technical issues. (★★★★☆☆)
6. **Maintaining robots:** Performing scheduled preventive maintenance and repairs on robot systems. (★★★★☆☆)
7. **Ensuring safety:** Ensuring all safety procedures and protocols are adhered to. (★★★★☆☆)
8. **Inventory management:** Managing parts and supplies for robots. (★★★★☆☆)
9. **Data logging and analysis:** Recording operational data and analyzing performance. (★★★★☆☆)
10. **Supporting technicians and engineers:** Providing technical support in complex robotics projects. (★★★★☆☆)
11. **Organizing workspace:** Maintaining an organized and clean workplace. (★★★★☆☆)
12. **Documenting work activities:** Keeping logs, maintenance reports, and technical documentation. (★★★★☆☆)
13. **Performing quality checks:** Checking the quality of automated processes and products. (★★★★☆☆)
14. **Optimizing processes:** Identifying and implementing improvements in robotics processes. (★★★★☆☆)
15. **Assembling and disassembling robots:** Assisting in assembling and disassembling robot components. (★★★★☆☆)
16. **Calibrating equipment:** Calibrating and testing sensors and actuators. (★★★★☆☆)
17. **Inspecting systems:** Performing visual and functional inspections of robots and systems. (★★★★☆☆)
18. **Testing new programs:** Testing and validating new robot programming and automation software. (★★★★☆☆)
19. **Implementing automation:** Developing and implementing small automation projects. (★★★★☆☆)
20. **Communication with team members:** Effectively communicating technical information with colleagues and supervisors. (★★★★☆☆)

### Required Knowledge

A Robotics All-Rounder should possess an extensive knowledge base to perform their tasks effectively. This includes:

1. **Advanced principles of robotics** (★★★★☆☆)
2. **Safety procedures and protocols** (★★★★☆☆)
3. **Structured programming with both visual and textual programming languages** (★★★★☆☆)
4. **Functional operation of industrial robots** (★★★★☆☆)
5. **Maintenance procedures and techniques** (★★★★☆☆)

6. **Use of specialized tools (★★★☆☆☆)**
7. **Concepts of electricity and electronics (★★★☆☆☆)**
8. **Logbook methods and data analysis (★★★☆☆☆)**
9. **Inventory management and logistics (★★★☆☆☆)**
10. **Advanced computer usage and robotics software (★★★☆☆☆)**
11. **Principles of mechanical movement and dynamics (★★★☆☆☆)**
12. **Fundamentals of automation and control systems (★★★☆☆☆)**
13. **Use of sensors and actuators (★★★☆☆☆)**
14. **Advanced networks and communication protocols (★★★☆☆☆)**
15. **Role and functions of robots in automated environments (★★★☆☆☆)**
16. **Advanced troubleshooting techniques (★★★☆☆☆)**
17. **Functioning of motors and drives (★★★☆☆☆)**
18. **Ergonomics and safe working practices in industrial environments (★★★☆☆☆)**
19. **Working with technical drawings and diagrams (★★★☆☆☆)**
20. **Environmental and sustainability guidelines in technology (★★★☆☆☆)**
21. **Quality control and quality assurance principles (★★★☆☆☆)**
22. **Advanced data logging software (★★★☆☆☆)**
23. **Knowledge of pneumatics and hydraulics (★★★☆☆☆)**
24. **Properties and applications of different materials (★★★☆☆☆)**
25. **Application of condition monitoring techniques (★★★☆☆☆)**

**New knowledge for this level:**

- **Structured programming with textual programming languages. (★★★☆☆☆)**
- **Digital twins and their basic use. (★★★☆☆☆)**

**Skills**

The following skills are essential for a Robotics All-Rounder:

1. **Operating complex robot systems (★★★★☆☆)**
2. **Structured programming with textual programming languages (★★★★☆☆)**
3. **Performing preventive and corrective maintenance (★★★★☆☆)**
4. **Advanced problem-solving and troubleshooting (★★★★☆☆)**
5. **Effective communication skills (★★★★☆☆)**
6. **Teamwork and leading small teams (★★★★☆☆)**

7. **Accuracy and attention to detail (★★★★☆☆)**
8. **Applying safety protocols (★★★★☆☆)**
9. **Keeping detailed logbooks (★★★★☆☆)**
10. **Material management and ordering parts (★★★★☆☆)**
11. **Advanced technical troubleshooting (★★★★☆☆)**
12. **Supporting and executing installations (★★★★☆☆)**
13. **Training new staff (★★★★☆☆)**
14. **Data analysis and reporting results (★★★★☆☆)**
15. **Preparing and organizing workspaces (★★★★☆☆)**
16. **Reading and interpreting electrical diagrams (★★★★☆☆)**
17. **Use of advanced measuring instruments (★★★★☆☆)**
18. **Knowledge of mechanical and electrical systems (★★★★☆☆)**
19. **Performing quality checks (★★★★☆☆)**
20. **Contributing to process optimization (★★★★☆☆)**

**New skills for this level:**

- **Structured programming with textual programming languages. (★★★★☆☆)**
- **Working with digital twins for simulation. (★★★★☆☆)**

**Final Objectives**

Upon completion, individuals in all profiles are capable of performing a wide range of advanced robotics tasks within a controlled and automated environment. They possess fundamental and new advanced knowledge and skills needed to operate, maintain, and program robots using textual languages, and to solve malfunctions (troubleshooting). They can work safely according to established protocols and collaborate effectively with other team members and technicians. The goal of this profile is to prepare students for roles in the robotics industry where they are responsible for ensuring efficient and safe robotic processes and optimizing production systems.

**Distinctive Features**

What sets this profile apart from previous levels is the introduction of structured programming with textual programming languages and the use of digital twins. The Robotics All-Rounder focuses on performing more complex tasks, such as advanced programming and process optimization, preparing students for mid-level positions within the robotics industry.

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**Specialist Technician (MBO-4)**

**Working Title:** Specialist Technician

**Educational Level:** MBO-4 (Middle Management Training)

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**Task Description**

A Specialist Technician at MBO-4 level has advanced tasks that prepare them for a crucial role in the robotics industry. These tasks include:

1. **Operating and monitoring robot systems:** Starting up, shutting down, and continuously monitoring robots during operations. (★★★★★☆☆)
2. **Advanced robot programming:** Programming robots using textual programming languages like Python and PLC. (★★★★★☆☆)
3. **Checking system functionality:** Performing advanced checks and tests to ensure robots function correctly. (★★★★★☆☆)
4. **Installing and configuring:** Independently executing installation and configuration tasks for robots and automation systems. (★★★★★☆☆)
5. **Diagnostics and troubleshooting:** Advanced diagnosis and resolution of malfunctions and technical issues. (★★★★★☆☆)
6. **Error handling:** Implementing error handling in code and systems to prevent structural problems. (★★★★★☆☆)
7. **Maintaining robots:** Performing scheduled preventive maintenance and repairs on robot systems. (★★★★★☆☆)
8. **Ensuring safety:** Ensuring all safety procedures and protocols are strictly adhered to. (★★★★★☆☆)
9. **Inventory and materials management:** Managing parts, materials, and supplies for robots. (★★★★★☆☆)
10. **Data analysis and reporting:** Recording, analyzing, and reporting operational data. (★★★★★☆☆)
11. **Leading technicians:** Providing technical support and leading less experienced technicians and engineers. (★★★★★☆☆)
12. **Working with digital twins:** Utilizing digital simulations to test and optimize robot systems. (★★★★★☆☆)
13. **Optimizing work processes:** Identifying and implementing improvements in robotics processes and business processes. (★★★★★☆☆)
14. **Documenting technical activities:** Keeping detailed logbooks, maintenance reports, and technical documentation. (★★★★★☆☆)
15. **Performing quality checks:** Checking the quality of automated processes and products. (★★★★★☆☆)
16. **Implementing automation projects:** Developing and implementing advanced automation projects. (★★★★★☆☆)
17. **Assembling and disassembling robots:** Independently assembling and disassembling robot components. (★★★★★☆☆)
18. **Calibrating sensors and actuators:** Calibrating and testing advanced sensors and actuators. (★★★★★☆☆)
19. **Inspecting systems:** Performing visual and functional inspections of robots and systems. (★★★★★☆☆)

20. **Communication with team and stakeholders:** Effectively communicating technical information with team members, supervisors, and other stakeholders. (★★★★★☆☆)

### **Required Knowledge**

A Specialist Technician should possess an extensive knowledge base to perform their tasks effectively. This includes:

1. **Expert knowledge of robotics systems** (★★★★☆☆)
2. **Safety procedures and protocols** (★★★★☆☆)
3. **Structured programming with emphasis on textual languages and best practices** (★★★★☆☆)
4. **Functional operation of industrial robots** (★★★★☆☆)
5. **Maintenance procedures and techniques** (★★★★☆☆)
6. **Use of specialized tools** (★★★★☆☆)
7. **Concepts of electricity and electronics** (★★★★☆☆)
8. **Logbook methods and data analysis** (★★★★☆☆)
9. **Inventory management and logistics** (★★★★☆☆)
10. **Advanced computer usage and robotics software** (★★★★☆☆)
11. **Principles of mechanical movement and dynamics** (★★★★☆☆)
12. **Automation and control systems** (★★★★☆☆)
13. **Use of sensors and actuators** (★★★★☆☆)
14. **Advanced networks and communication protocols** (★★★★☆☆)
15. **Role and functions of robots in automated environments** (★★★★☆☆)
16. **Advanced troubleshooting techniques** (★★★★☆☆)
17. **Functioning of motors and drives** (★★★★☆☆)
18. **Ergonomics and safe working practices in industrial environments** (★★★★☆☆)
19. **Working with technical drawings and diagrams** (★★★★☆☆)
20. **Environmental and sustainability guidelines in technology** (★★★★☆☆)
21. **Quality control and quality assurance principles** (★★★★☆☆)
22. **Advanced data logging software** (★★★★☆☆)
23. **Knowledge of pneumatics and hydraulics** (★★★★☆☆)
24. **Properties and applications of different materials** (★★★★☆☆)
25. **Application of condition monitoring techniques** (★★★★☆☆)

**New knowledge for this level:**

- **Error handling:** In-depth understanding of error handling in code and systems. (★★★★☆☆)
- **Digital twins:** Insight into the use and implementation of digital twins for simulation and optimization. (★★★★☆☆)
- **Structured programming with emphasis on documentation and code quality.** (★★★★☆☆)

## **Skills**

The following skills are essential for a Specialist Technician:

1. **Operating complex robot systems** (★★★★☆☆)
2. **Structured programming focusing on textual languages** (★★★★☆☆)
3. **Performing preventive and corrective maintenance** (★★★★☆☆)
4. **Advanced troubleshooting and diagnostics** (★★★★☆☆)
5. **Implementing error handling in systems and code** (★★★★☆☆)
6. **Working with digital twins for simulation and optimization** (★★★★☆☆)
7. **Effective communication skills** (★★★★☆☆)
8. **Leading technicians and teams** (★★★★☆☆)
9. **Accuracy and attention to detail** (★★★★☆☆)
10. **Strict adherence to safety protocols** (★★★★☆☆)
11. **Maintaining detailed technical documentation** (★★★★☆☆)
12. **Material management and logistical planning** (★★★★☆☆)
13. **Supporting and executing complex installations** (★★★★☆☆)
14. **Data analysis and reporting for process improvement** (★★★★☆☆)
15. **Project management skills for automation projects** (★★★★☆☆)
16. **Reading and interpreting advanced technical diagrams** (★★★★☆☆)
17. **Use of advanced measuring and calibration instruments** (★★★★☆☆)
18. **Knowledge of advanced mechanical and electrical systems** (★★★★☆☆)
19. **Performing quality checks and audits** (★★★★☆☆)
20. **Contributing to process optimization and innovation** (★★★★☆☆)

## **Final Objectives**

Upon completion, individuals in all profiles are capable of performing a wide range of advanced robotics tasks within a controlled and automated environment. They possess fundamental and new advanced knowledge and skills needed to operate and maintain robots, program them using textual languages, apply error handling, and use digital twins. They strictly follow safety protocols and can effectively collaborate with and lead team members. The goal of this profile is to prepare students for

roles in the robotics industry where they are responsible for ensuring efficient and safe robotic processes and optimizing production systems.

### Distinctive Features

What sets this profile apart from previous levels is the focus on error handling, digital twins, and advanced structured programming with emphasis on documentation and code quality. The Specialist Technician focuses on performing more complex tasks and leading teams, preparing students for higher positions within the robotics industry.

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### Robotics Engineer (HBO)

**Working Title:** Robotics Engineer

**Educational Level:** HBO (Higher Professional Education)

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### Task Description

A Robotics Engineer at HBO level has complex and advanced tasks that prepare them for a leading role in the robotics industry. These tasks include:

1. **Designing robot systems:** Designing and developing new robots and automated systems. (★★★★★☆☆)
2. **Advanced robot programming:** Programming robots using advanced programming languages like Python, C++, and ROS. (★★★★★☆☆)
3. **System integration:** Integrating robots with other systems and technologies, such as sensors, AI algorithms, and IoT. (★★★★★☆☆)
4. **Project management:** Leading and managing robotics projects from concept to implementation. (★★★★★☆☆)
5. **Performing system tests and validation:** Conducting extensive tests to ensure robot systems function optimally. (★★★★★☆☆)
6. **Advanced diagnostics and troubleshooting:** Resolving complex technical problems and system errors. (★★★★★☆☆)
7. **Implementing high-level error handling:** Developing systems with advanced error handling and self-correcting mechanisms. (★★★★★☆☆)
8. **Developing and using digital twins:** Creating digital representations of physical systems for simulation, testing, and optimization. (★★★★★☆☆)
9. **Data analysis and machine learning:** Analyzing operational data and applying machine learning for system optimization. (★★★★★☆☆)
10. **Leading multidisciplinary teams:** Coordinating teams consisting of technicians, engineers, and other professionals. (★★★★★☆☆)
11. **Innovation and research:** Identifying and implementing new technologies and trends in robotics. (★★★★★☆☆)
12. **Documenting technical activities:** Preparing comprehensive technical documentation and reports. (★★★★★☆☆)



13. **Performing quality checks and audits:** Ensuring the quality and compliance of systems and processes. (★★★★★☆☆)
14. **Strategic planning:** Contributing to the strategic direction of technology implementation within an organization. (★★★★★☆☆)
15. **Communication with stakeholders:** Presenting technical information to clients, management, and partners. (★★★★★☆☆)
16. **Integration of AI and machine learning:** Applying AI techniques for enhanced robot functionality. (★★★★★☆☆)
17. **Structured programming at expert level:** Designing software architectures emphasizing maintainability and scalability. (★★★★★☆☆)
18. **Research and publication:** Contributing to academic and industrial research and publishing findings. (★★★★★☆☆)
19. **Developing safety standards:** Developing and implementing safety standards and protocols for new systems. (★★★★★☆☆)
20. **Applying advanced technologies:** Integrating emerging technologies like blockchain and augmented reality into robotics systems. (★★★★★☆☆)

### Required Knowledge

A Robotics Engineer should possess an extensive knowledge base to perform their tasks effectively. This includes:

1. **Advanced principles of robotics** (★★★★★☆☆)
2. **Development and maintenance of automated systems** (★★★★★☆☆)
3. **Structured programming at expert level with focus on software architecture** (★★★★★☆☆)
4. **Advanced programming languages (Python, C++, ROS)** (★★★★★☆☆)
5. **System integration and architecture** (★★★★★☆☆)
6. **Data analysis and machine learning** (★★★★★☆☆)
7. **Concepts of mechatronics and system design** (★★★★★☆☆)
8. **Advanced networks and communication protocols** (★★★★★☆☆)
9. **Innovation and technology development** (★★★★★☆☆)
10. **Project management and leadership** (★★★★★☆☆)
11. **Safety standards and regulations** (★★★★★☆☆)
12. **Quality control and quality assurance principles** (★★★★★☆☆)
13. **Properties and applications of diverse materials** (★★★★★☆☆)
14. **Environmental and sustainability guidelines in technology** (★★★★★☆☆)
15. **Application of condition monitoring and predictive maintenance** (★★★★★☆☆)

**New knowledge for this level:**

- **Digital twins:** In-depth understanding and implementation of digital twins for complex systems. (★★★★★☆☆)
- **Advanced error handling:** Designing self-correcting systems and advanced error handling. (★★★★★☆☆)
- **Integration of AI and machine learning in robotics systems.** (★★★★★☆☆)
- **Strategic planning and innovation management.** (★★★★★☆☆)

## Skills

The following skills are essential for a Robotics Engineer:

1. **Designing and developing complex robot systems** (★★★★★☆☆)
2. **Structured programming at expert level with emphasis on software architecture** (★★★★★☆☆)
3. **Advanced problem-solving and troubleshooting** (★★★★★☆☆)
4. **Leading multidisciplinary teams and projects** (★★★★★☆☆)
5. **Implementing digital twins for simulation and optimization** (★★★★★☆☆)
6. **Developing advanced error handling mechanisms** (★★★★★☆☆)
7. **Data analysis and application of machine learning** (★★★★★☆☆)
8. **Effective communication with technical and non-technical stakeholders** (★★★★★☆☆)
9. **Strategic planning and innovation** (★★★★★☆☆)
10. **Research and development of new technologies** (★★★★★☆☆)
11. **Integration of AI and machine learning in systems** (★★★★★☆☆)
12. **High-level project management skills** (★★★★★☆☆)
13. **Developing safety standards and protocols** (★★★★★☆☆)
14. **Applying advanced technologies in robotics** (★★★★★☆☆)

## Final Objectives

Upon completion, individuals in all profiles are capable of performing a wide range of complex robotics tasks within an advanced and automated environment. They possess fundamental and new knowledge and skills, including structured programming at expert level, advanced error handling, and developing and implementing digital twins. They can lead, innovate, and solve complex problems. The goal of this profile is to prepare students for leading roles where they are responsible for innovation and strategic development within the robotics industry.

## Distinctive Features

What sets this profile apart from previous levels is the emphasis on innovation, research, and strategic development. The Robotics Engineer is proficient in structured programming at the highest level, advanced error handling, and using digital twins for system optimization. They are prepared for leadership and pioneering roles within the industry.

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## Conclusion

This comprehensive document provides a complete framework for the development of robotics education at all levels. By specifying knowledge and skills, linked to clear level indicators and the star system, educational institutions can develop targeted curricula that align with the needs of the modern industry. It emphasizes the importance of continuous growth, specialization, and innovation within robotics, preparing students for a dynamic future in a technologically advanced field.