

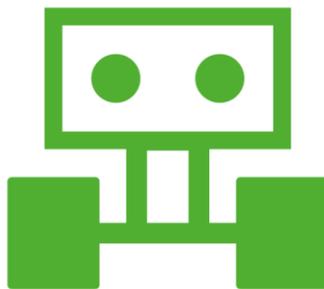


The Digital Skills Standard

# ICDL Digital Student

# ROBOTICS

Syllabus 1.0



QAN: 603/7793/8

**Syllabus Document**



### **Purpose**

This document details the syllabus for the Robotics module. The syllabus describes, through learning outcomes, the knowledge and skills that a candidate for the Robotics module should possess. The syllabus also provides the basis for the theory and practice-based test in this module.

### **Copyright © 2020 ICDL Foundation**

All rights reserved. No part of this publication may be reproduced in any form except as permitted by ICDL Foundation. Enquiries for permission to reproduce material should be directed to ICDL Foundation.

### **Disclaimer**

Although every care has been taken by ICDL Foundation in the preparation of this publication, no warranty is given by ICDL Foundation, as publisher, as to the completeness of the information contained within it and neither shall ICDL Foundation be responsible or liable for any errors, omissions, inaccuracies, loss or damage whatsoever arising by virtue of such information or any instructions or advice contained within this publication. Changes may be made by ICDL Foundation at its own discretion and at any time without notice.

# Robotics

This module sets out the basic principles of robotics and covers the assembly, programming, and control of a simple robot.

## Module Goals

Successful candidates will be able to:

- Understand key concepts relating to robots and robotics systems, and identify examples of robots
- Identify the main parts of a robot and their function, including microcontrollers, actuators, sensors, and power sources
- Understand the elements of a simple control system, and test a control system
- Understand basic programming concepts, and create and execute a programme in a visual programming language
- Set up a robot, implement robotic motion, and control a robot in an environment

CATEGORY	SKILL SET	REF.	TASK ITEM
<b>1 Robotic Concepts</b>	<i>1.1 Robots and Automated Systems</i>	1.1.1	Define robots, robotics systems.
		1.1.2	Identify teleoperated, semi-autonomous and autonomous robots.
		1.1.3	Identify fixed and mobile robots.
	<i>1.2 The Use of Robots</i>	1.2.1	Identify common uses of robots in different environments like: home, school, manufacturing, healthcare.
		1.2.2	Identify advanced uses of robots like: driverless cars, robot-assisted surgery.
		1.2.3	Identify ethical issues in the use of robots like: harming humans.
<b>2 Robotics Parts</b>	<i>2.1 Basic Parts and Components</i>	2.1.1	Identify the basic parts of a robot like: actuator, microcontroller, sensor, power source.
		2.1.2	Identify components in a robot kit like: chassis, electronics parts, cables, tools and parts for assembly.
	<i>2.2 Microcontroller</i>	2.2.1	Recognise that the microcontroller collects information from input devices like sensors, executes a program, controls output devices like LED lights, sound device.
		2.2.2	Identify common microcontroller ports like: power, USB, wireless, input, output.

CATEGORY	SKILL SET	REF.	TASK ITEM	
<b>3 Simple Control System</b>	<i>2.3 Actuator System</i>	2.3.1	Identify main parts of the actuator system like: switch, motor.	
		2.3.2	Explain how the actuator transforms electrical power into mechanical power, enabling the robot to function.	
	<i>2.4 Sensor</i>	2.4.1	Describe how a sensor detects changes in its environment like: light intensity, distance, angle.	
		2.4.2	Recognise the function of different types of sensors like: light, sound, gyroscope.	
	<i>2.5 Locomotion, Power</i>	2.5.1	Identify the parts of a robot that support motion like: arm, wheels.	
		2.5.2	Identify power sources like: batteries, solar power.	
	<i>3.1 Control System Overview</i>	3.1.1	3.1.1	Identify the elements of a control system and the basic types of control: open loop, closed loop..
			3.1.2	Recognise connections to a microcontroller like: button, power, motor, USB input, wireless technology, sensors, output devices.
			3.1.3	Identify connections to the microcontroller represented in a block diagram.
		3.1.4	3.1.4	Set up a simple control system using elements like: power, motor, sensors.
3.2.1			3.2.1	Run pre-defined programs to provide output values like: light intensity, sound, distance, angle.
			3.2.2	Recognise that there is a response time between inputs and outputs.
	3.2.3	Recognise that changing variables in a program affects outputs.		
<b>4 Visual Programming</b>	<i>4.1 Programming Basics</i>	4.1.1	Define the terms program, programming language.	
		4.1.2	Recognise blocks as a basic element in a visual programming language. Recognise common block categories like: Events, Control.	
		4.1.3	Recognise typical activities in the creation of a program like: analyse a task, design a solution, write a program, test and improve the program.	
		4.1.4	Identify the basic elements of a program like: sequence, decision, loop.	
		4.1.5	Describe how a flowchart can be used to present the steps in a solution.	

CATEGORY	SKILL SET	REF.	TASK ITEM
	<i>4.2 Constant, Variable</i>	4.2.1	Distinguish between the terms variable and constant used in a program.
		4.2.2	Create new variables and assign suitable input in a program.
	<i>4.3 Events, Controls</i>	4.3.1	Use an Events block in a program like: when.
		4.3.2	Use a Control block in a program like: wait, wait until.
		4.3.3	Apply a loop or continuous action using controls in a program like: forever, repeat.
		4.3.4	Apply conditions using controls in a program like: if, then, else.
		4.3.5	Apply logic operators in a program like: and, not, or.
	<i>4.4 Program Creation and Execution</i>	4.4.1	Outline a plan to describe and solve a problem like: control an output, complete a series of actions.
		4.4.2	Draw a flowchart to present the steps in a solution.
		4.4.3	Build a program in a visual programming language to solve a problem like: control an output, complete a series of actions.
		4.4.4	Recognise that there may be more than one way of writing a program to solve the same problem.
		4.4.5	Run a program. Identify and fix errors in a program.
<b>5 Working with Robots</b>	<i>5.1 Setup</i>	5.1.1	Describe and implement safety guidelines like: safe handling of electrical items and tools, awareness of safety of self and others.
		5.1.2	Assemble a robot using available tools.
	<i>5.2 Implementing Robotic Motion</i>	5.2.1	Implement simple robotic motion like: stop, move forward or backward, turn.
		5.2.2	Describe the relationships between power, distance, speed, time in robotic motion.
		5.2.3	Apply concepts of power, distance, speed, time to control motions like: move forward, backward. Recognise that momentum and friction can affect robotic motion.
		5.2.4	Describe the relationship between power, rotational speed, angle of rotation in robotic motion.

CATEGORY	SKILL SET	REF.	TASK ITEM
	<i>5.3 Implementing Robotic Controls</i>	5.3.1	Use a robot to collect sensor data like: distance, sound, angle, light.
		5.3.2	Build, test and refine a program to control the robot using an input sensor like: light, sound, gyroscope.
		5.3.3	Recognise the importance of testing in order to eliminate errors.
		5.3.4	Recognise that some causes of errors are random like: dust, unknown variables.
	<i>5.4 Control in an Environment</i>	5.4.1	Navigate a robot in an environment to complete tasks using functionality like: following or avoiding a line; following or avoiding an object, a barrier; moving up, down a slope.
		5.4.2	Navigate a robot in an environment to complete a scenario using an appropriate combination of motions and functionalities.
		5.4.3	Recognise the importance of teamwork when collaborating on a robot and understand skills like: planning, communication, allocation of tasks.