ICDL
The Digital Skills Standard

ICDL Digital Student

ROBOTICS

Syllabus 1.0

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.

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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
1 Robotic Concepts	*1.1 Robots and Automated Systems*	1.1.1	Define robots, robotics systems.
		1.1.2	Understand that robots can be teleoperated, semi-autonomous, autonomous.
		1.1.3	Understand that robots can be fixed or mobile.
	1.2 The Use of Robots	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.
2 Robotics Parts	*2.1 Basic Parts and Components*	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.
	2.2 Microcontroller	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.

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	2.3 Actuator System	2.3.1	Identify main parts of the actuator system like: switch, motor.
		2.3.2	Understand that the actuator transforms electrical power into mechanical power, enabling the robot to function.
	2.4 Sensor	2.4.1	Understand that 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.
	2.5 Locomotion, Power	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.
3 Simple Control System	*3.1 Control System Overview*	3.1.1	Identify the elements of a control system. Understand 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	Set up a simple control system using elements like: power, motor, sensors.
	3.2 Test a Simple Control System	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.
4 Visual Programming	*4.1 Programming Basics*	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	Understand the basic elements of a program like: sequence, decision, loop.
		4.1.5	Understand how a flowchart can be used to present the steps in a solution.

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	4.2 Constant, Variable	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.
	4.3 Events, Controls	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.
	4.4 Program Creation and Execution	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.
5 Working with Robots	*5.1 Setup*	5.1.1	Understand 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.
	5.2 Implementing Robotic Motion	5.2.1	Implement simple robotic motion like: stop, move forward or backward, turn.
		5.2.2	Understand 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	Understand the relationship between power, rotational speed, angle of rotation in robotic motion.

CATEGORY	SKILL SET	REF.	TASK ITEM
	5.3 Implementing Robotic Controls	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	Understand the importance of testing in order to eliminate errors.
		5.3.4	Understand that some causes of errors are random like: dust, unknown variables.
	5.4 Control in an Environment	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. Understand skills like: planning, communication, allocation of tasks.