



ICDL Module Artificial Intelligence

Syllabus Version 1.0

Purpose

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

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Artificial Intelligence Module

This module explores the evolution of Artificial Intelligence (AI) and its technologies, provides a broad understanding of Artificial Intelligence fields and explains why it is important to have an Artificial Intelligence strategy and how Artificial Intelligence can be applied to different scenarios and problems.

Module Goals

After studying this module, candidates should be able to:

- Explain "Artificial Intelligence" and how to identify systems using Artificial Intelligence.
- Understand and differentiate among the major types and methodologies used in Artificial Intelligence.
- Explain how Artificial Intelligence enables capabilities that are beyond conventional technology.
- Describe the contributions and applications of Artificial Intelligence.
- Explain the role of Artificial Intelligence agents and how they relate to the environment, including the ways to evaluate how agents act by establishing goals.
- Understand the fundamentals of knowledge representation, reasoning techniques, and know how to build simple knowledge-based systems.
- Understand the basics of some of the more advanced topics of Artificial Intelligence such as machine learning, deep learning, agents and robotics.
- Understand the basic concepts and basic approaches to syntax and semantics in natural language processing.
- Define what are rule-based systems and fuzzy expert systems.
- Understand the fundamental issues of machine learning approaches, and challenges of machine learning and model complexity.
- Be familiar with some of the basic learning techniques.
- Understand the basic of a fundamental knowledge of deep learning methodology.
- Discuss the history, concepts and key components of robots.
- Understand the role of Artificial Intelligence to analyse "big data".
- Explain the basics of Artificial Intelligence platforms and how they are used.

CATEGORY	SKILL SET	REF.	TASK ITEM
1 Concepts of Artificial Intelligence	1.1 Introduction to Artificial Intelligence	1.1.1	Recognise the meaning of Artificial Intelligence (AI).
		1.1.2	Define the term intelligence and recognise its components, like: reasoning, learning, problem solving. Also, be able to identify human intelligence.
		1.1.3	Understand the definition of Artificial Intelligence, describing its four categories, reactive machine, limited memory, the theory of mind, and self-awareness.
		1.1.4	Identify the disciplines of Artificial Intelligence such as philosophy, mathematics, neuroscience, psychology, computer engineering, linguistics, control theory and cybernetics economic.

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		1.1.5	Outline the history of Artificial Intelligence starting from the gestation of Artificial Intelligence, birth of Artificial Intelligence, followed by early enthusiasm, great expectations till today.
		1.1.6	Identify the main goals of Artificial Intelligence and how they are related to each other, such as reasoning, knowledge representation of data, perception, ability to move objects and natural language processing.
	<i>1.2 Basic concepts of Artificial Intelligence</i>	1.2.1	Understand Artificial Intelligence approaches such as cognitive science, laws of thought, Turing test and rational agent.
		1.2.2	Recognise the differences between strong, weak, narrow and broad Artificial Intelligence.
		1.2.3	Understand types of Artificial Intelligence algorithms, such as symbolic reasoning, connections modelled on the brain's neurons, Bayesian inference, and systems that learn by analogy.
		1.2.4	Outline the major braches of Artificial Intelligence like pattern recognition, knowledge representation, heuristics and learning.
		1.2.5	Identify the major domain fields of Artificial Intelligence, like machine learning and natural languages, and the classification of each field. Explain the difference between speech and voice recognition, and presenting samples of Artificial Intelligence field applications.
		1.2.6	Know the challenges when scaling Artificial Intelligence applications and why a GPU is important.
		1.2.7	Outline the most popular Artificial Intelligence programming languages, and understand the purposes of each language.
	<i>1.3 Agents and Environments</i>	1.3.1	Know what agent terminology is and how an agent interacts with environments through sensors and actuators.
		1.3.2	Understand the concepts of rationality and its terminologies learn and autonomy.
		1.3.3	Understand environment properties like observable / partially observable, and define the differences between them.

CATEGORY	SKILL SET	REF.	TASK ITEM
2 Expert and Fuzzy Logic Systems	<i>2.1 Introduction to Expert and Fuzzy Logic Systems</i>	2.1.1	Understand the base agents that can form representations of a complex world, and identify the meaning of expertise.
		2.1.2	Understand the term knowledge presentation and outline the classifications of term solutions like: optimal, satisficing, approximately optimal and probable.
		2.1.3	Understand what an inference engine is, and how it provides a methodology for reasoning about information in knowledge base.
	<i>2.2 Fundamentals of Expert System</i>	2.2.1	Know how to define the term expert system.
		2.2.2	Outline and understand the relation between the typical components of an expert system like inference engine, knowledge base, acquisition module, expert knowledge, expert engineer, inference engine, domain specific data, and user interface.
		2.2.3	Outline the main capabilities of an expert system.
		2.2.4	Identify the characteristics of an expert system.
		2.2.5	Distinguish between conventional systems and expert system.
		2.2.6	Outline the main advantages and disadvantages of an expert System. List the most commonly used applications.
		2.2.7	Understand the steps to develop an expert system.
		2.2.8	Know how to use an expert system to classify an unknown animal based on a question and answer dialogue.
		2.2.9	Understand MYCIN one of the initial expert systems to perform with the level of expertise of a human expert and to provide users with complete explanation of its logical reasoning.
	<i>2.3 Concepts of Fuzzy Logic system</i>	2.3.1	Define and understand the fuzzy system as a new method of reasoning that resembles human reasoning.
		2.3.2	Outline the major advantages and disadvantages of fuzzy logic.
		2.3.3	Understand how the fuzzy system is implemented in several fields.

CATEGORY	SKILL SET	REF.	TASK ITEM
3 Natural Language Processing	<i>3.1 Understand Natural Language Processing</i>	3.1.1	Be aware of the first use of computers to manipulate natural language, from development till present.
		3.1.2	Define natural language processing (NLP) and its major terminology.
		3.1.3	Be aware of how to programme computers to process and analyse large amounts of natural language data, such as lexical analysis, syntactic, semantic analysis, disclosure integration and programmatic analysis.
		3.1.4	Understand the major components of NLP that are required to understand natural language (typed or spoken).
		3.1.5	Outline the five major stages in building natural language processing such as recognition/ conversion, and segmentation/ parsing.
		3.1.6	Understand the two main tasks of natural language processing: text processing, and speech processing, and identify the major tasks of text processing. Outline the fundamental tasks of speech recognition and text to speech.
		3.1.7	Outline the strengths and weaknesses of natural language processing.
4 Concepts of Virtual Agents	<i>4.1 Key elements of virtual agents</i>	4.1.1	Understand why agents need to learn.
		4.1.2	Be aware that there are three categories of feedback in machine learning.
	<i>4.2 Machine learning categories</i>	4.2.1	Understand the meaning of reinforcement learning and how it is used by machines.
		4.2.2	Understand the meaning of supervised learning and how it is used by machines. Understand the differences between reinforced learning and supervised learning.
		4.2.3	Understand the meaning of unsupervised learning and how it is used by machines. Understand the difference between supervised and unsupervised learning.

CATEGORY	SKILL SET	REF.	TASK ITEM
5 Artificial Neural Networks (ANN) & deep learning	4.3 How machine learning works.	4.3.1	Be aware of machine learning terminology such as model, training, and prediction, and understand the relationship and differences between them.
		4.3.2	Be aware of how machine learning is already implemented in everyday life.
		4.3.3	Recognise the differences between machine learning and Artificial Intelligence.
	5.1 Introduction to artificial neural networks	5.1.1	Recognise the simple biological structure of a neural network, and its characteristics. Understand the concept of ANN as it relates to neural networks.
		5.1.2	Understand how to distinguish between biological neurons and artificial neurons.
		5.1.3	Outline the characteristics of an artificial neural network.
	5.2 Basic concepts of artificial neural networks	5.2.1	Understand how several neurons are arranged, or placed in relation to each other artificially. Understand the concept of layers, feedforward and feedback for the flow of information and the connectivity of neurons.
		5.2.2	Outline the reasons why neural networks are used. Be aware of different fields that ANN can perform which are easy for a human but difficult for a machine.
	5.3 The essentials of deep learning		5.3.1
5.3.2			Be aware of the steps required for deep learning processing.
5.3.3			Be aware of how deep learning can be applied to image recognition and handwriting.
5.3.4			Understand the differences between deep learning and machine learning.
5.3.5			Recognise some ways in which deep learning is currently applied.

CATEGORY	SKILL SET	REF.	TASK ITEM
6 Robotic Process Automation	6.1 Key concepts of robotic process automation	6.1.1	Understand the term robotics process automation.
		6.1.2	Be aware of the main benefits to using robotics and some commonly used activities.
		6.1.3	Recognise the characteristics of robotic process automation.
		6.1.4	Understand some differences between robots and Artificial Intelligence programmes.
		6.1.5	Be aware of a brief history of robots including how they have evolved particularly within many industries.
	6.2 How robot's work.	6.2.1	Understand the necessary components of a robot, such as: locomotion, actuator, sensor, and control system.
		6.2.2	Be aware of what robots need for different types of movement.
		6.2.3	Understand why vision is important for robots in many industries.
	6.3 Robotics in life	6.3.1	Understand that robots are now built to resemble the human body and be able to outline some current uses of them.
		6.3.2	Recognise how to classify robot processing automation software and be aware of examples of robots which currently use or will use this in the future.
7 Fundamentals of Big Data Analytics	7.1 Basic issues of big data	7.1.1	Define and understand the term 'big data' and its major types. Be aware of the concept of a storage repository.
		7.1.2	Recognised types of big data sources.
		7.1.3	Understand that big data is a powerful tool and recognise how it contributes to the improvement of areas such as: inferring knowledge, health, security, law enforcement and smart cities.
	7.2 Big data analytics tools	7.2.1	Define the term analytics and understand the four types of data analysis: diagnostic, descriptive, predictive and prescriptive. Define the relationship between them.
		7.2.2	Understand that there are various types of technology that handle big data. Recognise a popular framework for storing and processing large amounts of data.

CATEGORY	SKILL SET	REF.	TASK ITEM
8 Artificial Intelligence Platforms	8.1 An overview of platform types	8.1.1	Understand what an Artificial Intelligence platform is.
		8.1.2	Be aware of examples of machine learning platforms and what they provide.