# **Specializ****ation Syllabus Submission**

## Specialization Overview

**Specialization Title:** Introduction to Artificial Intelligence / Introducción a Inteligencia Artificial

**Partner Name:** Universidad Nacional Autónoma de México

**Corresponding Competency Area from Coursera’s Career Track Content List** : Artificial Intelligence

**Will this Specialization have a Culminating Project as the final course?** Yes

**Executive Summary:**

A learner with basic computer science and programming experience will be able to understand and apply a broad set of concept from Artificial Intelligence (AI) in a wide variety of domains. By the end of this Specialization, learners will have completed seven AI courses and a culminating project.

Over the last sixty years, AI has developed algorithms, programs and machines to solve a diverse range of problems. Its applications are transforming society and have generated extensive interest given the potential of AI. We can classify most AI algorithms and applications into two categories: predictive and adaptive. Reasoning, planning, knowledge representation, and creativity are aspects of prediction. For adaptation, solutions are searched depending on the scale at which problems change. Depending on this scale, we can classify adaptation in terms of learning, behavior, and evolution. For both categories, perception, actuation, communication, and coordination are relevant.

This Specialization offers a general introduction to a variety of topics: Artificial Intelligence Agents, Search and Planning, Constraint Satisfaction Problems, Decision Theory, Game Theory, Knowledge Representation, Reinforcement Learning, Artificial Neural Networks, Deep Learning, Enactive Cognition, Self-organization, and Genetic Algorithms. The courses provide guidelines for students to deepen the contents of their choice. Applications are highlighted throughout the courses, also discussing philosophical, ethical, and social implications. In the culminating project, learners will apply several topics to a problem of their choice.

The content will be bilingual, offering all videos and materials in English and Spanish.

## **Course 1**

**Course Title:** Sixty Years of Artificial Intelligence

**Corresponding Topic(s) from Coursera’s Career Track Content List:** Artificial Intelligence Agents.

**Course Project**

* **Title:** Potential and Perils of Artificial Intelligence
* **Type:** Essay
* **Prompt:** Discuss more deeply one of the topics from the course: a historic aspect of A.I., the implications and challenges of the synthetic method, the mind-body problem, a subfield of A.I. or related disciplines, or future perspectives at different levels: technological, social, ethical, and/or philosophical.
* **Artifact:** Peer evaluated essay.

**Course Learning Objectives: (3+ per course)**

*“After completing this course, a learner will be able to...”*

* Place artificial intelligence in historic, social, and philosophical contexts.
* Distinguish the different purposes of using the synthetic method (creating artificial systems) in science and engineering.
* Compare different A.I. subfields and related disciplines.
* Classify problems into stationary and non-stationary domains, preparing learners to use predictive and adaptive methods, respectively.

## **Course 2**

**Course Title:** Artificial Reasoning

**Corresponding Topic(s) from [Coursera’s Career Track Content List:](https://docs.google.com/presentation/d/1H5DaKuwlVZwCHRo3wC7086bNZfps03Ky2F7lwArm6VE/edit" \l "slide=id.g1692784de1_0_0)** Artificial Intelligence Agents,Search and Planning, Constraint Satisfaction Problems, Decision Theory, *Game Theory, Knowledge Representation*.

**Course Project:**

* **Title:** An Expert System for Diabetes Diagnosis.
* **Type:** Programming assignment.
* **Prompt:** Formalizediagnosis rules in a knowledge base. Use an inference engine to prompt questions to an user and give a medical diagnosis in a limited context.
* **Artifact:** A basic expert system**.**

**Course Learning Objectives: (3+ per course)**

*“In this course, a learner will be able to…”*

* Represent knowledge using ontologies and taxonomies.
* Design artificial agents to perform inferences in closed contexts.
* Solve Constraint Satisfaction Problems.
* Apply Decision and Game Theories.

## **Course 3**

**Course Title:** **Problem Solving by Searching**

**Corresponding Topic(s) from [Coursera’s Career Track Content List:](https://docs.google.com/presentation/d/1H5DaKuwlVZwCHRo3wC7086bNZfps03Ky2F7lwArm6VE/edit" \l "slide=id.g1692784de1_0_0)**  Artificial Intelligence Agents,Search and Planning

**Course Project:**

* **Title:** Optimal solutions for the Rubik’s Cube
* **Type:** Programming assignment.
* **Prompt:** Implement state space informed search algorithms for solving de Rubik’s Cube.
* **Artifact:** A Python Program.

**Course Learning Objectives: (3+ per course)**

*“In this course, a learner will be able to…”*

* Abstract problem solving domains as search trees and graphs.
* Design searching agents that are appropriate to given computational constraints.
* Design heuristic functions to be used in informed search algorithms.
* Implement python programs that solve problems by searching.

## **Course 4**

**Course Title:** Artificial Creativity

**Corresponding Topic(s) from [Coursera’s Career Track Content List:](https://docs.google.com/presentation/d/1H5DaKuwlVZwCHRo3wC7086bNZfps03Ky2F7lwArm6VE/edit" \l "slide=id.g1692784de1_0_0)**  Artificial Intelligence Agents,Search and Planning

**Course Project:**

* **Title:** Artificial Music
* **Type:** Programming assignment.
* **Prompt:** Build rules to compose artificially creative “melodies”. What does it take for an algorithm to be considered creative?
* **Artifact:** Artificial music generator.

**Course Learning Objectives: (3+ per course)**

*“In this course, a learner will be able to…”*

* Use the synthetic perspective to define creative processes.
* Compare computational creativity algorithms with search algorithms.
* Create and share their own generative art.

## **Course 5**

**Course Title:** Machine Learning

**Corresponding Topic(s) from Coursera’s Career Track Content List:** Reinforcement Learning, *Artificial Neural Networks, Deep Learning*.

**Course Project:**

* **Title:** Machine Learning with NumPy
* **Type:** Programming assignment
* **Prompt:** Implement and apply a machine learning algorithm in Python using NumPy.
* **Artifact:** Python program.

**Course Learning Objectives: (3+ per course)**

*“In this course, a learner will be able to…”*

* Use computational learning theory in specific applications.
* Compare the differences between supervised and non-supervised learning.
* Apply neural networks to classify simple patterns.
* Use reinforcement learning to solve a simple control problem.
* Apply concepts useful to start the Deep Learning Specialization.

## **Course 6**

**Course Title:** Adaptive Behavior

**Corresponding Topic(s) from Coursera’s Career Track Content List:** Artificial Intelligence Agents,Search and Planning, *Enactive Cognition*, *Self-organization*.

**Course Project:**

* **Title:** Braitenberg Vehicles.
* **Type:** Programming assignment.
* **Prompt:** Build a simulator where adaptive agents interact inspired on Braitenberg vehicles.
* **Artifact:** Simulator of artificial agents.

**Course Learning Objectives: (3+ per course)**

*“In this course, a learner will be able to…”*

* Explain the cybernetic control loop.
* Practice how feedback can lead to successful adaptation.
* Distinguish how self-organization can be used to solve problems which require adaptation.

## **Course 7**

**Course Title:** Evolutionary Computation

**Corresponding Topic(s) from Coursera’s Career Track Content List:** Search and Planning, *Genetic Algorithms*.

**Course Project:**

* **Title:** A simple genetic algorithm
* **Type:** Programming assignment.
* **Prompt:** Implement a basic genetic algorithm and use it to optimize the parameters of different functions.
* **Artifact:** A genetic algorithm project.

**Course Learning Objectives: (3+ per course)**

*“In this course, a learner will be able to…”*

* Distinguish evolutionary processes as search methods.
* Build a simple genetic algorithm.
* Review the basics of evolutionary robotics.

## **Course 8**

**Course Title:** Embodied Cognition

**Corresponding Topic(s) from Coursera’s Career Track Content List:** Artificial Intelligence Agents, *Enactive Cognition*

**Course Project:**

* **Title:** The Future of AI
* **Type:** Essay
* **Prompt:** Discuss potential future scenarios of AI technologies, what would be necessary and sufficient conditions, and the impact on society these technologies would have.
* **Artifact:** Peer evaluated essay.

**Course Learning Objectives: (3+ per course)**

*“In this course, a learner will be able to…”*

* Compare artificial agents, their “body”, and their environment.
* Estimate the role of perception and actuation in artificial intelligence.
* Distinguish the challenges of communication between artificial agents and between humans and agents
* Identify different coordination mechanisms.
* Describe the difference between intelligence and consciousness.

## **Course 9**

**Course Title:** Culminating Project

**Corresponding Topic(s) from Coursera’s Career Track Content List:** Artificial Intelligence Topics.

**Course Project:**

* **Title:** Specialization Culminating Project
* **Type:** Programming Project and Essay
* **Prompt:** Extend one of the topics covered in the Specialization, making an implementation, comparing it to other techniques, and reporting results in an essay.
* **Artifact:** Peer evaluated essay.

**Course Learning Objectives: (3+ per course)**

*“In this course, a learner will be able to…”*

* Apply knowledge acquired during the Specialization to a particular domain.
* Implement AI technology with a specific purpose.
* Compare developed solutions with existing ones.
* Report results in a structured essay.