DEPARTMENT OF COMPUTER SCIENCES
M.SC. PROGRAM IN ARTIFICIAL INTELLIGENCE
M.SC. COURSES DESCRIPTION

AI 615: Artificial Intelligence Models (3 hrs)

The objective of this course is to provide students with the most important mathematical and statistical backgrounds related to AI models. This course will cover the following topics: statistical models, probabilistic models and mathematical models.

AI 630: Robotics and Planning (3 hrs)

The objective of this course is to provide students with an overview of robotics in practice and research. The course covers the following topics: robotics programming, motion planning, kinematics, sensors, mobile robotics, robot communication, planning and programming of robot actions. Concepts and tools for building embedded real-time systems, and wired, wireless robotics.

AI 640: Computational Intelligence (3 hrs)

The objective of this course is to provide students with different methods of computational intelligence. The course covers the following topics: evolutionary algorithms (e.g., genetic algorithms, swarm intelligence, bee colony optimization), and hybridizations of these techniques. Introduce the concepts, algorithms and tools for developing computational intelligent systems. The students will learn how to model a real world problem mathematically to be solved by an evolutionary algorithm.

AI 641: Pattern Recognition (3 hrs)

The objective of this course is to provide students with the main concepts of pattern recognition. The course covers the following topics: patterns, uncertainty in pattern recognition, fuzzy sets, inductive learning of rules for recognition, learning discriminates, self-organizing nets for pattern recognition, functional-link net, roles of fuzzy logic, pattern recognition and neural nets, issues in the use of adaptive pattern recognition.

AI 650: Multi-agent Systems (3 hrs)

The objective of this course is to provide students with a broad and rigorous introduction to the theory, methods and algorithms of multi-agent systems. The course covers the following topics: logics for multi-agent systems; multi-agent organizations; an introduction and overview of software models and techniques in building multi-agent systems; a general perspective on the domain of collective and cooperative behavior; a conceptual framework for distributed problem solving; argumentation and dialogues in multi-agent Systems; multi-agent negotiation; communication and coordination in multi-agent systems; development of multi-agent systems.

AI 651: Intelligent Web (3 hrs)

The objective of this course is to provide students with technologies and languages for making the information on the Web accessible to computer programs. The course covers the following topics: languages for structuring documents (such as XML and XML schema); XML documents querying and transformation languages (such as XPath and XSLT); knowledge representation languages such as RDF and RDFS; and languages for searching and filtering documents.

AI 660: Speech Recognition and Understanding (3 hrs)

The objective of this course is to introduce students with an introduction to automatic speech recognition. This course will cover the following topics: speech synthesis, and dialogue systems, from the computer science and linguistics. The course provides a background in speech recognition and production, acoustic-phonetics, and speech signal analysis and representation. Then it introduces the acoustic modeling algorithms (such as hidden Markov models), language modeling and recognition search algorithms.

AI 662 Signal Processing (3 hrs)

The objective of this course is to introduce students with the basic concepts and principles underlying discrete-time signal processing. Concepts will be illustrated using examples of standard technologies and algorithms. This includes basic operations like filtering and frequency analysis, but also methods/systems for modeling, estimation and classification. This course will cover the following topics: time, frequency and z-domain description of discrete signals and linear time-invariant systems, analysis and design of filters, multirate systems, correlation and energy spectrum, statistical properties, modeling and estimation of discrete stochastic processes.

AI 670: Advanced Artificial Intelligence (3 hrs)

The objective of this course is to provide students with some advanced concepts in the field of artificial intelligence. The course covers the following topics: theoretical aspects in knowledge engineering, abstraction, reasoning, search algorithms, statistical classification of patterns, cognitive modeling, advanced interfaces, planning, computer image processing, machine learning, evolutionary algorithms, artificial intelligence distributed and parallel.

AI 671: Natural Language Processing (3 hrs)

The objective of this course is to introduce students with some basic concepts and skills in natural language processing. This course will cover the following topics: Syntactic processing, semantic interpretation and strategies, context and world knowledge, response generation systems (question-answering systems, natural language generation), typical application issues (e.g. machine translation), Arabic applications.

AI 672: Knowledge-Base Systems (3 hrs)

The objective of this course is to provide students with the main concepts of knowledge base systems. The course covers the following topics: Knowledge representations and mappings, approaches and issues (e.g. predicate logic, fuzzy logic, week and strong slot and filler structures), knowledge acquisition, the frame problem, symbolic reasoning under uncertainty (non-monotonic reasoning, augmenting a problem Solver), statistical reasoning (e.g. probability and Bays Theorem, Bayesian networks, Dumpster-Shafer theory), building knowledge-based systems.

AI 674: Logic and Reasoning (3 hrs)

The objective of this course is to introduce Logic from a computational perspective. It shows how to encode information in the form of logical sentences; it shows how to reason with information in this form; and it provides an overview of logic technology and its applications in computer science and mathematics. Topics include the syntax and semantics of Propositional Logic, Relational Logic, and Herbrand Logic, temporal logics ,validity, contingency, unsatisfiability, logical equivalence, entailment, consistency,

natural deduction (Fitch), mathematical induction, resolution, compactness, soundness, completeness.

AI 675: Machine Learning (3 hrs)

The objective of this course is to provide students with the theory and practice of machine learning from a variety of perspectives The course covers the following topics: learning decision tress. Neural network learning, Deep Learning, Statistical learning methods, genetic algorithms. Bayesian learning methods. Explanation-based learning and reinforcement learning will be covered. The course covers theoretical concepts such as inductive bias, the PAC and Mistake- bound learning frameworks, and minimum description length principle.

AI 680: Intelligent User Interfaces (3 hrs)

This course combines Human Computer Interaction and artificial intelligence with the goal of building intelligent and smart user interfaces, where the system's behavior can have an impact on the user experience. Intelligent user interfaces (IUIs) usually are designed with capabilities to model and understand the user, including how to perceive, interpret, learn, use language, reason, plan, and decide. This course explores issues in the design, implementation, and evaluation of Intelligent User Interfaces that use artificial intelligence technologies such as machine learning, computer vision and pattern recognition. The course will enable students in developing proposing and developing IUIs, given their domains or applications of interest.

AI 681: Image Processing and Computer Vision (3 hrs)

The objective of this course is to provide students with an introduction to the basic concepts techniques, and technologies of digital image processing to understand 3D scene by machines. The course covers the following topics: image and video representation technologies, image enhancement and filtering techniques, edge detection, segmentation techniques, feature extraction, reconstructing 3D scene information using techniques such as depth from stereo, structure from motion, shape from shading, motion and video analysis, and three-dimensional object recognition.

AI 691: Special Topics in Artificial Intelligence (3 hrs)

A special topic in artificial intelligence, which is not covered by the other courses. The department council should approve the topic and the contents of this course.

AI 699A	**Master Thesis**	**0 hrs**
AI 699B	**Master Thesis**	**3 hrs**
AI 699C	**Master Thesis**	**6 hrs**
AI 699D	**Master Thesis**	**9 hrs**

Courses from other Departments and Programs

CS 603: Research Methodologies (3 hrs)

The objective of this course is to introduce students with the basic concepts of scientific research methodologies. This course covers the following topics: methodologies of scientific research in information technology, elements of research proposal, documentation of references, design of experiments, analysis of data and results, and writing a research proposal.