Jordan University of Science & Technology

Faculty of Computer & Information Technology

Department of Computer Science

Curriculum for the bachelor's degree

In

Artificial Intelligence

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Vision

Stay at the top of computer science departments in Jordan and toward world-class distinguished department in high quality teaching and research.

Mission

To realize our mission, the CS department works to:

- Emphasize high-quality teaching and research, dedication to community services, and partnership with industry.
- Maintain high-quality undergraduate and graduate programs that deliver advanced knowledge in computer science while allowing prompt response to the needs of the local community.
- Deliver high-quality research, both theoretical and applied, and promotes collaboration with the industry in terms of research and training.
- Enhance staff-student relations and mutual understanding in order to create pleasant and productive teaching and research environment.

Objectives

The objective of the B.Sc. in AI program is to produce graduates that will be able to:

1. PEO1 (Problem Solving): Gain in-depth knowledge of Computing and Artificial Intelligence principles and techniques and apply them effectively and proficiently to solve real-life problems.
2. PEO2 (Self-Motivated and Life-Long Learning): Promote sustainable learning by developing transferable skills and knowledge to keep up with the evolving Artificial Intelligence technologies, meet the demands of the rapidly changing labor market, and pursue higher degrees in different subfields of Artificial Intelligence.
3. PEO3 (Leadership and Teamwork): Improve the ability to work effectively and productively as a leader or a team member toward accomplishing common goals.
4. PEO4 (Community Support): Maintain strong relationships with the local, regional, and international communities by contributing to economic growth and social development.

Outcomes

Graduates of the AI program will have the ability to:

1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.

2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
3. Communicate effectively in a variety of professional contexts.
4. Recognize professional responsibilities and make informed and equitable judgments in computing practice based on legal and ethical principles.
5. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
6. Apply computer science and artificial intelligence theory and software development fundamentals to produce computing-based solutions.

Study Plan for the Artificial Intelligence Program

A Bachelor of Science (B.Sc.) degree in Artificial Intelligence at faculty of Computer and Information Technology at JUST is awarded in accordance with the statute stated by JUST regulations for B.Sc. awarding issued by the Dean's Council based on 1987 law for awarding scientific degrees and certifications at JUST after completing (132) credit hours successfully, distributed as indicated in the following table:

Table (1)

Requirements	Mandatory	Elective	Total
University Requirements	16	9	25
Faculty Requirements	24	0	24
Departmental Requirements	74	9	83
Total	**114**	**18**	**132**

1. University Requirements (25 CHs) classified as:

1-a) University Mandatory Courses (16 CHs).
1-b) University Elective Courses (9 CHs).

2. Faculty Requirements (24 CHs) shown in table (2):

Table (2): Mandatory Faculty Requirements

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
MATH 101	Calculus I	3	3	0	-
MATH 102	Calculus 2	3	3	0	Passing MATH 101
MATH 241	Discrete Mathematics	3	3	0	-
CS 101	Introduction to Programming	3	3	0	CIS 99 or Concurrent
SE 103	Introduction to Information Technology	3	3	0	Concurrent with CS 101
SE 112	Introduction to Object-Oriented Programming	3	3	0	Passing CS 101
CS 211	Data Structures	3	3	0	MATH 241+ passing SE 112
CIS 221	Fundamentals of Database Systems	3	3	0	CS 211

3-a) Department mandatory requirements (74 CHs):

Table (3): Mandatory Department

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
AI 240	Introduction to Artificial Intelligence	3	3	0	CS 284
AI 244	Artificial Intelligence Programming	3	3	0	CS 101
CS 375	Operating Systems	3	3	0	CS 284
AI 328	Big Data Processing	3	3	0	CIS 221
AI 249	Machine Learning	3	3	0	AI 244
AI 342	Deep Learning	3	3	0	AI 249
AI 356	Information Retrieval	3	3	0	AI 249
AI 375	Digital Image Processing	3	3	0	CS 284 + Math 140
AI 378	Smart Systems	3	3	0	CS 375
AI 380	Optimization Algorithms	3	3	0	CS 284+ AI 244
AI 445	Natural Language Processing	3	3	0	AI 342
AI 446	Audio Signal Processing	3	3	0	AI 342
AI 447	Computer Vision	3	3	0	AI 342 + AI 375
AI 448	Deep Reinforcement Learning	3	3	0	AI 342
AI 471	Artificial Intelligence for Games	3	3	0	AI 342
AI 474	Extended Reality	3	3	0	AI 447
AI 477	Robotics	3	3	0	AI 342
AI 490	Internship	3	3	0	Passing 90 CHs or department approval
AI 491	Graduation Project (1)	2	2	0	Passing 90 CHs
AI 492	Graduation Project (2)	3	3	0	AI 491
Math 140	Linear Algebra	3	3	0	MATH101
CS 284	Analysis and Design of Algorithms	3	3	0	CS 211 + Math 233
AI 350	Data Science	3	3	0	AI 328
Math 233	Probability & Statistics (for computer science students)	3	3	0	Math 102
CIS 201	Introduction to Web Design	1	0	3	SE 112
CIS 203	Communication and Professional Ethics	2	2	0	-

3-a) Department Elective Requirements (9 CHs):

Chosen by the student from the below list of courses, provided that at least **3 CHs** of them are from the Department of Artificial Intelligence*.

Table (4): Elective Department

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
AI 365	Information Security and Privacy	3	3	0	AI 240
AI 421	Cloud Computing	3	3	0	AI 328
AI 442	Artificial Intelligence Planning	3	3	0	AI 380
AI 443	Multi-Agent Systems	3	3	0	AI 471
AI 452	Semantic Web	3	3	0	CIS 201
AI 453	Social Networks Analysis	3	3	0	AI 356
AI 454	Business Intelligence	3	3	0	AI 350
AI 455	Pattern Recognition	3	3	0	AI 342
AI 457	Recommender Systems	3	3	0	AI 378
AI 481	Artificial Intelligence for Medicine and Healthcare	3	3	0	AI 342
AI 482	Artificial Intelligence for Computational Biology and Bioinformatics	3	3	0	AI 342
AI 483	Artificial Intelligence for Financial and Industrial Applications	3	3	0	AI 342
AI 484	Fuzzy Logic	3	3	0	CS 284
AI 485	Drones and Autonomous Systems	3	3	0	AI 477
AI 495-I	Special Topics in Artificial Intelligence (1)	1	1	0	Dept. Approval
AI 495-II	Special Topics in Artificial Intelligence (2)	2	2	0	Dept. Approval
AI 495-III	Special Topics in Artificial Intelligence (3)	3	3	0	Dept. Approval
	400-level or higher CIT's course	3	3	0	Dept. approval

Course Numbering Convention

AI meaning: **Artificial Intelligence**			
Digit	**Meaning**	**Explanation**	
Hundreds	Course Level	1	First year
		2	Second year
		3	Third year
		4	Fourth year
Tens	Course Subject	0	Basic Principles

*The student is exempt from studying 3 CHs from the optional courses based table (4), if s/he joins one of the international academies specialized in offering technical courses or joins a technical training course offered in the college in which the number of training hours exceeds 150 hours, provided that s/he obtains an internationally accredited certificate for that course.

		1	Programming
		2	Big Data
		3	Mathematics and Statistics
		4	Learning
		5	Applications
		6	Security
		7	Hardware Components
		8	Specialized Topics
		9	Special Topics, Project, Internship
Ones	Course Sequence	Course sequence number within the subject area	

Recommended Study Plan

1st Year			
1st Semester			
Course Number	**Course Name**	**# CH**	**Prerequisite**
CS 101	Introduction to Programming	3	CIS 99 *(or concurrent)*
CS 101	Introduction to Programming (Practical)	0	Concurrent with CS101
SE 103	Introduction to IT	3	CS 101 *(or concurrent)*
Math 101	Calculus I	3	-
Math 241	Discrete Mathematics	3	-
HSS 110	Leader and Social Responsibility	3	-
LG 101	Communication Skills in English	3	Pass LG 099 or passing English exam
	Total	**18**	
2nd Semester			
SE 112	Introduction to Object-Oriented Programming	3	Passing CS 102
SE 112	Introduction to Object-Oriented Programming (Practical)	0	Concurrent with SE 112
CS 211	Data Structures	3	Math 241 and passing SE 112
Math 140	Linear Algebra	3	Math 101
Math 102	Calculus 2	3	Math 101
CIS 203	Communication and Professional Ethics	2	-
	Total	**14**	

2nd Year			
1st Semester			
Course Number	**Course Name**	**# CH**	**Prerequisite**
CS 284	Analysis and Design of Algorithms	3	CS 211 + Math 233
Math 233	Probability & Statistics (for computer science students)	3	Math 102
CIS 201	Introduction to Web Design	1	SE 112
CIS 221	Fundamentals of Database Systems	3	CS 211
ARB 102	Communication Skills in Arabic	3	-
-	University Elective	3	-
	Total	**16**	
2nd Semester			
AI 240	Introduction to Artificial Intelligence	3	CS 284
AI 244	Artificial Intelligence Programming	3	CS 101
AI 244	Artificial Intelligence Programming (Practical)	0	Concurrent with AI 244
MS 100	Military Science	3	-
AI 249	Machine Learning	3	AI 244
LG 103	Life Skills	2	-
-	University Elective	3	-
	Total	**17**	

3rd Year			
1st Semester			
Course Number	**Course Name**	**# CH**	**Prerequisite**
AI 375	Operating Systems	3	CS 284
AI 328	Big Data Processing	3	CIS 221
AI 375	Digital Image Processing	3	CS 284 + Math 140
AI 380	Optimization Algorithms	3	CS 284+ AI244
HSS 119	Entrepreneurship and Innovation	2	-
-	University Elective	3	-
	Total	**17**	
2nd Semester			
AI 350	Data Science	3	AI 328
AI 342	Deep Learning	3	AI 249
AI 356	Information Retrieval	3	AI 249
AI 378	Smart Systems	3	CS 375
-	Department Elective	3	-
	Total	**15**	
3rd Semester (Summer)			
AI 490	Internship	3	Passing 90 CHs or department approval
	Total	**3**	

4th Year			
1st Semester			
Course Number	**Course Name**	**# CH**	**Prerequisite**
AI 445	Natural Language Processing	3	AI 342
AI 447	Computer Vision	3	AI 342 + AI 375
AI 471	Artificial Intelligence for Games	3	AI 342
AI 477	Robotics	3	AI 342
AI 491	Graduation Project (1)	2	Passing 90 CHs
-	Department Elective	3	-
	Total	**17**	
2nd Semester			
AI 446	Audio and Speech Processing	3	AI 342
AI 448	Deep Reinforcement Learning	3	AI 342
AI 474	Extended Reality	3	AI 447
AI 492	Graduation Project (2)	3	AI 491
-	Department Elective	3	-
	Total	**15**	

Courses Description
Artificial Intelligence Courses

AI 240: Introduction to Artificial Intelligence (3C=3H+0L)

Prerequisite: CS 284

An introduction to the basic knowledge representation, problem solving, and learning methods of artificial intelligence. Topics will include specific AI techniques, a range of application areas, and connections between AI and other areas of study (i.e., philosophy, psychology). Techniques may include heuristic search, automated reasoning, machine learning, deliberative planning and behavior-based agent control. Application areas include robotics, games, knowledge representation, and natural language processing.

AI 244: Artificial Intelligence Programming (3C=3H+0L)

Prerequisite: CS 101

This course provides the fundamentals of the Python programming language, along with programming best practices. Students will learn about several libraries in python, that solve many computational problems related to AI and Machine Learning (ML) tasks such as obtaining and handling real-world messy data, performing simple data manipulation, analysis and visualization, and building ML models. Through this course, students will gain an in-depth understanding of "AI in practice" where students will gain practical experience in how to apply several techniques in practical tasks using programming language as python and popular Python AI libraries.

AI 249: Machine Learning (3C=3H+0L)

Prerequisite: AI 244

This course provides a broad introduction to principles, algorithms, and applications of machine learning. Topics include: Basic review of vital mathematical, statistical and algorithmic concepts, Supervised learning, curve fitting, linear models for regression (basic functions, gradient search, bias-variance, Bayesian regression, and evidence approximation), linear models for classification such as decision trees, discrimination functions, probabilistic generative models, probabilistic discriminative models, Laplace approximation. The course will also discuss Bayesian logistic regression, linear prediction with regularization. Lasso and Elastic Net, Feature selection and model selection. Other topics include supervised classification, KNN theory, principal component analysis and support vector machines.

AI 328: Big Data Processing (3C=3H+0L)

Prerequisite: CIS 221

This course addresses distributed storage and large data set processing focusing on architectures and technologies. Students will experience various data genres and management tools appropriate for processing big data. Students will learn all about Hadoop and its framework consisting of tools for distributed storage and data processing, to an open-source framework while addressing distributed storage and large data set processing. Additionally, students learn about other elements such as, NoSQL databases, and competing technologies. Through guided hands-on tutorials, students will become familiar with techniques using real-time and semi-structured data examples in order to design business solutions to manage big data projects.

AI 342: Deep Learning (3C=3H+0L)

Prerequisite: AI 249

This course will introduce students to the concept of deep learning and its key principles. The course covers feed-forward neural networks, convolutional neural networks (object classification, object detection, face verification, style transfer), recurrent neural network (natural language processing, speech recognition), sequence modelling, techniques to improve neural networks (regularization and optimizations, hyperparameter tuning, deep learning frameworks), generative adversarial networks, deep reinforcement learning, and adversarial attacks. It is expected by the end of the course, students will be able to build, train and apply fully connected deep neural networks, and to know how to implement efficient neural networks using the most popular libraries for deep learning such as Keras, PyTorch, and TensorFlow.

AI 350: Data Science (3C=3H+0L)

Prerequisite: AI 328

This course provides students with key concepts in data science and suitable programming skills to support these concepts. Specific topics include: definition of data science and its relationships with other fields; importance of data

science and its driving forces; data acquisition and exploration; data profiling; data cleaning; data quality; feature selection taking into consideration structured and unstructured data; model selection; result analysis and visualization of data and results. Many python packages necessary for data science and analytics are also covered.

AI 356: Information Retrieval (3C=3H+0L)

Prerequisite: AI 249

This course aims to understand information retrieval algorithms and identify challenging problems on the Web. Topics include keyword-based retrieval, file structures, thesaurus construction, lexical analysis, stemming, term weighting, associative indexing, Boolean operations, string searching and matching techniques, document modeling and inverted index construction and compression, vector space model and ranking methods, probabilistic and language models, evaluation methods, relevance feedback, query expansion. The course also covers the web search fundamentals, example of topics includes web search engine architecture, web crawling and indexing, web structure, and usage analytics.

AI 365: Information Security and Privacy (3C=3H+0L)

Prerequisite: AI 240

This course covers the fundamental issues and first principles of security and information assurance. Security policies, models and mechanisms related to confidentiality, integrity, authentication, identification, and availability issues related to information and information systems. Basics of cryptography such as key management and digital signatures, etc. And network security such as PKI, IPsec, intrusion detection and prevention. Risk management, security assurance and secure design principles. Issues such as organizational security policy, legal and ethical issues in security, standards and methodologies for security evaluation and certification.

AI 375: Digital Image Processing (3C=3H+0L)

Prerequisite: CS 284 + Math 140

Image sampling and quantization, color, point operations, segmentation, morphological image processing, linear image filtering and correlation, image transforms, eigenimages, multiresolution image processing, noise reduction and restoration, feature extraction and recognition tasks, image registration. Emphasis is on the general principles of image processing. Students learn to apply material by implementing and investigating image processing algorithms.

AI 378: Smart Systems (3C=3H+0L)

Prerequisite: CS 375

This course aims at preparing students to the smart cities and Internet of Things (IoT) markets. The course introduces the building blocks of IoT systems and the underlying technologies that drive the IoT revolution. Part of the course will deal with developing real-world IoT applications/mobile application prototypes from the sensing level to the end-user applications to solve existing problems in the society. Moreover, the course utilizes AI algorithms to build models and large-scale systems to solve problems such as telco management, intelligent transportation, urban planning, real time crowd management, retail intelligence, and industry 4.0 using various data sources.

AI 380: Optimization Algorithms (3C=3H+0L)

Prerequisite: CS 284 + AI 244

This course introduces the principal of optimization problems and algorithms. The course covers the most fundamental concepts in the field of optimization techniques including heuristics, metaheuristics, and evolutionary optimization techniques. The course will also show how to tackle several difficulties in different optimization problems. By the end of the course, students need to be able to identify and implement the main components of an optimization problem in a variety of applications including Machine Learning, Data Science, Neural Networks, and Deep Learning.

AI 421: Cloud Computing (3C=3H+0L)

Prerequisite: AI 328

The course gives an introduction to cloud computing, its techniques and main components. It covers the topics of data centers, virtualization, cloud storage and programming models. It discusses the motivating factors, benefits, challenges, and service models. It describes several concepts behind data center design and management. It also presents virtualization, data distribution, durability, consistency and redundancy.

AI 442: Artificial Intelligence Planning (3C=3H+0L)

Prerequisite: AI 272

Planning is a fundamental part of intelligent systems. It is the task of finding a sequence of actions needed to achieve a system its goals while optimizing the overall performance, intelligent planners can reason about the effects of actions, and efficiently searching the space of possible plans. Topics include action and plan representation, reactive systems, hierarchical and abstraction planning, case-based planning, machine learning in planning, multi-agent planning, Artificial Intelligence Planning for Robots, interacting with the environment, planning under uncertainty, plan execution, partial plans and plan refinement, task network and decomposition, Graphplan Algorithm, Pattern Databases, plan generation, planning modeling languages, and applications of planning.

AI 443: Multi-Agent Systems (3C=3H+0L)

Prerequisite: AI 471

A multi-agent system is composed of multiple autonomous entities such as sensor networks and robots, with distributed information, computational ability, and possibly ramified interests. This course serves as the foundation of multi-agent systems, including distributed optimization and problem solving. Topics include an introduction to game theory, basic game representations and solution concepts, models of cooperation, extensive form games, repeated games, security games, coalitional and Bayesian games, multi-agent learning, voting, and problem-solving in networks, communication, social choice, mechanism design, auctions, and negotiation.

AI 445: Natural Language Processing (3C=3H+0L)

Prerequisite: AI 342

Natural language processing (NLP) is a crucial part of artificial intelligence (AI), modeling how people share information. This course explores current statistical and deep learning techniques for the automatic analysis of natural (human) language data. Topics: language modeling, word-sense disambiguation, morphological analysis, part-of-speech tagging, syntactic parsing, semantic interpretation, co-reference resolution, and discourse analysis. Applications: information extraction, question answering, speech recognition, interactive dialog systems, machine translation, sentiment analysis, and summarization.

AI 446: Audio and Speech Processing (3C=3H+0L)

Prerequisite: AI 342

This course aims to give an elementary introduction to concepts, methods and applications of audio signal processing with a focus on speech. The course covers traditional as well as deep learning methods for automatic speech recognition, speech synthesis, affect detection, dialogue management, semantic interpretation, text generation, and applications to digital assistants and spoken language understanding systems.

AI 447: Computer Vision (3C=3H+0L)

Prerequisite: AI 342 + AI 375

This course provides a comprehensive introduction to computer vision. It is therefore primarily concerned with the problem of capturing and making sense of digital images. The field draws heavily on many major subjects including digital image processing, artificial intelligence, feature extraction and selection, image classification and recognition, and scene understanding. It also discusses various emerging applications of deep learning in computer vision, such as: Attention and transformers, Object detection and recognition, Image segmentation, image/video classification, Generative models (GANs, VAEs, autoregressive), and object tracking.

AI 448: Deep Reinforcement Learning (3C=3H+0L)

Prerequisite: AI 342

This course introduces deep reinforcement learning (RL), one of the most modern techniques of machine learning. Topics include: key features of RL, basics of RL, MDPs, and POMDP, sample complexity analyses of tabular RL, policy gradient and iteration, off-policy evaluation, TD learning and Q-learning, linear value approximation, proximal policy optimization, bandit, batch offline and online RL, various actor/critic algorithms, PAC exploration theory (tabular and function approximation).

AI 452: Semantic Web (3C=3H+0L)

Prerequisite: CIS 201

An introduction to semantic web technologies and their applications. Student will learn different aspects of web semantic representation and how to reason about data using ontologies. The course will introduce the existing technologies and how to apply semantic web technologies to current and potential real-world applications. Topics include the semantic web activity of W3C, semantic modeling and ontology representation, semantic web applications, logic for the semantic web, ontologies modeling and design using resource description framework (RDF) and web ontology language (OWL), and semantic web applications.

AI 453: Social Networks Analysis (3C=3H+0L)

Prerequisite: AI 356

An introduction to the concepts and methods of social network analysis. This course will introduce students to different techniques of extracting and analyze large-scale network data and how to reason about it. Students will also learn about social networks structure, dynamics and evolution. Topics include methods for social network analysis, network models, graph representation, graph traversal algorithms, graph mining, link analysis and network community detection, information propagation on the web, and recommendations systems. Student will also learn how to use some social network analysis packages/tools.

AI 454 Business Intelligence (3C=3H+0L)

Prerequisite: AI 350

This course provides an introduction to the concepts of business intelligence and explores how business problems can be solved and then applying data mining tools and analytics to gain new insights into organizational operations. This course will put an emphasis on the differences between types of reporting and analytics, enterprise data warehousing, data management systems, decision support systems, knowledge management systems and big data. Case studies are used to explore the use of application software, web tools, success and limitations of BI as well as technical and social issues.

AI 455: Pattern Recognition (3C=3H+0L)

Prerequisite: AI 342

This course covers pattern recognition techniques that are concerned with the theory and algorithms of putting abstract objects, e.g., measurements made on physical objects, into categories. Typically the categories are assumed to be known in advance, although there are techniques to learn the categories (clustering). Topics include pattern recognition systems, preprocessing and feature extraction, training methods, maximum likelihood and Bayesian parameter estimation, linear discriminant, perceptron learning, optimization by Gradient descent, theories of supervised and unsupervised learning techniques with applications, object classification and recognition, artificial neural networks, mixture modeling, expectation-maximization, hidden Markov models, Viterbi algorithm, Baum-Welch algorithm, linear dynamical systems, Kalman filtering, reinforcement learning with human interaction, and combination of multiple classifiers.

AI 457: Recommender Systems (3C=3H+0L)

Prerequisite: AI 378

This course will introduce students to a range of approaches for building recommender systems. Topics are collaborative, content-based, knowledge-based, and hybrid algorithms, filtering techniques, dimension reduction techniques for the user-product preference space, candidate generation, scoring, and re-ranking, and evaluation and metrics for recommender systems. Students will implement recommendation algorithms using an open-source toolkit and conduct experimental evaluations.

AI 471: Artificial Intelligence for Games (3C=3H+0L)

Prerequisite: AI 342

The purpose of this course is to familiarize students with issues and techniques of Artificial Intelligence (AI) for computer games. Topics include mathematical background (a review that includes some basics, trigonometry, vectors, local space and world space), physics background (a review that includes topics like time, distance, mass, position, velocity, acceleration and force), state-driven agent design, create autonomously moving game agents, application as a simulation, designing the AI (players, teams, states, motions, maps, projectiles, triggers, decision making, path planning, perception, target selection, as well as strategies), graphs and graph search algorithms, scripting (creating a scripted finite state machine), goal-driven agent behavior, and fuzzy logic, all within the context of computer games.

AI 474: Extended Reality (3C=3H+0L)

Prerequisite: AI 447

The course focuses on designing for Extended Reality (XR), which encompasses Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR). XR changes the way we think about designing digital interfaces because we are no longer constrained by two-dimensional (2D) space. The course focuses on integrating virtual intelligence into XR spaces to create dynamic user interfaces and personalized experiences. It starts with introducing the principles of human-computer interaction and the design and evaluation of user interfaces and related guidelines, standards, and specification languages before introducing XR concepts and technologies covering tools in AR, VR and MR and related topics (spatial computing, differences between modalities, marker and face detection, Unity AR libraries, SDKs and location-based related computation), the future of XR, ethical AI design and digital objects, and respond to live briefs from industry partners (Teams engage in a process of critical making to create innovative, proof-of-concept prototypes).

AI 477: Robotics (3C=3H+0L)

Prerequisite: AI 342

This course covers the fundamental elements of mobile robot systems from a computational standpoint and provides an introduction to the design and implementation of intelligent mobile robot systems. Topics include mobile robots control (sensing, vision, control, motion, kinematics theory, navigation, localization and perception), software control architectures, sensor interpretation, map building and navigation, computer vision and image processing, camera calibrations and multi-camera view, mobile robotics, multi-robot systems, task planning, agent architectures, and reasoning. Students program a small mobile robot to perform simple tasks in real-world environments.

AI 481: Artificial Intelligence for Medicine and Healthcare (3C=3H+0L)

Prerequisite: AI 342

This course introduces the different applications of AI in the health care domain with a focus on medical data analytics. Data analytics has emerged as a promising tool for solving problems across many Health-related disciplines. This course provides a clear understanding of the analytical techniques currently available to solve several health problems. The course explains the novel techniques for acquiring, handling, retrieving, and making the best use of Health data. The course will bridge the gap between computer scientists and the domain-specific medical experts and help students gain more knowledge in this domain.

AI 482: Artificial Intelligence for Computational Biology and Bioinformatics (3C=3H+0L)

Prerequisite: AI 342

This course introduces artificial intelligence (AI) in bioinformatics, computational biology, and biomedicine. It covers topics related to complex biological analysis, the application of AI principles, and the integration of diverse biological content through different AI methods and technologies. The course will cover how to apply AI techniques such as data modelling, machine learning, deep learning, statistical methods, and data mining in Bioinformatics and Biomedicines problems. The course explores how to apply AI in bioinformatics technologies into several topics such as DNA, RNA, and protein structure and folding problems, drug discovery, digital health, genetics, and metabolic pathways.

AI 483: Artificial Intelligence for Financial and Industrial Applications (3C=3H+0L)

Prerequisite: AI 342

This course explores the role of emerging AI algorithms and techniques on financial decisions. This course introduces the basics of AI and its impact on financial services. It gives an overview of the potential implementations of AI within an organization. The course explores a deep dive into determining if the business is prepared for the future using several AI techniques. The course provides hands-on financial forecasting experience using several AI and machine learning techniques and grasp forecasting techniques on specific real-world financial data.

AI 484: Fuzzy Logic (3C=3H+0L)

Prerequisite: CS 284

Introduction to fuzzy sets, fuzzy relations; fuzzy measures; fuzzy logic and approximate reasoning; applications of fuzzy systems in pattern recognition, control, and signal processing. The course aims to show the differences between fuzzy sets and crisp sets. Various terms used in the fuzzy sets and the grammar of fuzzy sets will be discussed in this course. Topics include how to model fuzzy sets, how to handle with arithmetic of fuzzy quantities, and how to acquire operations with fuzzy relations.

AI 485: Drones and Autonomous Systems (3C=3H+0L)

Prerequisite: AI 477

Introduction to unmanned aerial systems (UAS) including drones and autonomous unmanned aerial vehicles (UAV) with sensors including those for obstacle avoidance, other instruments, and payloads that rely on complex algorithms and have various uses. The course aims at preparing the students to understand the commercial and research capabilities of drones including sensors, platforms, navigation, power source, propulsion, payloads, command, communication and control, range, altitude, speed, wide area surveillance. By the end of the course, the students will be able to understand systems view of drones with hardware and software including data collection, storage, and analytical requirements, and systems life cycle with needs and purpose: assessment, goals/objectives, requirements, testing and training.

AI 490: Internship (3C=3H+0L)

Prerequisite: Passing 90 CHs or department approval

A student is required to conduct training in one of the local organizations for at least six weeks for a period of 60 working days, presents a report from the organization to describe the effectiveness of the practice according to the training regulations.

AI 491: Graduation Project (1) (2C=2H+0L)

Prerequisite: Passing 90 CHs

The graduation project provides a unique opportunity for students in Artificial Intelligence program to apply their knowledge of the foundations, theory, and methods of AI and software development to address and provide solutions (i.e., developing software applications) to problems in industry, government and the non-profit sector and other areas. The course activities focus on a two semester-length project sponsored by a local organization if available. Typically, two to four students work together as a team on each graduation project. Each team is supervised by a faculty mentor and projects typically progress through several phases. This course includes the first stage of the graduation project where the student(s) should define, analyze the problem, and finally write a proposal. Then to present it to a predetermined committee in the department. It includes weekly meetings with the supervisors.

AI 492: Graduation Project (2) (3C=3H+0L)

Prerequisite: AI 491

This is the second stage of the graduation projects, which includes the practical aspects which are design, implementation and testing for the resulting project. Cooperative formative research, design, development, and testing of a sizable and realistic sociotechnical system, i.e., a solution to a real-world problem that includes both technical and human components. Students work as a team with a client on a real-world open-ended problem, and gain experience in Artificial Intelligence (problem definition, software development, iterative design), and in other fields relevant to the problem. Both student participation in the classroom and effective teamwork outside the classroom are stressed. It includes weekly meetings with the supervisors.

AI 495-I: Special Topics in Artificial Intelligence (1) (1C=1H+0L)

Prerequisite: Dept. Approval

The department chooses a topic related to the field of Artificial Intelligence as needed. This course should cover state-of-the-art problems and solutions in Artificial Intelligence.

AI 495-II: Special Topics in Artificial Intelligence (2) (2C=2H+0L)

Prerequisite: Dept. Approval

The department chooses a topic related to the field of Artificial Intelligence as needed. This course should cover state-of-the-art problems and solutions in Artificial Intelligence.

AI 495-III: Special Topics in Artificial Intelligence (3) (3C=3H+0L)

Prerequisite: Dept. Approval

The department chooses a topic related to the field of Artificial Intelligence as needed. This course should cover state-of-the-art problems and solutions in Artificial Intelligence.