1.	School	**King Abdullah II School for Information Technology**
2.	Department	**Artificial Intelligence**
3.	Program title (Arabic)	**الذكاء الاصطناعي**
4.	Program title (English)	**Artificial Intelligence**

5. Components of Curriculum:

The curriculum for the bachelor's degree in **Artificial Intelligence Program** consists of (132) credit hours distributed as follows

Number	**Type of requirement**	**credit hours**
First	University Requirements	**27**
Second	School courses	**24**
Third	Specialty courses: (Obligatory specialty courses)	**69**
	(Elective specialty courses)	**12**
Fourth	-	**0**
Total		**132**

6. Numbering System:

A- Department number

Number	**Department**
1	Computer Science (CS)
2	Computer Information Systems (CIS)
3	Business Information Systems (BIS)
4	Information Technology (IT)
5	Artificial Intelligence (AI)

B- Course number

Domain number	Domain title	Domain number	Domain title
0	General	5	Applications
1	Programming Languages	6	Computer Networks and Data Communication
2	Fundamentals of AI and Data Science	7	Machine Learning
3	Embedded Systems and Robotics	8	Natural Language Processing
4	Computational Sciences and Algorithms	9	Special Topics and Project

C- Course number consists of 7 digits

School		Department		Level	Serial number	
1	**9**	**0**	**5**	**X**	**X**	**X**

First: University Requirements (27) credit hours distributed as follows:

Preparation Program Requirements All students admitted to the university must apply for a degree examination in Arabic and English and the computer is prepared or approved by the university to determine their level. Based on the results of the examinations, either the student will study one or more of the requirements of the preparatory program. (0 - 15 Credit Hours)					
No.	**Course Title**	**Course No.**	**Credit Hours**	**Prerequisites**	**Notes**
1	Community Service	0300150	0	-	-
2	Computer Skills Placement Test	1902098	0	-	-
3	Basics of Computing	1932099	3	1902098	Pass/Fail
4	Arabic Placement Test	3201098	0	-	-
5	Basics of Arabic	3201099	3	3201098	Pass/Fail
6	Arabic Languages Skills	3201100	3	3201099	Pass/Fail
7	English Placement Test	3202098	0	-	-
8	Basics of English	3202099	3	3202098	Pass/Fail
9	English Language Skills	3202100	3	3202099	Pass/Fail
Compulsory Requirements (18 Credit Hours)					
No.	**Course Title**	**Course No.**	**Credit Hours**	**Prerequisites**	**Notes**
1	Military Sciences	2220100	3		
2	National Culture	3400100	3		
3	Ethics and Humans Values	3410100	3		
4	Entrepreneurship Innovation and Scientific Research	3410101	3	3410100/1932099	
5	Life And Practical Skills	3410102	3	3410100/1932099	
6	Introduction to Philosophy and Critical Thinking	3400103	3	3410100/1932099	

C- Electives
(9 Credit Hours)

Elective courses: (9) credit hours to be chosen from the first, second and third groups mentioned below. The student has to choose one course from each of the groups.

(First Group)

No.	Course Title	Course No.	Credit Hours	Prerequisites	Notes
1	Islam and Contemporary Issues	0400101	3	-	-
2	Arab-Islamic Civilization	2300101	3	-	-
3	Jordan: History and Civilization	2300102	3	-	-
4	Great Books	3400107	3	-	-
5	Jerusalem	3400108	3	-	-

Electives
(Second Group)

No.	Course Title	Course No.	Credit Hours	Prerequisites	Notes
1	Environmental Culture and Development	0310102	3	-	-
2	Islamic Culture	0400102	3	-	-
3	Health Culture	0720100	3	-	-
4	Legal Culture	1000102	3	-	-
5	Physical Fitness Culture	1100100	3	-	-

Electives
(Third Group)

No.	Course Title	Course No.	Credit Hours	Prerequisites	Notes
1	Electronic Commerce	1600100	3		
2	Social Media	1900101	3		
3	Appreciation of Arts	2000100	3		
4	Foreign Language	2200103	3		
5	Special Subject	3400106	3		

Second: School courses: distributed as follows:

- **A. Obligatory school courses: (24) credit hours**
- **B. Elective school courses: (0) credit hours**

A. Obligatory school courses: (24) credit hours:

Course Number	Course Title	Contact Hours		Credit Hours	Pre-requisite
		Theoretical	Practical		
1901101	Discrete Mathematics	3	-	3	-
1931102	Computer Skills for Scientific Faculties	3	-	3	Pass Qualifications Exam or 1932099
1904101	Fundamentals of Information Technology	3	-	3	-
1904120	Web Applications Development	3		3	1931102
1902110	Object-Oriented Programming	3		3	1931102
1901242	Data Structures	3	-	3	1902110
1902224	Database Management Systems	3	-	3	1902110
1915101	Linear Algebra for Computational Sciences	3	-	3	0301101
1902390	Seminar-Road to Software Industry	2	-	0	Passing 45 hours

B. Elective school courses: (0) credit hours:

Third: Specialty courses: (81) credit hours distributed as follows:

A. Obligatory specialty courses: (69) credit hours:

Course Number	Course Title	Contact Hours		Credit Hours	Pre-requisite
		Theoretical	Practical		
301131	Principles of Statistics	3	-	3	-
301101	Calculus-1	3	-	3	-
1915111	AI Programming	3	-	3	1931102
1905120	Introduction to Artificial Intelligence	3	-	3	1904101
1905220	Ethics of Artificial Intelligence and Data Science	3	-	3	1905120
1905221	Knowledge Representation and Reasoning	3	-	3	1905120
1905222	Data Mining	3	-	3	1902224
1905320	Artificial Intelligence	3	-	3	1901242
1905321	Ontologies and Knowledge Graphs	3	-	3	1905221
1905322	Computer Vision	3	-	3	1915370
1905330	Embedded Systems	3	-	3	1901242 and 1905320
1905380	Natural Language Processing	3	-	3	1905320
1901341	Theory of Algorithms	3	-	3	1901242
1901363	Computer Networks	3	-	3	1901242
1911322	Information Security and Privacy	3	-	3	1901363 and 1902224
1902353	Human Computer Interaction	3	-	3	1904120
1902372	Software Engineering	3	-	3	1902224
1915370	Machine Learning and Neural Networks	3	-	3	1905222
1905420	Cognitive Science	3	-	3	1905320
1905430	Internet of Things	3	-	3	1905320 and 1901363
1905431	Intelligent Robotics	3	-	3	1905330
1915471	Deep Learning	3	-	3	1915370
1905490	Training	6 Weeks		0	(Success 90 hours)
1905491	Project-1	-	-	0	(Success 90 hours)
1905492	Project-2	-	-	3	1905491

B. Elective specialty courses: (12) credit hours:

	Course Title	Contact Hours		

Course Number		Theoretical	Practical	Credit Hours	Pre-requisite
1905310	Advanced AI Programming	3	-	3	1905111
1915241	Bioinformatics	3	-	3	1905222
1915251	Applied Statistics	3	-	3	301131
1905323	User Adaptive Systems	3	-	3	1905320 and 1902353
1915331	NoSQL Databases	3	-	3	1902224
1915341	Social Network Analysis	3	-	3	1905222 And 1901341
1905350	Knowledge Graphs Technologies and Applications	3	-	3	1905321
1915352	Healthcare and Medical Data Analytics	3	-	3	1905222
1915371	Pattern Recognition and Information Analysis	3	-	3	1905222
1905381	Advanced Natural Language Processing	3	-	3	1905380
1905382	Digital Speech Processing	3	-	3	1905320
1902383	Information Technology Entrepreneurship and Innovation	3	-	3	1902224
1915431	Big Data	3		3	1915370
1905432	Reinforcement learning	3	-	3	1905330
1905433	Intelligent Agents	3	-	3	1905431
1905434	Advanced Embedded Systems	3	-	3	1905330
1915441	Data Visualization	3	-	3	1915370
1905435	Brain-Computer Interaction	3	-	3	1905320
1901444	Computational Problems and Techniques	3	-	3	1901341
1905450	Game AI	3	-	3	1905320
1905452	Software Engineering for AI-Enabled Systems	3	-	3	1905320 and 1902372
1905453	Virtual Reality	3	-	3	1905322
1905454	Multimedia Intelligent Systems	3	-	3	1905320
1915461	Cloud Computing	3	-	3	1905222 and 1901363
1904472	IT Project Management	3	-	3	1902372
1905480	Arabic Language Engineering	3	-	3	1905380
1915481	Model Deployment Frameworks	3	-	3	1915370

1911489	Security Intelligence	3	-	3	301131 and 1905320
1905493	Special Topics in Artificial Intelligence	3	-	3	1905320

Fourth: Courses offered by other faculties and departments

Course Number	Course Title	Contact Hours		Credit Hours	Pre-requisite
		Theoretical	Practical		
1901101	Discrete Mathematics	3	-	3	-
1931102	Computer Skills for Scientific Faculties	3	-	3	Pass Qualifications Exam or 1902099 or (1901098)
1904101	Fundamentals of Information Technology	3	-	3	-
1904120	Web Applications Development	3	-	3	1904101
1902110	Object-Oriented Programming	3	-	3	1931102
1901242	Data Structures	3	-	3	1931102
1902224	Database Management Systems	3	-	3	1901233
1902390	Seminar-Road to Software Industry	2	-	0	Passing 45 hours
301131	Principles of Statistics	3	-	3	-
301101	Calculus-1	3	-	3	-
1901341	Theory of Algorithms	3	-	3	1901233
1901363	Computer Networks	3	-	3	1901242
1911322	Information Security and Privacy	3	-	3	1901363 and 1902224
1902353	Human-Computer Interaction	3	-	3	1904120
1902372	Software Engineering	3	-	3	1902224

1902383	Information Technology Entrepreneurship and Innovation	3	-	3	1902224
1901444	Computational Problems and Techniques	3	-	3	1901341
1904472	IT Project Management	3	-	3	1902372
1911489	Security Intelligence	3	-	3	301131 and 1905320

Fifth: Advisory Study Plan

First Year

First Semester			Second Semester		
Course Number	**Course Title**	**Credit Hours**	**Course Number**	**Course Title**	**Credit Hours**
1931102	Computer Skills for Scientific Faculties	3	1915101	Linear Algebra for Computational Sciences	3
1904101	Fundamentals of Information Technology	3	1901242	Data Structures	3
0301101	Calculus-1	3	1905120	Introduction to Artificial Intelligence	3
1901101	Discrete Mathematics	3	1904120	Web Applications Development	3
-	University requirement	3	-	University requirement	3
Total		**15**	**Total**		**15**

Second Year

First Semester			Second Semester		
Course Number	**Course Title**	**Credit Hours**	**Course Number**	**Course Title**	**Credit Hours**
1902224	Database Management Systems	3	1905222	Data Mining	3
0301131	Principles of Statistics	3	1905320	Artificial Intelligence	3
1902110	Object-Oriented Programming	3	1901341	Theory of Algorithms	3
1905221	Knowledge Representation and Reasoning	3	1905220	Ethics of Artificial Intelligence and Data Science	3
1915111	AI Programming	3	1915370	Machine Learning and Neural Networks	3
-	University requirement	3	-	University requirement	3
Total		**18**	**Total**		**18**

Third Year

First Semester	Second Semester

Course Number	Course Title	Credit Hours	Course Number	Course Title	Credit Hours
1905380	Natural Language Processing	3	1902372	Software Engineering	3
1905330	Embedded Systems	3	1905322	Computer Vision	3
1901363	Computer Networks	3	1902353	Human-Computer Interaction	3
1911322	Information Security and Privacy	3	1905321	Ontologies and Knowledge Graphs	3
-	University requirement	3	1902390	Seminar-Road to Software Industry	0
-	Elective specialty course	3	-	University requirement	3
			-	Elective specialty course	3
Total		**18**	**Total**		**18**

Fourth Year

First Semester			Second Semester		
Course Number	**Course Title**	**Credit Hours**	**Course Number**	**Course Title**	**Credit Hours**
1905491	Project -1	0	1905492	Project -2	3
1905490	Training	0	1905420	Cognitive Science	3
1905430	Internet of Things	3	1905431	Intelligent Robotics	3
-	University requirement	3	1915471	Deep Learning	3
-	University requirement	3	-	University requirement	3
	Elective specialty course	3	-	Elective specialty course	3
Total		**12**	**Total**		**18**

****** Student can take training (1905490 with 0 credit hours) after completing 90 credit hours.***

A. Obligatory School Courses Description

Course Number	Course Title	Credit Hours

1901101	Discrete Mathematics	3
Prerequisite: (None)		

Course Description

This course studies the mathematical elements of computer science and their applications. Topics include propositional logic; predicate logic; mathematical reasoning; techniques of proof; mathematical induction; set theory; number theory; matrices; sequences and summations; functions, relations and their properties, elementary graph theory, and tree (graph theory). In each subject, its characteristics, forms, ways of representing it, the operations used in it, and ways of linking these subjects together are studied. Homework will be assigned.

Course Number 1931102	Course Title Computer Skills for Scientific Faculties	Credit Hours 3
Prerequisite: (Pass Qualifications Exam or 1932099)		

Course Description

This course studies the fundamental concepts of programming using C++. Topics includes: basic structures of programming tools, like: variable names, data types, input and output statements, and output formatting. Files. Selection statements structures. Repetition statements structures. Functions. Enumeration datatype and strings data type. Arrays; 1D and 2D. The lectures will be provided in the lab through active teaching methodologies individually or within groups.

Course Number 1904101	Course Title Fundamentals of Information Technology	Credit Hours 3
Prerequisite: (None)		

Course Description

This course will introduce the fundamental knowledge of information technologies, and it works as an introductory course for computer-related courses. It is a combination between a theoretical and a practical course. In particular, the course provides students with a grounding knowledge on several areas of information technologies including cutting edge technologies, careers in IT, basic concepts of cloud computing and web technologies, and a general perceptive of project management. Students are also going to be introduced practically to hardware maintenance, software diagnostics and technical support. In addition, critical thinking methodologies and techniques will be discussed, including numbering systems, flowcharts and related case studies. Operating systems such as LINUX/UNIX with, memory allocation, and an introduction to networks and security, and block chain concepts. The final part is concerned with technical applications needed such as excel, advanced excel, technical writing, report generating and type writing. Technical sections will be taught on lab sessions and group works. Active learning methodologies will be applied through role playing, presentations and problem-solving exercises.

Course Number 1904120	Course Title **Web Application development**	**Credit Hours** **3**
Prerequisite: (1931102)		
Course Description This course aims to improve students' ability in Front-End Web applications development using client-side programming such as HTML 5, Cascading Style Sheet (CSS3), JavaScript. In addition, the students will learn the fundamental concepts of front-end web development frameworks such as Bootstrap and React front-end frameworks. The course will cover the Bootstrap framework, which is the most popular CSS framework for creating responsive mobile-first websites. This course will teach you how to create pages of a website using the Bootstrap v5 framework. In addition, the course also covers the basic concepts of the React framework such as Communicating with Props, Class-Based Components, State in React Components, Lifecycle Methods, Handling User Input with Forms and Events, Making API Requests with React, and Single Page Application Development. This course uses active teaching methodologies, such as weekly lab applied sessions, group work and technical projects.		

Course Number **1902110**	**Course Title** **Object-Oriented Programming**	**Credit Hours** **3**
Prerequisite: (1931102)		
Course Description The course aims to cover the fundamental concepts of OOP, such as Encapsulation and Information-Hiding, Inheritance, Polymorphism, and Abstraction. The course uses Java Programming language starting from the basic Java syntax based on Eclipse IDE. It focuses on the understanding and practical mastery of OOP principles and Java components, such as classes, objects, input/output, scanner objects (to read either from the keyboard or a file), loops, decision-making, array and multidimensional array, data abstraction, methods, method overloading, objects garbage-collector, an introduction to exception-handling, etc. Finally, it presents an introduction to JavaFX and its hierarchy based on Java inheritance OOP concepts, for developing rich client applications. Lectures will be given in the lab for practical application. This course is assessed through exams, practical tests and assignments.		

Course Number **1901242**	**Course Title** **Data Structures**	**Credit Hours** **3**
Prerequisite: (1902110)		

Course Description This course introduces the students to the concepts of data structures. Topics includes: Pointers, and pointer operations. Array implementation of lists, stacks, and queues. Dynamic implementation of lists (singly, doubly, circular), stack operations and queue operations (and their implementation as linked lists). STL, like: vectors, pairs, maps, sets, lists, stacks, queue. Recursion. Tree dynamic, like binary search trees, segment, red-black, AVL trees. Hash Table and Collision resolution. Weekly lab assignments will be given to the students and to be discussed through active teaching methodologies, in addition to problem-solving tasks.	

Course Number **1902224**	**Course Title** **Database Management Systems**	**Credit Hours** **3**
Prerequisite: (1902110)		
Course Description The course aims to provide students with an overview of database management system architecture and environment, an understanding of the basic database design and implementation techniques, and a practical experience of designing and building relational databases. Furthermore, it enables applying conceptual design methodologies for databases and learning about the architecture and environments of the database management system. Students will practice using database tools to create and manage database schemas systems and formulate DDL, DML commands and run SQL queries. Advanced SQL topics such as creating database functions, database Stored Procedures and database Triggers will be covered. Also, students will learn how to manage database privileges and design suitable security and integrity constraints for database schemas. Furthermore, the course will provide the students with practice project to connect a relational DB using a programming language, in addition to practice using basic Oracle Forms and Oracle Reports. This course will use a combination of traditional lectures, active teaching methodologies, and hands-on lab lectures.		

Course Number **1915101**	**Course Title** **Linear Algebra for Computational Sciences**	**Credit Hours** **3**
Prerequisite: (0301101)		

Course Description

The course uses linear algebra as one of the most important tools in applied mathematics, data science, and artificial intelligence to help students learn how to handle vectors and matrices, solve matrix-vector equations, perform Eigen value and Eigen vector and diagonalization analyses and use principal component analysis to do dimension reduction on real-world datasets. It covers topics such as: solving systems of linear equations; matrices and matrix operations; homogeneous and non-homogeneous systems; Gaussian elimination; elementary matrices and a method for finding A−1; determinants; Euclidean vector spaces; linear transformations from Rn to Rm and their properties; general vector spaces; subspaces; basis; dimension; row space; column space; null space of a matrix; rank and nullity; and inner product spaces. All analysis will be performed in python or any similar popular programming language. Lectures will be given in the lab for practical application. This course is assessed through exams, practical tests and assignments.

Course Number **1902390**	**Course Title** **Seminar-Road to Software Industry**	**Credit Hours** **3**
Prerequisite: (Passing 45 hours)		

Course Description

IT students increasingly demand and require coverage of emerging technologies to prepare themselves for subsequent employment and research. Industry and professional bodies are also concerned that IT education does not always prepare students adequately for the world of work. This professional practice seminar course aims to contribute to solving these two issues by providing real-world experiences, inspiring students to choose their career path, and exposing them to the trends, methods, and techniques that are of current interest in software industry through a weekly seminar series. Professionals from software companies are invited to present different aspects of their companies and to share their first-hand experience with students. This course can enhance IT education and motivate students by covering leading-edge technologies and practices. After each seminar, students will submit a personal evaluation and short reports relevant to the seminar's presentation. Attendance and participation in 8 seminars, including the evaluation of each seminar and the short reports are the minimum requirements to pass the course.

B- Obligatory Courses Description

Course Number 0301131	Course Title Principles of Statistics	Credit Hours 3
Prerequisite: (None)		
Course Description Describing statistical data by tables, graphs and numerical measures, Chebychev's inequality and the empirical rule, counting methods, combinations, permutations, elements of probability and random variables, the binomial, the Poisson, and the normal distributions, sampling distributions, elements of testing hypotheses, statistical inference about one and two populations parameters		

Course Number 0301101	Course Title Calculus-1	Credit Hours 3
Prerequisite: (None)		
Course Description Functions: domain, operations on functions, graphs of functions; trigonometric functions; limits: meaning of a limit, computational techniques, limits at infinity, infinite limits; continuity; limits and continuity of trigonometric functions; the derivative: techniques of differentiation, derivatives of trigonometric functions; the chain rule; implicit differentiation; differentials; Roll's Theorem; the mean value theorem; the extended mean value theorem; L'Hopital's rule; increasing and decreasing functions; concavity; maximum and minimum values of a function; graphs of functions including rational functions (asymptotes) and functions with vertical tangents (cusps); antiderivatives; the indefinite integral; the definite integral; the fundamental theorem of calculus ; the area under a curve; the area between two curves; transcendental functions: inverse functions, logarithmic and exponential functions; derivatives and integrals; limits (the indeterminate forms); hyperbolic functions and their inverses; inverse trigonometric functions.		

Course Number 1915111	Course Title AI Programming	Credit Hours 3
Prerequisite: (1931102)		

Course Description

This course builds programming skills for students which is required develop and implement applications and algorithms of Artificial Intelligence and data science. This course will focus on programming using Python 3 https://www.python.org/. Python is high-level programming language like Java, C++, or C#. This course provides students with the required skills to solve problems by implementing programs using Python. Topics include: fundamentals of Python programming, Object-Oriented programming using Python, Data Structures and Algorithms, and Python packages. This course is a lab-based course which includes in-class practical assignments and tasks. The course will also briefly introduce other programming languages such as Lisp and Prolog. This course will use a combination of lectures, group discussions, case studies analysis, and hands-on work.

Course Number 1905120	Course Title Introduction to Artificial Intelligence	Credit Hours 3
Prerequisite: (1904101)		

Course Description

The aim of the course is to bring to the awareness of students the different research areas and aspects of artificial intelligence. students will be shown (1) how to express knowledge of a simple domain in first-order predicate calculus and how to solve problems using explicit knowledge and reasoning, and how to develop an expert system. Students will (1) be familiarized with the notion of search and (2) shown how to use some appropriate search techniques (blind or heuristic) for some problems. The students will also be given some grounding in the principal techniques of data mining and be introduced to some applications of data mining. Students will be introduced to some learning techniques to help obtain a clear picture of the concepts of machine learning. Active learning methodologies will be applied through role playing, presentations and problem-solving exercises.

Course Number 1905220	Course Title Ethics of Artificial Intelligence and Data Science	Credit Hours

		3
Prerequisite: (1905120)		
Course Description This course focuses on ethical issues in computing special in Artificial Intelligence (AI) and Data Science (DS). The main themes are privacy, fairness/bias, and explainability in AI and DS. The objectives are to learn how to identify and measure these aspects in the outputs of algorithms, and how to build algorithms that correct these issues. The course will follow a case-study-based approach, where we will examine these aspects by considering real-world case studies for each of these ethical issues. It is intended to give students a chance to reflect on the ethical, social, and cultural impact of AI by focusing on the issues faced by and brought about by professionals in AI but also by citizens, institutions, and societies. Specific topics addressed in the course include the technical, safety-related, and economic implications of AI-enabled automation. Specific sub-areas include transportation, manufacturing, journalism, legal advising, and military applications; AI-endowed advisory tools in areas such as environmental and resource planning; biases and mediocrities in AIs, which can reinforce human prejudice. Furthermore, this course covers ethical writing through many practical skills including referencing styles, citation (i.e., Endnote, Mendeley, RefWorks, and Zotero), quotation, and also through the awareness of the good document requirements, plagiarism forms, copyrights, fair use, creative commons, and intellectual property rights. This course will use a combination of lectures, class discussions, reading and writing assignments, case studies analysis, and hands-on work.		

Course Number **1905221**	**Course Title** **Knowledge Representation and Reasoning**	**Credit Hours** **3**
Prerequisite: (1905120)		
Course Description In this course, we discuss the formalization of knowledge and its processing within machines. We shall show how to design and develop computer systems (*Knowledge-based systems*) that can draw conclusions (using reasoning), similar to human reasoning where knowledge is represented in a machine-interpretable form. We shall examine many knowledge representation formalisms such as semantic networks, rule systems, classical logic (Resolution proofs), and description logic. We shall also show how to deal with incomplete information using defeasible reasoning. This course will use a combination of lectures, class discussions, reading and writing assignments, case studies analysis, and hands-on work.		

Course Number **1905222**	**Course Title** **Data Mining**	**Credit Hours**

		3
Prerequisite: (1902224)		
Course Description This course provides the students with an introduction to data mining and knowledge discovery (KDD). The course will focus on issues relating to the feasibility, usefulness, effectiveness, and scalability of techniques for the discovery of patterns hidden in large data sets. The students will learn the basic concepts of data pre-processing, frequent pattern mining and association rules, sequential patterns, and sub-graph patterns; and explore their applications, Classification methods, such as decision trees, k-nearest neighbour, and Naïve Bayes, ensemble learning methods such as random forest …etc., outlier detection methods, such as Simple Statistical Methods and local outlier factor (LOF), cluster analysis techniques, such as k-means, hierarchical methods, and density-based methods. Active learning methodologies will be applied through role playing, presentations and problem-solving exercises.		

Course Number **1905320**	**Course Title** **Artificial Intelligence**	**Credit Hours** **3**
Prerequisite: (1901242)		
Course Description The aim of the course is to enable students to solve problems using explicit knowledge and reasoning techniques and to develop expert systems for simple problems. Students will be able (1) to express knowledge of a simple domain in propositional and/or first-order predicate calculus, (2) to design and develop expert solutions to simple problems where AI techniques can be employed, and (3) to write simple programs in Prolog that reason about the available knowledge to achieve their goals. Furthermore, students will learn some simple blind and heuristic search algorithms such as depth-first, breadth-first, best-first, hill climbing, and simulated annealing and techniques on how to control search using production systems. They will also have the ability to decide the appropriate search techniques (blind or heuristic) for some problems. The students will also be given some grounding in the principal techniques of data mining and be introduced to some applications of data mining. Students will be introduced to some learning techniques to help obtain a clear picture of the concepts of machine learning. This course will use a combination of lectures, class discussions, reading and writing assignments, case studies analysis, and hands-on work.		

Course Number **1905321**	**Course Title** **Ontologies and Knowledge Graphs**	**Credit Hours**

Prerequisite: (**1905221)**	**3**
Course Description The course will introduce knowledge graphs and compare them to other data models such as RDMS and File Systems. Approaches for representing relational databases to knowledge graphs will be presented. The course will introduce the main architecture of the Semantic Web and the notion of Linked Data. It will also demonstrate the knowledge representation formalisms and how it is used for constructing knowledge graph. Ontology engineering principles Will be presented. The course will demonstrate methods and methodologies for ontology evaluation. Students will be presented with practical knowledge of applying ontology engineering methodology in a specific context. The RDF data model will be presented and how it differs from RDFS and OWL. SPARQL query language will be presented and learned. Active learning methodologies will be applied through role playing, presentations and problem-solving exercises.	

Course Number **1905322**	**Course Title** **Computer Vision**	**Credit Hours**
Prerequisite: (**1915370)**		**3**
Course Description This course introduces the students to the fundamental techniques and concepts of computer vision and image processing. This course will cover the following topics: image formation and representation, image enhancement in spatial and frequency domain, image morphological processing, image registration, edge detection and segmentation, feature detection and matching, object recognition and classification, object detection and tracking, 3D vision, and application to models of human and machine vision. This course will use a combination of lectures, class discussions, reading and writing assignments, case studies analysis, and hands-on work. Practical hands-on computer vision best practices will be given in Lab weekly.		

Course Number **1905330**	**Course Title** **Embedded Systems**	**Credit Hours** **3**
Prerequisite: (1901242 and 1905320)		
Course Description The course aims to introduce students to basic logic design system, logic gates, combinational and sequential logic circuits. Then basic input and output devices, after that microcontroller-based embedded systems design, development and implementation with focus on real-time applications. Topics to be covered include, basic logic design, basic input and output systems. Embedded system types, microcontroller architecture, programming (Embedded C), interrupt management and other related topics. This course will use a combination of lectures, class discussions, reading and writing		

assignments, case studies analysis, and hands-on work. Practical hands-on computer vision best practices will be given in Lab weekly.

Course Number 1905380	Course Title Natural Languages Processing	Credit Hours
Prerequisite: (**1905320)**		**3**
Course Description The aim of the course is to introduce students to the concepts of Natural Language Processing and its applications. It discusses linguistic theories and computational techniques. The course covers the topics of Origins of Natural Language Processing (NLP); Language structure representation; The role of knowledge; Knowledge representation; Parsing techniques; Finite-state techniques; Recursive and augmented transition networks; Language ambiguity; Well-Formed constructs; Features and the lexicon; Language semantics; and Applications. Examples of NLP applications that are covered by this course include; machine translation, information retrieval, text summarization, reference resolution, question answering, parsing, sense disambiguation, morphological analysis, speech analysis and synthesis. Active learning methodologies will be applied through role playing, presentations and problem-solving exercises. Moreover, hands-on practice on using NLTK (Natural Language Toolkit) is weekly practiced in the lab. In addition, guest speakers belonging to the Jordan's ICT will demonstrate state-of-the-art practices and application of NLP.		

Course Number 1901341	Course Title Theory of Algorithms	Credit Hours 3
Prerequisite: (1901242)		
Course Description The main goal of this course is to introduce complexity analysis of algorithms with an emphasis on efficient design techniques for solving various computational problems. Topics include complexity analysis including big O, big omega, and big theta notations. Recurrence equations and recursive algorithms. Algorithm design techniques include sequential, divide-and-conquer, greedy, and dynamic programming. Sorting algorithms include insertion sort, merge sort, heap sort, and quicksort. Searching algorithms include breadth-first search and depth-first search. Graph-based algorithms including Kruskal's algorithm. Optimization problems include minimum spanning tree and multistage graph problems. The assessment of this course is through exams, quizzes, and assignments.		

Course Number 1901363	Course Title Computer Networks	Credit Hours

		3
Prerequisite: (1901242)		
Course Description This course explores key concepts and essential technologies of computer networks and broad range of topics in networking. It includes general overview, networks applications, network classifications and topologies, network layers, channel performance measures, transmission media, communication network protocols and architecture; Data link layer: framing, error detection and correction, CSMA/CD, LAN IEEE standards; Network layer: IP service model, IP addressing, subnetting, host configuration DHCP, ARP Protocol, ICMP protocol; Transport layer: UDP protocol, TCP protocol, TCP reliable transfer and sliding window, TCP flow and congestion control; Application layer: DNS protocol, NAT protocol, HTTP protocol, persistent and non-persistent HTTP connection. Weekly practice in the lab through active teaching methodologies.		

Course Number **1932322**	**Course Title** **Information Security and Privacy**	**Credit Hours** **3**
Prerequisite: (1901363 and 1902224)		
Course Description This course introduces information security and privacy. The course covers topics related to cryptography such as symmetric and asymmetric encryptions, hash functions, digital signatures, key management, and public key infrastructures. Also, the course covers topics related to network security as packet sniffing, spoofing, TLS, IPSec, Firewalls, and wireless network security. Furthermore, topics related to Authentication, Authorization, Web security and Steganography will be covered. Risk analysis and ethics, and their applications to the development of a secure healthcare systems as a case study will be presented. Practical hands-on will be provided.		

Course Number **1902353**	**Course Title** **Human Computer Interaction**	**Credit Hours**
Prerequisite: (**1904120)**		**3**
Course Description This course aims to introduce various Human Computer Interaction related topics. This course explains the components and steps of designing, developing, and evaluating interactive computer systems for human use. It also addresses the importance of Ergonomics, interaction design and its activities, data gathering and analysis, prototyping, evaluation paradigms and techniques universal design principles, and Non-traditional interfaces of all kinds. It also highlights the steps of designing graphical user interfaces to achieve usability and user experience in interactive systems. The course also presents the need to adopt ideas that serve users with special needs and impairments. The content of the course enables students to deploy interaction design principles into health-related		

applications (healthcare and patient management), where students are required to show the interaction design activities, prototyping, evaluation paradigms and techniques, and universal design principles in the project, which is considered one of the most important outcomes of the course where students apply everything they have learned in this course.

Course Number 1902372	Course Title Software Engineering	Credit Hours 3
Prerequisite: (1902224)		
Course Description This course aims is to present software engineering as a body of knowledge. The course is designed to present software engineering concepts and principles in parallel with the Software Development Life Cycle (SDLC). The course will begin with an introduction to software engineering, giving students a definition of this body of knowledge, as well as a discussion of the main methodologies of software engineering including agile methods i.e., XP. Students will then learn about the five major phases of the SDLC: requirements gathering and analysis, design, coding/implementation, validation, and evolution. This includes software modelling using Unified Modelling Language (UML), a standardized general-purpose modelling language used to create visual models of object-oriented software, for requirements gathering and analysis, and design. Students will also learn about project management and quality management for the purpose of delivering high-quality software that satisfies customer needs and is within budget and schedule. Delivery will be by in-class lectures, recorded lectures, practical sessions in the lab, case studies from different domains (i.e., healthcare domain), and assignments. Assignments will include a term project illustrative of professional practice in developing computer information systems. One or two guest speakers with many years of experience in software engineering will be invited to share their first-hand experience with students.		

Course Number 1915370	Course Title Machine Learning and Neural networks	Credit Hours 3
Prerequisite: (1905222)		
Course Description This course will help students to develop basic understanding of principles of learning theory, theoretical and mathematical foundations of the machine learning and derive practical solutions using predictive analytics. In addition, it explains what machine learning is and how it is related to statistics and data analysis. The class will cover topics in regression, classification, mixture models, neural networks, basic deep learning, ensemble methods and reinforcement learning, hidden Markov models, and Bayesian networks, generative/discriminative learning, parametric/non-parametric learning, support vector machines, unsupervised learning, expectation maximization,		

dimensionality reduction, and kernel methods. The course will also discuss recent applications of machine learning, autonomous navigation, bioinformatics, speech recognition, and text and web data processing. Delivery will combine traditional lectures with other active teaching methodologies, such as group discussions, group solving problems, analysis of cases and debates, case study from different domains, and assignments.

Course Number 1905420	Course Title Cognitive Science	Credit Hours
Prerequisite: (**1905320)**		**3**
Course Description The course introduces the main terms and foundations of cognitive science and aims to understand the relationship between the computer and the human mind. The main goal is to simulate human processes in a computerized model. Using self-learning algorithms that use data mining, pattern recognition and natural language processing, the computer can mimic the way the human brain works. Active learning methodologies will be applied through role playing, presentations and problem-solving exercises.		

Course Number 1905430	Course Title Internet of Things	Credit Hours
Prerequisite: (**1905320 and 1901363)**		**3**
Course Description Internet-of-Things (IoT) course aims at preparing students to the IoT market, given the increasing demand for professionals on this hot emerging area. The course presents the latest IoT applications, devices, technologies, architecture, communication protocols and trends. IoT middleware/streaming applications used in IoT will be reviewed. IoT challenges including cybersecurity challenges, skills needed and best practices will also be covered. Part of the course will deal with developing real-world IoT applications/mobile application prototypes from the sensor design to the end-user applications to solve existing problems in the society. Moreover, the course utilizes artificial Intelligence 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 telco and other data sources. It also introduces typical application scenarios in which IoT provides innovative new services to enhance productivity and save costs. Active learning methodologies will be applied through role playing, presentations and problem-solving exercises. Moreover, hands-on practice on developing real-world IoT applications will be weekly practiced in the lab. In addition, guest speakers belonging to the Jordan's ICT will demonstrate state-of-the-art practices and application of IoT.		

Course Number	Course Title	Credit Hours

1905431	Intelligent Robotics	3
Prerequisite: (1905330)		

Course Description

The aim of this course is to introduce students to the basic principles of robotics. It covers the assembly, programming, and control of a simple robot. Students are expected to (1) know and understand key concepts relating to robots and robotics systems, (2) identify examples of robots, (3) identify the main parts of a robot and their function, including microcontrollers, actuators, sensors, and power sources, (4) understand the elements of a simple control system, and test a control system, (5) understand basic programming concepts, and create and execute a program, and (6) set up a robot, implement robotic motion, and control a robot in an environment. Active learning methodologies will be applied through role-playing, presentations and problem-solving exercises. Moreover, hands-on practice on developing real-world IoT applications will be weekly practiced in the lab. In addition, guest speakers belonging to the Jordan's ICT will demonstrate state-of-the-art practices and robot development.

Course Number 1915471	Course Title Deep Learning	Credit Hours 3
Prerequisite: (1915370)		

Course Description

This course will introduce students to the concept of Deep learning, and it will help students to understand its key principles. The course covers feed-forward neural networks, convolutional neural networks, recurrent neural network, deep reinforcement learning, and other fundamental concepts and techniques. This course will also teach the students the mathematical foundation underlying deep learning. 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 deep neural networks using the most popular libraries for Deep Learning such as Keras, PyTorch, and TensorFlow. The course will introduce students also to a wide spectrum of deep learning applications in real-word problems. Delivery will combine traditional lectures with other active teaching methodologies, such as group discussions, group solving problems, analysis of cases and debates, case study from different domains, and assignments.

Course Number 1905490	Course Title Training	Credit Hours

Prerequisite: (**Success 90 hours)**	**0**
Course Description A student is required to training in one of related organisations for not less than 6 weeks, and presents a report from the organization to describe the effectiveness of the practice according to the training regulations of Dean's council for KASIT Departments. Or have a specialized certificate in one of the technological information subjects that is considered and published from a certified organization.	

Course Number **1905491**	**Course Title** **Project -1**	**Credit Hours**
Prerequisite: **(Success 90 hours)**		**0**
Course Description 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.		

Course Number **1905492**	**Course Title** **Project -2**	**Credit Hours**
Prerequisite: (**1905491)**		**3**
Course Description This is the second stage of the graduation project which includes the practical aspects which are design, implementation and testing for the resulting project. Documentation of the whole project should be delivered to the department and the supervisor(s) and a presentation is done for the whole project at the end of the semester. It includes weekly meetings with the supervisors.		

C. Elective Specialty Courses Description

Course Number	**Course Title**	**Credit Hours**

1905310	Advanced AI programming	3
Prerequisite: (1915111)		

Course Description

This course will focus on understanding of how to perform Machine Learning with Python. In this course, student will learn to understand and format problems to be solved using ML techniques. They will also gain knowledge representation skills for preparing data to be used in prediction tasks and they will acquire expertise in creating models by combing the data with algorithms in that can predict the future. Students will learn how to use Python and libraries such as it scikit-learn to create Machine Learning solutions. This course will cover an introduction to ML and applications, setting up a Python development environment correctly, complete machine learning tool sets, the various regression, classification and other ML algorithms performance metrics such as R-squared, MSE, accuracy, confusion matrix, precision, recall, etc., unsupervised Machine Learning (ML) algorithms such as Hierarchical clustering, k-means clustering etc., Jupyter (IPython) notebook, Spyder and various IDE, Communicating visually and effectively with Matplotlib and Seaborn, using of train/test, K-fold and Stratified K-fold cross validation to select correct model and predict model perform with unseen data, and much more. Active learning methodologies will be applied through role-playing, presentations and problem-solving exercises. Moreover, hands-on practice on developing real-world applications will be weekly practiced in the lab.

Course Number 1915241	Course Title Bioinformatics	Credit Hours 3
Prerequisite: (1905222)		

Course Description

This course explores how the integration of computer science, statistics and mathematics knowledge can be used to tackle complex life sciences problems. It covers several topics like: general genomics, cells and DNA sequence features; sequence alignment; sequence motifs; search sequence databases; phylogenetic trees; Hidden Markov Models, and microarray data analysis: normalization and clustering; other emerging topics. Active learning methodologies will be applied through role-playing, presentations and problem-solving exercises. The students are required to present case studies on one of the related topics.

Course Number 1915251	Course Title Applied Statistics	Credit Hours 3
Prerequisite: (0301131)		

Course Description

This course is an introduction to practical applied statistics with R, a programming language and software environment for statistical computing, and with RStudio, an integrated development environment for R. Topics include introduction to R programming, summarizing data, probability and statistics in R, simple and multiple linear regression, categorical predictors and interactions, model diagnostics, collinearity, variable selection and model building, selected data analyses. The course graphically introduces those concepts utilizing R as a programming environment for applying statistical/probabilistic methods and techniques. This course is a practical course and will contain small projects and programming assignments for specific problems using R programming language.

Course Number 1905323	Course Title User Adaptive Systems	Credit Hours
Prerequisite: **(1905320 and 1902353)**		**3**

Course Description

The course applies machine learning techniques to identify user needs, draw requirements, design, and evaluate user-adaptive systems. It also aims to introduce common techniques for user modelling and adaptation and apply them in practical recommender systems. Students will be presented with similarity metrics that can be applied in different contexts. Also, the course will show how a generated user model can be used in systems to adapt individual users or to groups of users. Generated user models can be used for adapting hypermedia systems based to users' interests, needs preferences etc. Active learning methodologies will be applied through role-playing, presentations and problem-solving exercises. Moreover, hands-on practice on developing and modelling a user adaptive system will be weekly practiced in the lab.

Course Number 1915331	Course Title NoSQL Databases	Credit Hours 3
Prerequisite: (1902224)		

Course Description

This course explores the origins of NoSQL databases and the characteristics that distinguish them from traditional relational database management systems. Core concepts of NoSQL databases will be presented, followed by an exploration of how different database technologies implement these core concepts. It gives a closer look at 1-2 databases from each of the four main NoSQL data models (key-value, column family, document, and graph), highlighting the business needs that drive the development and use of each database. This course will introduce some examples of NoSQL databases such as Cassandra, MongoDB, Apache Hive, HBase, and Neo4j. Finally, it presents criteria that decision makers should consider when choosing between relational and non-relational databases and techniques for selecting the NoSQL database that best addresses specific use cases. The course contains a practical application on NoSQL databases through small projects and weekly assignments.

Course Number 1915341	Course Title Social Network Analysis	Credit Hours 3
Prerequisite: (1915222 and 1901341)		
Course Description This course gives a basic understanding of what social network analysis is and how it can be applied. The course will cover recent information on the structure and analysis of large social and information networks and on models and algorithms that abstract their basic properties. In this course student will learn about social networks structure and evolution, and how to practically analyze large-scale network data and how to reason about it. Topics covered in this course includes graph theory, link prediction, recommendation systems, graph mining, network community detection, graph visualization, graph data science, information propagation on the web, and connections with work in the social sciences and economics.		

Course Number 1905350	Course Title Knowledge Graphs Technologies and Applications	Credit Hours
Prerequisite: (**1905321)**		**3**
Course Description The course will demonstrate knowledge of existing applications and technologies of knowledge. It will also use common Semantic Web tools to apply semantic web technologies. The tools include semantic Web browsers, search engines, text-based and visualization-based tools. The course will reason about the significance of knowledge graphs and the directions in which the field is going to develop. Students will be introduced with different applications that use knowledge graphs such, health applications, learning applications and governmental applications. Active learning methodologies will be applied through role-playing, presentations and problem-solving exercises. Moreover, hands-on practice on developing and modelling knowledge graphs will be weekly practiced in the lab.		

Course Number 1915352	Course Title Healthcare and Medical Data Analytics	Credit Hours 3
Prerequisite: (1905222)		
Course Description		

This course introduces the characteristics of medical data and associated data mining challenges on dealing with such data. It focuses on studying those data science techniques in the context of concrete healthcare analytic applications such as predictive modelling, computational phenotyping and patient similarity, diseases detection. In this course, the students will learn how can the application of data analytics improve health and health care and how the data analytics-based solutions can result in better diagnosis, and better care. In healthcare, large amounts of heterogeneous medical data have become available in various healthcare organizations (payers, providers, pharmaceuticals). This data could be an enabling resource for deriving insights for improving care delivery and reducing waste. The enormity and complexity of these datasets present great challenges in analyses and subsequent applications to a practical clinical environment. The basics of data mining within the context of a wide variety of health care settings, and the types of data and data analysis challenges that you will likely encounter by gathering the data, move on to classifying, analyzing and finally visualizing medical data. The course will host a number of experts in the field of IT operations and related healthcare sector from the local market to cover the practical side of the course and share their first-hand experience with students.

Course Number **1915371**	**Course Title** **Pattern Recognition and Information Analysis**	**Credit Hours** **3**
Prerequisite: (1905222)		
Course Description The course aims to cover a wide understanding of different related topics, such as pattern recognition systems, pre-processing, and feature extraction from images and documents, supervised and unsupervised learning, object classification and recognition. In addition, the course aims at studying the concepts of information retrieval, and text and document mining. Furthermore, the course will introduce the recommendation systems based on pattern recognition such as collaborative and content-based recommendation systems. Active learning methodologies will be applied through role-playing, presentations and problem-solving exercises. Moreover, hands-on practice on developing and modelling knowledge graphs will be weekly practiced in the lab.		

Course Number **1905381**	**Course Title** **Advanced Natural Language Processing**	**Credit Hours**
Prerequisite: (**1905380)**		**3**

Course Description

Natural language processing (NLP) is an important technology and essential part of artificial intelligence. NLP is concerned with the problem of automatically analyzing and generating a natural language in written or spoken form. This course covers wide range of advanced topics including fundamental concepts and principals in NLP with emphasis on statistical approaches to NLP. This course will focus on applying recent advances in analyzing and generating speech and text. It will cover techniques and algorithms such as recurrent neural networks, deep learning, neural networks and mathematical definitions of the relevant machine learning models and derive their associated optimization algorithms. In the application part, the course will cover applications such as; question answering, machine translation, text classification, information extraction, grammar induction, dictionary generation, analyzing latent dimensions in text, transcribing speech to text, and other. Active learning methodologies will be applied through role playing, presentations and problem-solving exercises. Moreover, hands-on practice on using NLTK (Natural Language Toolkit) is weekly practiced in the lab. In addition, guest speakers belonging to the Jordan's ICT will demonstrate state-of-the-art practices and application of NLP.

Course Number **1905382**	**Course Title** **Digital Speech Processing**	**Credit Hours**
Prerequisite: (**1905320)**		**3**
Course Description This course aims to provide students with the foundation knowledge on speech production and perception along with processing of speech signal in digital domain. It helps students to design, develop, and evaluate intelligent systems that are based on human speech biometric. Various applications will be taught in this course including Automatic Speech Recognition, Automatic Speech Synthesis, Automatic Speaker Recognition, Automatic Dialects Recognition, Automatic Emotions Recognition, Automatic Speech to Speech Translation, Conversational Agents, and many others. The state-of-the-art digital speech processing tools and algorithms, and written and spoken language resources will be covered in this course. Active learning methodologies will be applied through role playing, presentations and problem-solving exercises. Moreover, hands-on practice on developing automatic Speech processing applications will be weekly practiced in the lab.		

Course Number **1902383**	**Course Title** **Information Technology Entrepreneurship and Innovation**	**Credit Hours** **3**
Prerequisite: (1902224)		
Course Description		

This course is to introduce students to new and innovative technologies and examine how these powerful systems have fundamentally reshaped modern organizations. These new information technologies are being used to change how organizations operate, produce products and services, and communicate both internally and as well as with external partners. Using online collaborative technologies that were developed in the context of social networking and online communities and data-driven and Artificial Intelligence technologies, corporations are reengineering both internal business processes and those related to customers, suppliers, and business partners. Developing innovative ways to communicate and collaborate can lead to new business opportunities and new efficiencies. This course investigates the technologies, methods, and practices of developing new innovations such as online communities, data revolution, and the Artificial Intelligence paradigms to reengineer business processes and develop innovative, value-adding, and sustainable business activities within existing corporations and new start-ups. The students will learn how to translate innovative, data-driven, and AI ideas into concrete project requirements, develop technological solutions, launch a business venture, and assess its effectiveness. Delivery will combine traditional lectures with other active teaching methodologies. A case study of innovative Healthcare Information Systems (HCIS) is selected for discussion throughout the course to highlight basic concepts of innovative HCIS project development. Students are advised to develop innovative solutions for simple problems in HCIS.

Course Number **1915431**	**Course Title** **Big Data**	**Credit Hours** **3**
Prerequisite: (1915370)		

Course Description

This course shall first introduce the overview Big Data applications, market trend, and the things to learn. Then, will introduce the fundamental platforms, such as MapReduce, Hadoop ecosystem, Spark, H2O Framework, Apache Storm, and other tools. Afterwards, the course will introduce several data storage methods and how to upload, distribute, and process them. This shall include HDFS, HBase, Pig, and Hive, document database, and graph database. The course will go on to introduce different ways of handling data analytics algorithms on different platforms. Then, the course will introduce visualization issues on Big Data. It also provides a first hands-on experience in handling and analyzing large, complex structured, semi-structured, and unstructured data. Students will then have fundamental knowledge on Big Data to handle various real-world challenges. The course will zoom in to discuss large-scale machine learning methods, and related big data frameworks. The course contains a set of homeworks and weekly tasks. The course hosts several experts in the field of big data from the local market to cover the practical side of the course and to share their first-hand experience with students.

Course Number **1905432**	**Course Title** **Reinforcement learning**	**Credit Hours** **3**
Prerequisite: (1905330)		

Course Description
The course is about prediction and control using reinforcement learning, including aspects of deep reinforcement learning, i.e., the application of neural networks-based functional approximation to reinforcement learning problems. The course covers theory and applications related to the following topics: Markov decision processes. Value function approximation. Policy gradient methods, Actor-critic algorithms. Integration of Learning and Planning. Exploration vs exploitation trade-offs. Active learning methodologies will be applied through role playing, presentations and problem-solving exercises. Moreover, hands-on practice on reinforcement learning applications will be weekly practiced in the lab.

Course Number 1905433	Course Title Intelligent Agents	Credit Hours 3
Prerequisite: (1905431)		
Course Description The aim of this course is to introduce the notion of Multi-Agent systems (MAS) which can be viewed as a collection of distributed autonomous artifacts capable of accomplishing complex tasks through interaction, coordination, collective intelligence and emergence of patterns of behavior. We shall discuss the following concepts and issues: what are agents and MAS, MAS architectures, Communication (Coordination, Negotiation, MAS learning), Knowledge representation, Distributed planning, Agents and MAS applications. By the end of the course, students are expected to (1) have good understanding of the ideas, models, and paradigms offered by intelligent agents and MAS; (2) build MAS or select the right MAS framework for solving a problem; and (3) use the agent technology in different areas of applications. Active learning methodologies will be applied through role playing, presentations and problem-solving exercises. Moreover, hands-on practice on Multi-Agent systems applications will be weekly practiced in the lab.		

Course Number 1905434	Course Title Advanced Embedded Systems	Credit Hours 3
Prerequisite: (1905330)		
Course Description		

This course aims to cover and provide students insights to selected topics in advanced embedded systems. It includes concepts Analogue to Digital Converter (ADC), Universal Synchronous Asynchronous Receiver Transmitter (USART), and Pulse Width Modulation (PWM). Advance real time applications and formal models of computation for embedded (centralized and distributed) systems. Active learning methodologies will be applied through role playing, presentations and problem-solving exercises. Moreover, hands-on practice on embedded systems applications will be weekly practiced in the lab.

Course Number **1915441**	**Course Title** **Data Visualization**	**Credit Hours** **3**
Prerequisite: (1915370)		
Course Description This course will give you the skills you need to leverage data to reveal valuable insights and advance your career. The course will focus on studying algorithms for creating effective visualizations capable of promoting data comprehension and analysis. The course discusses the key techniques and theory used in visualization, including data models, graphical perception, and visual encoding and interaction. Students will learn about the variety of existing approaches and systems in data visualization and develop skills in evaluating different visualization techniques as applied to particular tasks. Also, these visualization techniques will be used to display data through static and interactive forms and graphics that help in understanding relationships and communicating with non-specialists. The course also discusses visual representation methods, such as graph drawing, parallel coordinates, tree mapping, and encourages students to design new innovative visualizations and experiment their potentials on case studies of various data sources. In addition, the course will introduce the popular packages in python programming and other open sources visualization tools. Delivery will combine traditional lectures with other active teaching methodologies, such as group discussions, group solving problems, analysis of cases and debates, case study from different domains, and assignments.		

Course Number **1905433**	**Course Title** **Brain-Computer Interaction**	**Credit Hours** **3**
Prerequisite: (1905320)		
Course Description		

The course will cover the Brain-Computer Interface (BCI) design with a focus on modern methods. In addition, the course will cover the Basic Neuroscience, Stimulating the Brain, Signal Acquisition, Signal Processing, related BCIs Machine Learning, Major Types of BCIs such as Invasive BCIs, Semi-Invasive BCIs, Non-Invasive BCIs, Stimulating and Bidirectional BCIs, BCI Applications using Matlab, BCI devices such as Emotiv, Ethics of BCI, basics of EEG. The course will cover some of the most common brain-computer interface examples such as in Medicine, Rescue/Disaster Management, Security, Education, and Rehabilitation. Active learning methodologies will be applied through role playing, presentations and problem-solving exercises. Moreover, hands-on practice on designing Brain-Computer Interface applications will be weekly practiced in the lab.

Course Number **1901444**	**Course Title** **Computational Problems and Techniques**	**Credit Hours** **3**
Prerequisite: (1901341)		
Course Description The main goal of this course is to enable the students to solve classical computational problems, such as 0-1 knapsack, rod cutting, matrix chain multiplication, N-queens, and sudoku, using various computational techniques. The students will be introduced to the theoretical concepts for the computational problems and techniques and their implementations. The course covers various computational techniques such as complete search, iterative (all subsets and all permutations), backtracking, greedy approach, dynamic programming, and divide-and-conquer (binary search technique). Also, the course covers two-pointers and range queries including static (partial and prefix sums) and dynamic (segment tree) with their implementations and usage. Weekly problems will be presented in the lab either individually or within groups.		

Course Number **1905450**	**Course Title** **Game AI**	**Credit Hours**
Prerequisite: (**1905320)**		**3**
Course Description This course introduces students to the techniques used to simulate Artificial Intelligence in computer games. AI is used in games to generate responsive or intelligent behaviour mainly for Non-Player Characters (NPCs), assist game designers in analyzing existing level designs, synthesizing new		

ones, and statistically model player behaviour. This course helps to understand how to decide which move to take based on future possibilities and n-moves look ahead. The course also explores how to solve parameters (e.g. time or distance) optimization applications, these applications usually have exponential possibilities. Some of covered techniques to stimulate intelligence in computer games include: movement, pathfinding with A* search, decision/ behaviour trees, state machines, machine learning, tactics. Student will also learn some of the algorithms used for game development such as evade algorithms and flocking, etc. Several games will be considered to show how various steps of the algorithm are implemented in code. Students will work in small teams to develop technical practical projects. Active learning methodologies will be applied through role playing, presentations and problem-solving exercises. Moreover, hands-on practice on developing intelligent computer games will be weekly practiced in the lab. In addition, guest speakers belonging to the Jordan's ICT will demonstrate state-of-the-art practices on developing computer games.

Course Number 1905452	Course Title Software Engineering for AI-Enabled Systems	Credit Hours
Prerequisite: (**1905320 and 1902372)**		**3**

Course Description

The course takes a software engineering perspective on building software systems with a significant machine learning or AI component. It discusses how to take an idea and a model developed by an AI expert or data scientist and deploy it as part of scalable and maintainable system (e.g., mobile apps, web applications, IoT devices). Rather than focusing on modeling and learning itself, this course assumes a working relationship with the AI expert and data scientist and focuses on issues of design, implementation, operation, and assurance and how those interact with the data scientist's modeling. This course is aimed at software engineers who want to understand the specific challenges of working with AI components and at AI experts and data scientists who want to understand the challenges of getting a prototype model into production; it facilitates communication and collaboration between both roles. The course also covers the applications of AI in the SDLC (i.e., Requirements prioritization, Bug prediction, etc.). One or two guest speakers with many years of experience in developing intelligent software engineering will be invited to share their first-hand experience with students.

Course Number 1905453	Course Title Virtual Reality	Credit Hours
Prerequisite: (**1905322)**		**3**

Course Description

This course introduces the basic principles of Virtual Reality and its applications. The necessary hardware and software components of interactive 3D systems as well as human factors are discussed. The material is reinforced by practical assignments and projects. The topics will be as follows: applications, human sensory/motor system & capabilities. History of VR and AR,

differences between VR/AR and normal experience. Virtual Reality Technology (VR): VR input devices, filtering & tracking, VR output devices, Augmented Reality (AR) hardware, spatial audio, and haptic. This course aims to make students know the basic concept and framework of virtual reality, teach students the principles and multidisciplinary features of virtual reality, teach students the technology for multimodal user interaction and perception in VR, in particular the visual, audial and haptic interface and behaviour, and provide students with an introduction to the VR system framework and development tools. Active learning methodologies will be applied through role playing, presentations and problem-solving exercises. Moreover, hands-on practice on virtual reality applications will be weekly practiced in the lab.

Course Number **1905454**	**Course Title** **Multimodal Intelligent Systems**	**Credit Hours** **3**
Prerequisite: (1905320)		

Course Description

This course aims to provide students with the foundation knowledge of unimodality, bimodality, and multimodality intelligent systems using human physiological and behavioural biometrics such as voice, fingerprint, iris, hand written signature, gait, and others. Fusion techniques will be taught in this course to enable students to combine biometrics at feature and decision levels. Students will be taught real world applications of fusing human biometrics with some hands-on experience. Active learning methodologies will be applied through role playing, presentations and problem-solving exercises. Moreover, hands-on practice on modelling multimodal systems will be weekly practiced in the lab.

Course Number **1915461**	**Course Title** **Cloud Computing**	**Credit Hours** **3**
Prerequisite: (1905222 and 1901363)		

Course Description

The course discusses the basic APIs used in the Microsoft and Amazon Clouds, including the techniques for building, deploying, and maintaining machine images and applications. Student will learn how to use Cloud as the infrastructure for existing and new services. They will use open source implementations of highly available clustering computational environments, as well as the

Representational State Transfer Web Services called (RESTful), to build very powerful and efficient applications. Also, students will learn how to deal with not trivial issues in the Cloud, such as load balancing, caching, distributed transactions, and identity and authorization management. It is expected that students will become familiar with Linux OS. In addition, the course will cover Container Orchestration, Docker, Kubernetes, Cloud-based File System, Cloud-based Databases, Scalable Data Storage, Cloud based Machine Learning, Cloud based Analytics, Graph Processing, Graph Databases on the Cloud, introduction to Big Data Programming frameworks such as MapReduce, Spark, and Hadoop. It covers topics of data centers, virtualization, cloud storage, and programming models. The course also addresses the motivating factors, benefits, challenges and the service model. The course introduces several concepts in the design and management of data centers. It also presents concepts such data distribution, robustness, consistency and redundancy. Delivery will combine traditional lectures with other active teaching methodologies, such as group discussions, group solving problems, analysis of cases and debates, case study from different domains, and assignments.

Course Number **1904472**	**Course Title** **IT Project Management**	**Credit Hours** **3**
Prerequisite: (1902372)		
Course Description Students are expected to explore the processes, procedures, tools and techniques and results to create and execute an integrated project plan; it also expected to create project charter, determine requirements, defining creating and managing the project scope, and validating the deliverables. IT project managers are responsible for planning, organizing, allocating resources, budgeting and successfully executing organizations' specific IT goals. This course uses active teaching methodologies, such as weekly lab applied sessions, group work and technical projects. In addition, speakers from the industry will be invited to discuss case studies and show the latest trends on the industry.		

Course Number **1905480**	**Course Title** **Arabic Language Engineering**	**Credit Hours**
Prerequisite: (**1905380)**		**3**
Course Description Arabic Language Engineering course is an interdisciplinary course concerned with the use of Natural Language Processing tools and techniques to analyze and generate Arabic language in the forms of text and speech. It investigates the challenges of processing Arabic language. It discusses the linguistic theories and computational techniques for machine translation, information retrieval, text summarization, reference resolution, question answering, parsing, sense disambiguation,		

morphological analysis, speech analysis and synthesis. Active learning methodologies will be applied through role playing, presentations and problem-solving exercises. Moreover, hands-on practice on developing NLP applications for Arabic will be weekly practiced in the lab. In addition, guest speakers belonging to the Jordan's ICT will demonstrate state-of-the-art practices on Arabic NLP applications.

Course Number 1915481	Course Title Model Deployment Frameworks	Credit Hours 3
Prerequisite: (1915370)		
Course Description In this course, the student will learn how to deploy ML models and make them available to end-users. In addition, the student will learn about the Model Deployment Platforms such as Django and Flask, and others. The student will build scalable and reliable infrastructure to deliver inference requests both in real-time and batch depending on the use case. Student will also implement workflow automation and progressive delivery that complies with current MLOps practices to keep your production system running. Additionally, you will continuously monitor your system to detect model decay, remediate performance drops, and avoid system failures so it can continuously operate at all times. Delivery will combine traditional lectures with other active teaching methodologies, such as group discussions, group solving problems, analysis of cases and debates, case study from different domains, and assignments.		

Course Number 1911489	Course Title Security Intelligence	Credit Hours 3
Prerequisite: (301131 and 1905320)		
Course Description This course introduces students to protecting an organization from external and inside threats as well as the processes, policies and tools designed to gather and analyze that information. It studies		

in-depth investigation of attackers and their techniques. Topics included: Various concepts, algorithms and techniques related to hunting, features extraction, attacks' classification and tracking.

Course Number 1905493	Course Title Special Topics in Artificial Intelligence	Credit Hours
Prerequisite: (**1905320)**		**3**
Course Description The course goes in depth on selected topics and methods within Artificial Intelligence (AI) and its applications. Including Information extraction, industrial applications of AI, advanced logic-based AI, Statistical Relational learning, representing and reasoning about knowledge, in addition to computational intelligence algorithms in search, optimization and classification. On the other hand, the course will review and analyse the basic approaches to building intelligent software agents and AI applications in remote sensing. An agent is a system situated within and part of an environment that senses that environment and acts on it. Intelligent software agents are AI programs that can assist users in various ways. For instance, they can perform tasks on the user's behalf, they can advise, train or teach the user, they can monitor events for the user, or help different users collaborate. This will allow the act of making computers demonstrate intelligent behaviour, so that they can solve new problems or cope with the unknown.		