جامعـــــة اربد الاهلية

كلية العلوم وتكنولوجيا المعلومات

الخطـة الدراسيـة

لدرجـة البكالوريـوس

فـــي

علم البيانـات والذكـاء الاصطنـاعي

2023-2022

COURSES DESCRIPTION

FACULTY REQUIREMENTS: (21 CREDIT HOURS)

COMPULSORY FACULTY REQUIREMENTS: (15 CREDIT HOURS)

Course Name:	**Introduction to IT**			**Course Code:**	**401102**
Hours:	Credit	Theoretical	Practical	Pre-Requisite:	
	3	3	1		
This course gives the basic concepts of computers and information technology, both physical and programmatic, and includes: an introduction to physical and programmatic computer components, counting systems, and methods of data representation. Stages of software development, application software and system software, focusing on foundations and methods of problem solving and algorithm design. Introduction to C ++ programming language and includes: program structure in C ++ language, basic data types, arithmetic and logical operations, control structures in addition to previewing and compiling software					

Course Name:	**Computer Skill (2)**			**Course Code:**	**401115**
Hours:	Credit	Theoretical	Practical	Pre-Requisite:	Introduction to IT
	3	3	1		
This course covers the basic concepts of a programming language using C++, and includes: Development of major programming languages. Description of sentence structure and their implications, analysis of sentence structure and construction, names of variables, and includes: linking, verification of type and sphere of influence. Data types, expressions, data references and control sentence structures.					

Course Name:	**Programming Language (1)**			**Course Code:**	**401211**
Hours:	Credit	Theoretical	Practical	Pre-Requisite:	Computer Skill (2)
	3	3	1		
The basic skills of writing and debugging code using a common programming language (e.g., the C++ or Java programming language), an integrated development environment (IDE) (e.g., MS Visual (VC++) development studio), data types, arithmetic and conditional operators, control structures, functions, parameter passing by value and by reference and arrays					

Course Name:	**Calculus (1)**			**Course Code:**	**404101**
Hours:	Credit	Theoretical	Practical	Pre-Requisite:	
	3	3	0		
Functions: domain, operations on functions, graphs of functions, trigonometric, inverse, logarithmic and exponential functions; inverse trigonometric functions; continuity limits. Derivative: differentiation techniques, chain rule, implicit differentiation; the differences. Rolle's Theory, Key Value Theory; increasing and decreasing jobs; concavity; Maximum and minimum function values, graphs including Boolean functions; Indefinite integral. Fundamental Theorem of Calculus. Integration by substitution. The area between the curve and the x-axis.					

Course Name:	**Statistics & Probability (1)**	**Course Code:**	**404131**

Hours:	Credit	Theoretical	Practical	Pre-Requisite:	
	3	3	0		
This course will include descriptive statistics, probability; Axioms of probability, rules of probability, conditional probability, independence. Discrete and continuous random variables, expectations, and probability distributions. Sampling distributions t, Chi square, F, CLT distributions. Score estimation: for mean and variance, difference between two means and percentage of variances, hypothesis testing for small, large and dependent samples, correlation, simple and multiple linear regression. Quality of fit tests.					

ELECTIVE FACULTY REQUIREMENTS: (6 CREDIT HOURS)

Course Name:	Linear Algebra (1)			Course Code:	404241
Hours:	Credit	Theoretical	Practical	Pre-Requisite:	Calculus (1)
	3	3	0		
System of linear equations, matrices, determinants, vector space in the second and third dimensions, non-vector multiplication, vector multiplication, general vector space, subspaces, linear independence, base and dimension, orthogonal basis, (Gram-Smith) operations, base change, linear transformations.					

Course Name:	Modeling & Simulation			Course Code:	401452
Hours:	Credit	Theoretical	Practical	Pre-Requisite:	Statistics & Probability (1)
	3	3	0		
This course discusses different topics in simulation and modeling, such as the uses, advantages and disadvantages of simulation, types of models, the steps in discrete-event system simulation, statistical models, simple queuing models, random numbers and random variates, input modeling, model verification and validation, and its use in input-output analysis. Sample implementations for queuing system simulations are discussed using selected languages.					

Course Name:	Programming Languages Design & Implementation			Course Code:	401452
Hours:	Credit	Theoretical	Practical	Pre-Requisite:	Programming Language (1)
	3	3	0		
This course will acquaint the student with the fundamental ideas surrounding the design and implementation of high-level programming languages. The course will stress underlying theoretical concepts as well as a significant, practical course project. At the same time, the course will focus on making this material accessible to students of varied backgrounds.					

Course Name:	Graph Theory			Course Code:	404463
Hours:	Credit	Theoretical	Practical	Pre-Requisite:	Linear Algebra (1)
	3	3	0		

The course treats graph theoretical notions and problems, and the use of algorithms, both in the mathematical theory of graphs and its applications. In the course, the basic theory of graphs of different kinds is developed in detail, especially trees and bipartite graphs.

DEPARTMENT REQUIREMENTS: (81 CREDIT HOURS)

COMPULSORY DEPARTMENT REQUIREMENTS: (66 CREDIT HOURS)

Unit Number	Credit hours	Title of the unit	prerequisite
401115	3	Introduction to Algorithms	401112 Computer skills
This unit will cover the following contents: Solving summations and recurrences, Efficiency and complexity analysis, Tree terminology and algorithms, Binary trees, Hashing methods and solving collision in hashing, Heaps and heap sort, Insertion sort, merge sort and quicksort, Graph terminology, representation, and algorithms, Algorithms of Prim, Kruskal, Dijkstra and Floyd. Breadth-first and depth-first search, The greedy, divide-and conquer, and dynamic programming techniques.			

Unit Number	Credit hours	Title of the unit	prerequisite
401215	3	Object oriented programming	401211 Programming language 1
This unit will cover the following contents: Introduction to computer programming for Windows using C#. This includes C# syntax, basics of C# classes, interfaces, exception handling, assemblies, .NET collections, Windows Forms, and relational database programming.			

Unit Number	Credit hours	Title of the unit	prerequisite
401251	3	Data Structures	401112 Computer skills 2 (Faculty of Science students)
The main core components will be based on the following: 1. Principles of data design. Data types and structures. Abstract data types (ADTs) and encapsulation. 2. Unsorted List and Sorted List ADTs. Stack and Queue ADTs. Linked structures. Implementing 3. Unsorted Lists, Sorted Lists, Stacks and Queues as linked structures. Programming with recursion. 4. Binary Search Trees.			

Unit Number	Credit hours	Title of the unit	prerequisite
409231	3	Algorithms of Data Science and Artificial Intelligence	401115 Introduction to Algorithms And 401453 Artificial Intelligence

The main focus will be bases on the following:

1. Formal techniques of the design and analysis of algorithms.
2. Asymptotic analysis of upper and average complexity bounds.
3. Empirical measurements of performance; time and space tradeoffs in algorithms.
4. Correctness and finiteness of algorithms.
5. Algorithmic strategies: Brute-force, greedy, divide-and-conquer, backtracking, branch-and-bound, heuristics, pattern matching and string/text algorithms.

Implementation strategies for Graph, Network and Tree algorithms.

Unit Number	Credit hours	Title of the unit	prerequisite
401332	3	Operating Systems	401112 Computer skills 2 (Faculty of Science students

This unit will focus on the following parts:

1. Operating system fundamentals.
2. Memory management.
3. Virtual memory.
4. Multiprogramming. Resource scheduling and allocation. CPU scheduling.
5. Tasks management and synchronization.
6. Deadlock management. Secondary storage management and file handling.
7. System security and protection.

Unit Number	Credit hours	Title of the unit	prerequisite
409101	3	Data Science Principles	401102 Introduction to Information Technology

This unit will cover and the student is expected to understand the following:Introduction to Data Science, Big data, Python programming (Pycharm IDE), Data Science process, Statistics and Data mining, Machine learning, Supervised Machine learning, Machine learning, Unsupervised Machine learning

Unit Number	Credit hours	Title of the unit	prerequisite
409441	3	Big Data	409341 Data Engineering

The unit will focus on the following: 1. Basics of Programming in Data Science. 2. Advanced Concepts of Programming. Integration and Testing. SDLC and Agile Methodology. Object-Oriented Design. ... 3. Big Data Fundamentals. 4. Advanced Concepts of Big Data. Large Scale Data Processing. ETL and Data Ingestion. NoSQL Databases.

Unit Number	Credit hours	Title of the unit	prerequisite
409120	3	Artificial Intelligence	409101 Data Science Principles
This unit will cover the following main core contents: Introduction to introduction to AI, Solving problems by searching , AI Real world problems, Genetic Algorithm, Beyond classical search , ,Adversarial search , Knowledge representation and expert systems			

Unit Number	Credit hours	Title of the unit	prerequisite
409112	3	Artificial Intelligence Programming	409112 Artificial Intelligence
Artificial Intelligence programming unit , core components :Introduction to Python, Variables, simple data types and lists, Working with lists and if statements, Dictionaries, user input and while loops , Functions and classes, Files, exception and testing, After this course, students are expected to be able to write programs and to start their projects in Python programming language.			

Unit Number	Credit hours	Title of the unit	prerequisite
409321	3	Data Mining	409241 Database
This course will focus on the following : 1. Introduction to Data Mining, Classification, Clustering, Association Rule Discovery, Anomaly 2. Detection, Web Mining, Collaborative Filtering, and various data mining topics			

Unit Number	Credit hours	Title of the unit	prerequisite
409223	3	Data Science Programming	409112 Artificial Intelligence programming

This unit will focus on the following:

1. providing students with the skills necessary to use Python for data analysis in scientific computing.
2. In particular the course will cover with Python: The NumPy package for scientific computing.
3. The Pandas data analysis library, including reading and writing of CSV files.
4. The IPython and PyDev development environments.
5. The Matplotlib 2D plotting library.
6. The course will also provide an introduction to best-practice software engineering techniques and Unix command line tools.

Unit Number	Credit hours	Title of the unit	prerequisite
409221	3	Machine Learning	409112 Artificial Intelligence programming + 409321 Data mining

This course provides a broad introduction to machine learning. Main components include:

1. supervised learning (generative/discriminative learning, parametric/non-parametric learning, neural networks, and support vector machines);
2. unsupervised learning (clustering, dimensionality reduction, kernel methods); learning theory (bias/variance tradeoffs, practical advice); reinforcement learning and adaptive control.

Unit Number	Credit hours	Title of the unit	prerequisite
409222	3	Neural Networks	409221 Machine Learning

This course provides a broad introduction to Neural Networks. Main components include:

1. This includes single- and multi-layer perceptrons; radial-basis function networks; support vector machines; stochastic machines and deep networks; recurrent and dynamic networks; supervised and unsupervised learning; application to pattern classification and function approximation problems.

Unit Number	Credit hours	Title of the unit	prerequisite
409241	3	Database	401251 Data Structures

This course provides a comprehensive concepts of :

1. The relational database design and SQL (implemented in Oracle) used with relational databases.
2. The presentation stresses at relational data model; relational algebra; SQL; database analysis and design; ER and enhanced modelling; data normalization. Programming language.

Unit Number	Credit hours	Title of the unit	prerequisite
409322	3	Deep Learning	409222 Neural Networks

This unit will focus on the following:

1. An introduction to deep learning.
2. This includes supervised and unsupervised learning, linear and logistic regression, continuous optimization, generalization theory and over fitting, regularizes, and probabilistic modeling.

Unit Number	Credit hours	Title of the unit	prerequisite
409211	3	Knowledge based system	409210 Knowledge Representation and reasoning

This unit will focus on the following:

1. Introduction to expert systems: definition and applications.
2. Characteristics of expert systems.
3. Knowledge representation. Inference methodologies.
4. Rule-based and production systems. Forward and backward inference systems.
5. Fuzzy logic and probabilistic logic.
6. Frame-based systems. Natural language understanding systems.

Unit Number	Credit hours	Title of the unit	prerequisite
409341.	3	Data Engineering	409255 DataBase

The unit will focus on the following:

1. Managing extracting, transforming and loading (ETL) data.
2. This course will explain the data life cycle in a Data science project covering data types, such as structured, semi structured and unstructured and the different formats of data and techniques used in the ETL process. It also takes the student through staging, profiling, cleansing, and migrating data as well as insight exploration using basic visualization techniques.

Unit Number	Credit hours	Title of the unit	prerequisite
409432	3	Natural Language Processing	409322 Deep learning

The unit will focus on the following:

1. An introduction to Natural Language Processing.
2. The study of Computing systems that can process, understand, or communicate in human language.
3. The primary focus of the course will be on understanding various NLP tasks, algorithms for effectively solving these Problems, and methods for evaluating their performance.

Unit Number	Credit hours	Title of the unit	prerequisite
409232	3	Visual programming	401112 Computer skills 2 (Faculty of Science students unit)

This course will cover the following:

1. The student must be able to create programs by manipulating program elements graphically rather than defining them textually.
2. Programming using visual expressions and spatial arrangements of text and graphic symbols, which are used either as syntax elements or secondary notation.
3. Data flow or diagrammatic programming.
4. To create "boxes and arrows", where squares or other screen elements are treated as entities connected by arrows, lines, or arcs representing relationships

Unit Number	Credit hours	Title of the unit	prerequisite

409431	3	Computer Vision	409322 Deep learning

This unit will cover the following:

1. Students will learn fundamentals of image formation, camera imaging geometry, feature detection and matching. Algorithms of stereo, motion estimation and tracking, image classification, with neural networks will be deeply address in this course.
2. The topics of object detection and tracking will be taught to students.
3. It aims to cover a wide understanding of different related topics, such as pattern recognition systems, pre-processing and feature extraction, supervised and unsupervised learning, object classification and recognition.

Unit Number	Credit hours	Title of the unit	prerequisite
409311	3	Robotics	409211 Knowledge based systems

The purpose of this course is to :

1. To introduce the student to basics of modeling, design, planning, and control of robot systems. In particular, the material treated in this course is a brief survey of relevant results from geometry, kinematics, statics, dynamics, and control.
2. The course enriches the student with the needed algorithms for robotics related problems.

Unit Number	Credit hours	Title of the unit	prerequisite
409343	3	Information Retrieval	409255 Knowledge bases systems

This course includes the following topics:

1. Introduction to Information Retrieval, Basic Techniques of information retrieval, Tokens and Terms, Static Inverted Indices, Query Processing,
2. Index Compression, Dynamic Inverted Indices, Probabilistic Retrieval, Measuring Effectiveness, Web Search.

Unit Number	Credit hours	Title of the unit	prerequisite
409210	3	Knowledge Representation and reasoning	404152 Discrete Mathematics

The course introduces students to the main concepts of cognitive and knowledge based systems. This includes structured knowledge representations, as well as knowledge-based methods of problem solving, planning, decision-making, and learning.

Unit Number	Credit hours	Title of the unit	prerequisite
409442	3	Advanced AI	409311 Robotics
This course teaches advanced technologies of artificial intelligence. This includes evolutionary computation; **reinforcement** learning; Knowledge Representation; and Reasoning.			

Unit Number	Credit hours	Title of the unit	prerequisite
409443	3	AI and Machine Learning Applications	409322
The course introduces students to the bias/variance theory; innovation process in machine learning and AI. This includes applying learning algorithms to building smart robots (perception, control), text understanding (web search, anti-spam), computer vision, medical informatics, audio, database mining, and other areas.			

Unit Number	Credit hours	Title of the unit	prerequisite
409113	3	Cognitive Computing	401453
This course aims to introduce students to the basic concepts and methodology needed to implement and analyze computational models of cognition. It considers the fundamental issues of using a computational approach to explore and model cognition. In particular, we explore the way that computational models relate to, are tested against, and illuminate psychological theories and data. The course will introduce both symbolic and sub-symbolic modelling methodologies, and provide practical experience with implementing models. The symbolic part will focus on cognitive architectures, while the sub-symbolic part will introduce probabilistic models.			

Unit Number	Credit hours	Title of the unit	prerequisite
409444	3	Selected Topics in AI (1)	
This course covers selected topics in current research and advancements in various AI fields.			

Unit Number	Credit hours	Title of the unit	prerequisite
409445	3	Selected Topics in AI (2)	409445
This course covers selected topics in current research and advancements in various AI fields.			

Unit Number	Credit hours	Title of the unit	prerequisite
409471	3	Practical Training	Last year Training

The student is required to do:

1. practical training in a well-known software company for a period of (2) months, fulltime training, with at least (6) hours per day, or 3 months part-time training with at least (4) hours per day.
2. In addition to training hours, for the part-time training, the student is allowed to register not more than (10) credit hours in the first or the second semester, or (4) credit hours in the summer semester.
3. The student is required to perform tasks that are related to his major, such as writing, developing, or learning some new software.

Unit Number	Credit hours	Title of the unit	prerequisite
409472	3	Graduation Project	Last year unit

The Student will be able to develop a project on his own, the contents will be as per the plan below:

1. Project is aimed at developing real world problem solving skills, including problem definition, analysis, and needed software.
2. A project should be performed by a group of students under the supervision of a faculty member.
3. Students are required to develop a complete implementation fulfilling the project objectives and submit a final report.
4. Project must be presented to a committee of the faculty.