Ajloun National University

جامعة عجلون الوطنية

Faculty of Information Technology

Department of

Data Science and Artificial Intelligence

Study Plan for the Bachelor's Degree In Data Science and Artificial Intelligence

Academic year 2025/2026

أقرت بقرار مجلس العمداء رقم (2025/6-2026) في جلسته الأولى المنعقدة بتاريخ 2025/10/6.

Vision

Excellence and leadership in providing educational and research programs on artificial intelligence and Internet technology at the local, regional and global levels.

Mission

The mission of the Department of Data Science and Artificial Intelligence is to provide high-quality educational and research programs that seek to develop knowledge and skills in the fields of data science and artificial intelligence. The focus is on achieving academic and research excellence, with special emphasis on innovation and practical applications in these two advanced sectors

Goals

1) Providing distinguished educational programs: It aims to develop high-quality educational programs that cover the fields of data science and artificial intelligence, and meet the needs of students and the requirements of the changing labor market.
2) Enhancing knowledge and skills: It seeks to develop basic and advanced knowledge and skills in the field of data science and artificial intelligence.
3) Achieving academic excellence: It focuses on achieving excellence in academic performance and developing study programs that reflect the latest developments in the fields of data science and artificial intelligence.
4) Promoting innovation and practical applications: It seeks to encourage students to innovate and apply acquired concepts and techniques to solve practical problems.
5) Directing scientific research: Promoting scientific research in the fields of data science and artificial intelligence to develop knowledge and make important contributions in these fields.
6) Preparing students for the labor market: It aims to develop study programs that suit the needs of the labor market and enhance employment opportunities for graduates.
7) Strengthening interaction with the community: It seeks to enhance interaction between the department, the local community and industry to update educational content and direct research to meet the needs of the community.
8) Promoting continuous learning: It encourages the spirit of continuous learning and provides skill development opportunities for faculty members and students.
9) Promoting Diversity and Inclusion: It seeks to promote diversity and inclusion in the learning and research environment to ensure a diverse representation of the community.
10) Achieving global impact: It aims to achieve global impact through the department's contributions in the fields of science.

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Learning Outcomes

Knowledge
Understanding mathematical methods, algorithms, computer operating systems, and various tools for statistical analysis of data and application of data statistics.
Knowledge of programming methods and languages and how to build computer programs and smart applications.
An understanding of the basics of science, security, databases, and big data, and their mining and retrieval.
Describe the basic concepts of data science and artificial intelligence and understand the different methods and tools for dealing with them.
Skills
Solving mathematical problems and designing algorithms.
Design and develop computer programs and implement artificial intelligence solutions.
Classifying, processing and analyzing data and using data management and retrieval solutions.
Apply theories and concepts in data science and artificial intelligence, such as machine learning, neural networks, computer vision, and robotics.
Competencies
Employing concepts and theories for exploratory data analysis and providing smart and innovative software solutions.
Commitment to ethics related to data science and artificial intelligence.
The student must produce and implement smart computer applications and have the ability to infer, deduce, analyze, extrapolate and interpret data.
Work collaboratively to apply acquired knowledge, develop communication skills, and work in a team spirit through the experience of building smart projects.

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Contents of the Study Plan

The study plan for the bachelor's degree in Data Science and Artificial Intelligence of (132) credit hours distributed as follows:

Certified On Campus learning (1+1, An hour and a half of on campus learning + one half hour of campus learning).

Certified Electronic (1+1, An hour and a half synchronous Electronic + campus learning).

Certified Blended (1+1, An hour and a half synchronous Blended + campus learning).

Number	Type of Requirement	Credit Hours	percentage%
First	University Requirements	27	20.45%
Second	Faculty Requirements	18	13.64 %
Third	Supportive Requirements	9	6.82 %
Fourth	Department Compulsory Requirements	69	52.27 %
	Department Elective Requirements	9	06.82 %
Total		132	100%

University Coding System

Faculty Code	Department Code	(Level Year)	Knowledge Area	Course sequence
3	15			

0Remedial
1 First
2 Second
3 Third
4 Fourth

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Knowledge Area

Knowledge Number	Knowledge Area	Number of Credit Hours
0	Programming	18
1	Computer Science and Algorithms	18
2	Fundamentals of Data Science & Artificial Intelligence	18
3	Special Topics in Data Science & Artificial Intelligence	30-15
4	Graduation Project	3
5	Field Training	3

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First: University Requirements (27) Credit Hours

1. University Compulsory Requirement (12) Credit Hours

Learning Type			Course code	Course Name	Course activities	Activities Hours	Credit Hour	Prerequisite
Electronic	Blended	On						
	√		704107	Entrepreneurship and Innovation	Theory	1	1	
	√		704109	Leadership and Social Responsibility	Theory	1	1	
	√		704116	Life Skills	Theory	1	1	
√			704117	English Language Skills (1)	Theory	2	2	714099
	√		704118	Arabic Language Skills (1)	Theory	2	2	704099
	√		704119	National Culture	Theory	2	2	-
√			704200	Military Science	Theory	3	3	-

2. University Elective Requirements (15) Credit Hours

Learning Type			Course code	Course Name	Course activities	Activities Hours	Credit Hour	Prerequisite
Electronic	Blended	On						
	√		201101	Law in our Lives	Theory	3	3	
	√		202132	Human rights	Theory	3	3	
	√		401100	Principles of Administration	Theory	3	3	
√			701140	Arabic Library and Lexicography	Theory	3	3	-
		√	704103	International and Arabic Contemporary Issues	Theory	3	3	
√			704104	Islamic Culture	Theory	3	3	-
	√		704108	Integrity and Transparency	Theory	3	3	
	√		704110	Digital Culture	Theory	3	3	
	√		704112	Arabic language skills (2)	Theory	3	3	704118
		√	704113	Art of Rhetoric and Dialogue	Theory	3	3	
	√		704115	Development and Family Planning in Islam	Theory	3	3	
	√		704132	Traffic safety	Theory	3	3	
	√		704141	History of Jerusalem	Theory	3	3	
	√		704151	Computer skills (1)	Theory	3	3	724099
	√		704152	Computer skills (2)	Theory	3	3	704151
	√		404132	Principles of Islamic Economics	Theory	3	3	

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	√		704172	Sports and Health	Theory	3	3	

Second: Faculty Requirements (18) Credit Hours

1. Faculty Compulsory Requirements (18) Credit Hours

Learning Type			Course code	Course Name	Course activities	Activities Hours	Credit Hour	Prerequisite
Electronic	Blended	On						
√			311100	Introduction to Computer Programming	Theory	3	3	--
	√		313160	Introduction to Software Engineering	Theory	3	3	--
		√	314121	Introduction to cyber security	Theory	3	3	
		√	315117	Introduction to Artificial Intelligence	Theory	3	3	311100
		√	311101A	Programming Language (1)	Theory	2	2	311100
		√	311101L	Lab of Programming Language (1)	Practical	2	1	311101A
	√		311178	English Language Information Technology Students	Theory	3	3	704117

Third: Supportive Requirements (9) Credit Hours

Learning Type			Course code	Course Name	Course activities	Activities Hours	Credit Hour	Prerequisite
Electronic	Blended	On						
	√		601131	Principles of Statistics	Theory	3	3	-
	√		601241	Linear Algebra (1)	Theory	3	3	601101
	√		601101	Calculus 1	Theory	3	3	--

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Fourth: Department Requirements (78) Credit Hours

1. Department Compulsory Requirements (69) Credit Hours

Learning Type			Course code	Course Name	Course activities	Activities Hours	Credit Hour	Prerequisite
Electroni c	Blended	On						
		√	311202A	Object Oriented programming	Theory	2	2	311101A
		√	311202L	Lab of Object-Oriented programming	Practical	2	1	311202A
√			315120	Fundamentals of Data Science	Theory	3	3	-
		√	315130	Probability and Statistics for Data Science	Theory	3	3	601131
		√	311210	Discrete Mathematics for IT	Theory	3	3	601101
		√	315202A	Advanced Topics in Programming	Theory	2	2	311101A
		√	315202L	Advanced Topics in Programming Lab	Practical	2	1	315202A
		√	315204A	Data Science and Artificial Intelligence Programming	Theory	2	2	315202A
		√	315204L	Data Science and Artificial Intelligence Programming Lab	Practical	2	1	315204A
	√		315214A	Computing Systems for Data Science and Artificial Intelligence	Theory	2	2	315120
	√		315214L	Computing Systems for Data Science and Artificial Intelligence Lab	Practical	2	1	315214A
		√	315211	Fundamentals of Digital Logic	Theory	3	3	311100
		√	315213A	Data Structures	Theory	2	2	311202A
		√	315213L	Data Structures Lab	Practical	2	1	315213A
	√		315220A	Database Systems	Theory	2	2	311100A
		√	315220L	Database Systems Lab	Practical	2	1	315220A
	√		315230A	Data Engineering and Analysis	Theory	2	2	315120A+ 315204A
		√	315230L	Data Engineering and Analysis Lab	Practical	2	1	315230A
		√	315309A	Robotics Programming	Theory	2	2	315204A
		√	315309L	Robotics Programming Lab	Practical	2	1	315309A
		√	315315	Analysis and Design of Algorithms	Theory	3	3	315213A
	√		315316	Fundamentals of Operating Systems	Theory	3	3	315315
	√		315320A	Machine Learning and Neural Networks	Theory	2	2	315204A
		√	315320L	Machine Learning and Neural Networks Lab	Practical	2	1	315320A
	√		315321	Big Data	Theory	3	3	315230A
	√		315330	Data modeling and Simulation	Theory	3	3	315130
		√	315424A	Advanced Artificial Intelligence	Theory	2	2	315315
		√	315424L	Advanced Artificial Intelligence Lab	Practical	2	1	315424A
	√		315431A	Deep Learning	Theory	2	2	315320A
		√	315431L	Deep Learning Lab	Practical	2	1	315431A
		√	315432A	Natural Language Processing	Theory	2	2	315230A
		√	315432L	Natural Language Processing Lab	Practical	2	1	315432A
	√		315433	Data Visualization	Theory	3	3	315204A

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√			315440	Graduation Project	Practical	6	3	Pass of 90 hours
√			315450	Field Training	Practical	6	3	Pass of 90 hours

2. Department Elective Requirements (9) Credit Hours

Learning Type			Course code	Course Name	Course activities	Activities Hours	Credit Hour	Prerequisite
Electroni	Blended	On						
	√		315205A	Introduction to Website Design	Theory	2	2	311101A
		√	315205L	Introduction to Website Design Lab	Practical	2	1	315205A
	√		315212A	Multimedia Systems	Theory	2	2	311101A
		√	315212L	Multimedia Systems Lab	Practical	2	1	315212A
	√		315233	Introduction to Computer Networks	Theory	3	3	315211
		√	315334	Data Management and Governance	Theory	3	3	315330
		√	315335	Business Intelligence	Theory	3	3	315230A
		√	315336A	Internet of Things	Theory	2	2	315117A
		√	315336L	Internet of Things Lab	Practical	2	1	315336A
		√	315435	Information Retrieval	Theory	3	3	315220A
		√	315436A	Pattern Recognition	Theory	2	2	315424A
		√	315436L	Pattern Recognition Lab	Practical	2	2	315436A
		√	315331	Data Mining and Warehousing	Theory	3	3	315230
		√	315437	Special Topics in Data Science	Theory	3	3	Pass of 60 hours
		√	315438	Special Topics in Artificial Intelligence	Theory	3	3	Pass of 60 hours

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First Year

First Semester

Course Number	Course Name	Course activities	Activities Hours	Credit Hours*	Prerequisite
311100	Introduction to Computer Programming	Theory	3	3	-
313160	Introduction to Software Engineering	Theory	3	3	-
314121	Introduction to Cyber Security	Theory	3	3	-
601131	Principles of Statistics	Theory	3	3	-
-	Compulsory University Requirement	Theory	2	2	-
-	Compulsory University Requirement	Theory	1	1	-
Total		15			

Second Semester

Course Number	Course Name	Course activities	Activities Hours	Credit Hours*	Prerequisite
311101A	Programming Language (1)	Theory	2	2	311100
311101L	Programming Language (1) Lab	Practical	2	1	311101A
315120	Fundamentals of Data Science	Theory	3	3	-
315117	Introduction to Artificial Intelligence	Theory	3	3	311100
315130	Probability and Statistics for Data Science	Theory	3	3	601131
311178	English Language Information Technology Students	Theory	3	3	704117
-	Compulsory University Requirement	Theory	2	2	-
-	Compulsory University Requirement	Theory	1	1	-

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Total	18

Second Year

First Semester

Course Number	Course Name	Course activities	Activities Hours	Credit Hours*	Prerequisite
601101	Calculus 1	Theory	3	3	--
311202A	Object Oriented programming	Theory	2	2	311101A
311202L	Lab of Object-Oriented programming	Practical	2	1	311202A
315202A	Advanced Topics in Programming	Theory	2	2	311101A
315202L	Advanced Topics in Programming Lab	Practical	2	1	315202A
315220A	Database Systems	Theory	2	2	311100
315220L	Database Systems Lab	Practical	2	1	315220A
-	Compulsory University Requirement	Theory	2	2	-
-	Compulsory University Requirement	Theory	1	1	-
-	Elective University Requirement	Theory	3	3	-
Total			**18**		

Second Semester

Course Number	Course Name	Course activities	Activities Hours	Credit Hours*	Prerequisite
311210	Discrete Mathematics for IT	Theory	3	3	601101
315211	Fundamentals of Digital Logic	Theory	3	3	311100
315204A	Data Science and Artificial Intelligence Programming	Theory	2	2	315202A
315204L	Data Science and Artificial Intelligence Programming Lab	Practical	2	1	315204A
315213A	Data Structures	Theory	2	2	311202A
315213L	Data Structures Lab	Practical	2	1	315213A
601241	Linear Algebra (1)	Theory	3	3	601101

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-	Elective University Requirement	Theory	3	3	-
Total		**18**			

Third Year

First Semester

Course Number	Course Name	Course activities	Activities Hours	Credit Hours*	Prerequisite
315214A	Computing Systems for Data Science and Artificial Intelligence	Theory	2	2	315120
315214L	Computing Systems for Data Science and Artificial Intelligence Lab	Practical	2	1	315214A
315315	Analysis and Design of Algorithms	Theory	3	3	315213A
315330	Data modeling and Simulation	Theory	3	3	315130
315230A	Data Engineering and Analysis	Theory	2	2	315120+315204A
315230L	Data Engineering and Analysis Lab	Practical	2	1	315230A
-	Elective Compulsory Requirement	Theory	3	3	-
-	Elective University Requirement	Theory	3	3	-
Total		**18**			

Second Semester

Course Number	Course Name	Course activities	Activities Hours	Credit Hours*	Prerequisite
315309A	Robotics Programming	Theory	2	2	315204A
315309L	Robotics Programming Lab	Practical	2	1	315309A
315320A	Machine Learning and Neural Networks	Theory	2	2	315204A
315320L	Machine Learning and Neural Networks Lab	Practical	2	1	315320A
315316	Fundamentals of Operating Systems	Theory	3	3	315315

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315321	Big Data	Theory	3	3	315230A

Fourth Year

-	Elective University Requirement	Theory	3	3	-
Total		**18**			

First Semester

Course Number	Course Name	Course activities	Activities Hours	Credit Hours*	Prerequisite
315424A	Advanced Artificial Intelligence	Theory	2	2	315315
315424L	Advanced Artificial Intelligence Lab	Practical	2	1	315424A
315431A	Deep Learning	Theory	2	2	315320A
315431L	Deep Learning Lab	Practical	2	1	315431A
315432A	Natural Language Processing	Theory	2	2	315230A
315432L	Natural Language Processing Lab	Practical	2	1	315432A
315433	Data Visualization	Theory	3	3	315204A
-	Elective University Requirement	Theory	3	3	-
Total		**15**			

Second Semester

Course Number	Course Name	Course activities	Activities Hours	Credit Hours*	Prerequisite
315440	Graduation Project	Practical	6	3	Pass of 90 hours
315450	Field Training	Practical	6	3	Pass of 90 hours
-	Elective Department Requirement	Theory	3	3	-
-	Elective University Requirement	Theory	3	3	-
Total		**12**			

أقرت بقرار مجلس العمداء رقم (2025/6-2026) في جلسته الأولى المنعقدة بتاريخ 2025/10/6.

Courses Description

Faculty Compulsory Requirements (18 Credit Hours)

Course Number	**:**	311100
Course Title	**:**	**Introduction to Computer Programming**
Credit Hours	**:**	3
Prerequisites	**:**	-

General concepts of problem-solving, program concepts, program flowcharts, variables and constants, data types, arithmetic and logical operations, solving problems using decision-making statements, solving problems using repetition statements, solving problems using logical case statements, programming functions, lists and arrays, linked sequences, sorting lists.

Course Number	**:**	311101A
Course Title	**:**	**Programming Language1**
Credit Hours	**:**	2
Prerequisites	**:**	311100

Fundamentals of programming, introduction to programming languages and their evolution, principles of programming in C++, variables and naming conventions, data types, arithmetic and logical operations, control statements, repetition statements, functions, arrays, introduction to object-oriented programming.

Course Number	**:**	311101L
Course Title	**:**	**Programming Language1 Lab**
Credit Hours	**:**	1
Prerequisites	**:**	311101A

This Lab provides students with a foundational introduction to programming concepts using the C++ language. Students will learn the basic principles of structured and object-oriented programming, including variables, data types, operators, control structures, functions, and arrays. The course focuses on practical laboratory exercises to develop applied programming skills and enhance problem-solving abilities.

Course Number	**:**	313160
Course Title	**:**	**Introduction To Software Engineering**
Credit Hours	**:**	3
Prerequisites	**:**	-

Basic principles of systems engineering and software engineering, software development, planning and managing software projects, software requirements specification and processes, system modelling, preliminary software modelling, system architecture design,

various methods of system and software design such as object-oriented design and distributed design, CASE tools for software engineering.

Course Number	**:**	315107
Course Title	**:**	**Introduction to Artificial Intelligence**
Credit Hours	**:**	3
Prerequisites	**:**	311101A

This course provides an overview of the general principles of artificial intelligence, This The course covers the basic principles, techniques, and applications of artificial intelligence. It explores topics such as knowledge representation, logic, inference and problem-solving, search algorithms, game theory, perception, learning, and planning methods. The course also includes discussions on knowledge representation, computational logic, knowledge engineering, expert systems, and natural language processing. Machine learning will be introduced, and important programming languages such as Python and R will be covered.

Course Number	**:**	311178
Course Title	**:**	**English Language Information Technology Students**
Credit Hours	**:**	3
Prerequisites	**:**	704117

The English for IT course aims to develop basic language skills (listening, speaking, reading, writing, and grammar) with a focus on IT-related terminology and concepts. Common topics include sentence patterns, tense rules, conditional sentences, the passive voice, and computer-related conversations, with the goal of enabling students to communicate effectively in their academic and professional environments.

Supportive Requirements (9 Credit Hours):

Course Number	**:**	601101
Course Title	**:**	**Calculus 1**
Credit Hours	**:**	3
Prerequisites	**:**	-

Functions, exponential and logarithmic functions, limits and continuity, differentiation, rules of differentiation, tangents and normals, the Mean Value Theorem and its applications, indeterminate forms (0/0, ∞/∞), horizontal and vertical asymptotes, local extreme values, concavity, graphing curves, definite integrals, the Fundamental Theorem of Calculus, indefinite integrals, integration by substitution, applications of definite integrals (area, volumes, volumes of revolution).

Course Number	**:**	601131
Course Title	**:**	**Principles of Statistics**
Credit Hours	**:**	3
Prerequisites	**:**	-

Definition and uses of statistics, types of data and its collection methods, descriptive statistics: organizing and presenting data, summarizing data with tables, graphs, and numerical measures, measures of central tendency (mean, median, mode), measures of dispersion (range, quartiles and interquartile range, percentiles and percentile range, variance, and standard deviation), outliers, standard scores, Chebyshev's rule and the empirical rule, linear transformations in preparing descriptive statistics, definition of probability and its uses, elements of probability, counting methods, conditional probability, random variables, expectation and variance, computing probabilities and areas under the curves of discrete random distributions (binomial distribution) and continuous random distributions (normal distribution), Central Limit Theorem.

Course Number	**:**	601241
Course Title	**:**	**Linear Algebra (1)**
Credit Hours	**:**	3
Prerequisites	**:**	601101

Linear systems of equations, matrices and operations on matrices, homogeneous and non-homogeneous systems, Gaussian elimination method, elementary matrices, matrix transpose, matrix inverse, determinants and their properties and calculation methods, Cramer's rule, vector spaces, subspaces, linear independence, bases, dimensions, row spaces, column spaces, null space, rank and nullity, eigenvalues and eigenvectors, diagonalization problem, linear transformations, kernel and range.

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Compulsory Department Requirements (69 Credit Hours):

Course Number	**:**	311202A
Course Title	**:**	**Object-Oriented Programming**
Credit Hours	**:**	2
Prerequisites	**:**	311101A

Object-oriented programming concepts and models, a review of control structures, data types, functions, arrays, and pointers, data abstraction, encapsulation and information hiding, class properties and associated operations, inheritance, and polymorphism, templates.

Course Number	**:**	311202L
Course Title	**:**	**Object-Oriented Programming Lab**
Credit Hours	**:**	1
Prerequisites	**:**	311202A

This Lab provides students with practical experience in object-oriented programming concepts and paradigms using C++. Students begin by reviewing programming fundamentals such as control structures, data types, functions, arrays, and pointers, and then gradually apply them in the context of object-oriented design. Through practical labs, students implement fundamental principles such as data abstraction, encapsulation, inheritance, and polymorphism. This gives students a deeper understanding of how object-oriented programming supports concepts such as program organization, reusability, and program reliability.

Course Number	**:**	315120
Course Title	**:**	**Fundamentals of Data Science**
Credit Hours	**:**	3
Prerequisites	**:**	-

The principles and fundamental tools, concepts, and techniques of data science, including data collection, integration, exploratory data analysis, predictive modeling, descriptive modeling, creating data programs, evaluation, and effective communication. These topics will be addressed broadly, with a focus on integrating and synthesizing concepts and how to apply them to problem-solving.

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Course Number	**:**	315130
Course Title	**:**	**Probability and Statistics for Data Science**
Credit Hours	**:**	3
Prerequisites	**:**	601131

Development and understanding of modern intensive computational methods for statistical inference and exploratory data analysis. Advanced computational methods for statistics, including univariate and multivariate optimization methods, integrative methods, and simulation techniques. Demonstrating how to draw inferences about the population of interest in data mining problems. Theory of sample distributions, principles of data reduction, interval estimation, point estimation, sufficiency statistics, order statistics, hypothesis testing, and correlation and regression.

Course Number	**:**	315202A
Course Title	**:**	**Advanced Topics in Programming**
Credit Hours	**:**	2
Prerequisites	**:**	311202A

This course introduces advanced programming concepts using Python. It assumes basic knowledge of control structures in Python, functions, files, data structures, and the NumPy library. The course covers data collection from various sources, including web scraping, web APIs, CSV, and other structured data files, as well as databases. It includes data analysis using the Pandas library, regular expressions, and other string processing methods, classes, object-oriented programming, and building real-world software applications.

Course Number	**:**	315202L
Course Title	**:**	**Advanced Topics in Programming Lab**
Credit Hours	**:**	1
Prerequisites	**:**	315202A

This course provides advanced programming training using Python, focusing on handling various structured data formats and databases. Students will gain practical skills in advanced data analysis with the Pandas library, advanced text processing using regular expressions, and comprehensive principles of object-oriented programming. The course also emphasizes developing strong, real-world software applications.

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Course Number	**:**	311210
Course Title	**:**	**Discrete Mathematics for Information Technology Students**
Credit Hours	**:**	3
Prerequisites	**:**	601101

Introduction to logic, propositional logic, conventional and unconventional proofs, sets, set operations, functions, countable and uncountable sets, integers and remainder arithmetic, sequences, series, mathematical induction, recursion, counting, permutations, combinations, probabilities, relations, graph theory, trees.

Course Number	**:**	315204A
Course Title	**:**	**Data Science and Artificial Intelligence Programming**
Credit Hours	**:**	2
Prerequisites	**:**	315202A

Implementation of data science models and artificial intelligence models using programming languages and/or tools for data science and artificial intelligence such as Python, SAS, and WEKA at different stages of the model development process, including data preprocessing, exploration data analysis, descriptive statistics, model development, and model evaluation.

Course Number	**:**	315204L
Course Title	**:**	**Data Science and Artificial Intelligence Programming Lab**
Credit Hours	**:**	1
Prerequisites	**:**	315204A

This course helps students to work with data science libraries such as Pandas, NumPy, Matplotlib, and SciPy. It covers data preprocessing, exploratory data analysis, descriptive statistics, model development, and comprehensive model evaluation.

Course Number	**:**	315211
Course Title	**:**	**Fundamentals of Digital Logic**
Credit Hours	**:**	3
Prerequisites	**:**	311100

Binary system: Digital computer systems, binary numbers, conversion of numbers to octal and hexadecimal systems, one's and two's complements; Logical algebra and logic gates: Basic definitions of logical algebra, theories of logical algebra, theories of digital logic gates, functions of logic gates, families of integrated circuits; Simplification of logical function: Karnaugh map, 3-variable, 4-variable, 5-variable. Sum of products, product of sums,

essential prime implicants; Combinational logic: Integrated combinational circuits, sequential circuits, flip-flops, registers, counters, memory units.

Course Number	**:**	315214A
Course Title	**:**	**Computing systems for data science and artificial intelligence**
Credit Hours	**:**	2
Prerequisites	**:**	315120

The goal of this course is to provide students an overview of the various programs and equipment that help data scientists analyze their data. These technologies include R, Hadoop, Spark, and more. It also provides an introduction to big data, cloud, and Internet of Things computing.

Course Number	**:**	315214L
Course Title	**:**	**Computing systems for data science and artificial intelligence Lab**
Credit Hours	**:**	1
Prerequisites	**:**	315214A

This course provides training on the fundamentals of programming with R, Spark, and Hadoop.

Course Number	**:**	315213A
Course Title	**:**	**Data Structures**
Credit Hours	**:**	2
Prerequisites	**:**	311202A

Basic concepts, an introduction to algorithms, and methods of data representation. Topics include pointers and symbolic chains, queues, stacks, circular linked list structure, linear linked list structure, and multilinked linked list structure. Additionally, tree structures, sorting algorithms, and search algorithms are covered.

Course Number	**:**	315213L
Course Title	**:**	**Data Structures Lab**
Credit Hours	**:**	1
Prerequisites	**:**	311213A

This lab provides hands-on experience with the fundamental concepts of data structures and algorithmic analysis. Students will develop a deep understanding of how data is represented,

organized, and manipulated in memory, and how these choices affect the efficiency of algorithms. The course focuses on theoretical understanding and practical application of key structures and algorithms used in software development and problem solving.

Course Number	**:**	315316
Course Title	**:**	**Fundamentals of Operating Systems**
Credit Hours	**:**	3
Prerequisites	**:**	315315

This course covers the fundamental concepts and mechanisms of modern operating systems. It includes a historical overview of operating systems, computer structures and operating systems, key issues in concurrency, thread management, deadlock control, synchronization, scheduling, memory management, and process management. The course also addresses multi-threading concepts.

Course Number	**:**	315320A
Course Title	**:**	**Machine Learning and Neural Networks**
Credit Hours	**:**	2
Prerequisites	**:**	315204A

Fundamentals of machine learning, algorithms and their applications. Topics include supervised learning, unsupervised learning, deep learning, and reinforcement learning. This course focuses on practical applications of machine learning and artificial intelligence, including computer vision, data extraction, speech recognition, text processing, and bioinformatics. Various computer architectures designed for efficient machine learning will be covered.

Course Number	**:**	315320L
Course Title	**:**	**Machine Learning and Neural Networks Lab**
Credit Hours	**:**	1
Prerequisites	**:**	315320A

This course provides practical experience and application of machine learning algorithms, including supervised learning, unsupervised learning, deep learning, and reinforcement learning. It emphasizes the effective implementation of machine learning techniques and explores the different applications and stages of development using specialized Python libraries.

Course Number	**:**	315321
Course Title	**:**	**Big Data**
Credit Hours	**:**	3
Prerequisites	**:**	315230A

This course provides data science students with understanding of Big Data and its role in data analysis. It provides the terminology and the core concepts behind big data problems, applications, and systems. It introduces one of the most common frameworks, Hadoop and Spark, that have made big data analysis easier and more accessible. Also, it will provide you with the necessary skill in manipulating big data distributed over a cluster using functional concepts and in-memory distributed collections framework written in Scala or Spark. We'll cover Spark's programming model in detail, being careful to understand how and when it differs from familiar programming models, like shared-memory parallel collections or sequential collections. Through hands-on examples in Spark and Scala, student learns when important issues related to distribution like latency and network communication should be considered and how they can be addressed effectively for improved performance.

Course Number	**:**	315330
Course Title	**:**	**Data Modeling and Simulation**
Credit Hours	**:**	3
Prerequisites	**:**	315130

Data modeling and simulation deals with statistical description of data, data fitting methods, regression analysis, analysis of variance, and goodness of fit. Probability and random processes, discretion and continuous distributions, central limit theorem, measure of randomness, Monte Carlo methods. Stochastic processes, Markov chains, time series models. Modeling and Simulation Concepts, Discrete Event Simulation: Event Scheduling/Verification of Advance Time Algorithms and Validation of Simulation Models. Continuous simulation: modeling using stochastic differential equations and their simulation.

Course Number	**:**	315220A
Course Title	**:**	**Database Systems**
Credit Hours	**:**	2
Prerequisites	**:**	311100

Basic concepts and terminology of databases, database administrator, database management systems. Characteristics and methodology of the database, the three-level architecture of the data schema, the canonical relational model for describing databases: symbols and concepts. Concepts, constraints, and operations related to the relational

model, relational algebra, building a database from canonical relational models, overview of SQL language, functional dependencies, simplifying database designs.

Course Number	**:**	315220L
Course Title	**:**	**Database Systems Lab**
Credit Hours	**:**	1
Prerequisites	**:**	315220A

This course provides training in the use of software tools to create tables, enter and edit data, add records, update fields, and manage constraints. It also covers querying tables, retrieving and sorting data, as well as modifying, deleting, and restructuring tables.

Course Number	**:**	315230A
Course Title	**:**	**Data Engineering and Analysis**
Credit Hours	**:**	2
Prerequisites	**:**	315120+3015204A

Basic concepts of data science, its analysis, and applications. The topics covered in this course include data acquisition, cleaning, aggregation, exploration, and presentation, as well as building and analyzing models and verifying them. It also covers the statistical and mathematical foundations of data science. This course addresses the data lifecycle in a data science project, covering types of data such as structured, semi-structured, and unstructured data, different data formats, techniques used, and exploration using visualization or basic review techniques for data.

Course Number	**:**	315230L
Course Title	**:**	**Data Engineering and Analysis Lab**
Credit Hours	**:**	1
Prerequisites	**:**	315230A

This laboratory provides hands-on exercises introducing students to the most widely used tools in data engineering. Students will be able to perform Extract, Transform, and Load (ETL) processes on various types of data from different sources. They will also gain the ability to extract and identify key features from collected datasets.

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Course Number	**:**	315309A
Course Title	**:**	**Robot Programming**
Credit Hours	**:**	2
Prerequisites	**:**	315204A

This course aims to provide students with the skills to program, modify, and operate robots. It introduces the robot operating system and several commonly used tools in robot programming, with a focus on autonomous mobile robots. The course emphasizes creating user programs that interact with sensors and actuators of mobile robot devices, implementing motion control algorithms. It also covers debugging programs using available tools, testing them through simulation tools, and executing them on mobile robots.

Course Number	**:**	315309L
Course Title	**:**	**Robot Programming Lab**
Credit Hours	**:**	1
Prerequisites	**:**	315309A

This course will teach students on programming, modifying, and operating robotic systems. It introduces the Robot Operating System (ROS) and familiarizes students with widely used tools in robotics programming such as Arduino. The course also covers working with sensors and managing their output.

Course Number	**:**	315315
Course Title	**:**	**Analysis and Design of Algorithms**
Credit Hours	**:**	3
Prerequisites	**:**	315213A

Introduction to algorithms; algorithm design techniques, algorithm analysis: the concept of basic operations, the concept of the best, average, and worst-case analysis, complexity analysis: Theta Big, Omega Big, O Big notations, recurrence equations, recursive algorithms, basic search algorithms, basic sorting algorithms, concept of flowcharts, and algorithm flowcharts.

Course Number	**:**	315424A
Course Title	**:**	**Advanced Artificial Intelligence**
Credit Hours	**:**	2
Prerequisites	**:**	315315

Advanced Artificial Intelligence covers the types and domains of artificial intelligence, how to build an application that behaves intelligently, advanced applications of artificial

intelligence, search methods, knowledge representation, problem-solving methods, and machine learning methods specific to artificial intelligence such as patterns. The course includes the completion of a practical application or research project by students.

Course Number	**:**	315424L
Course Title	**:**	**Advanced Artificial Intelligence Lab**
Credit Hours	**:**	1
Prerequisites	**:**	315424A

This course will learn students on using the CLIPS software, including defining facts, managing rules, operating the inference engine, monitoring processes, defining templates, and saving and restoring work.

Course Number	**:**	315431A
Course Title	**:**	**Deep Learning**
Credit Hours	**:**	2
Prerequisites	**:**	315320A

This course provides an understanding of the fundamental principles of deep learning. It covers feedforward neural networks, convolutional neural networks (CNN), recurrent neural networks (RNN), sequence modeling, and reinforcement learning, along with other core concepts and techniques. The course will also teach students the underlying computations behind deep learning. By the end of the course, students are expected to be able to build, train, and apply fully connected deep neural networks, know how to implement efficient neural networks using common deep learning libraries such as Keras, PyTorch, and Tensor Flow. This course will also introduce students to a wide range of real-world applications of deep learning in various domains.

Course Number	**:**	315431L
Course Title	**:**	**Deep Learning Lab**
Credit Hours	**:**	1
Prerequisites	**:**	315431A

This course will teach students on using popular deep learning libraries such as Keras, PyTorch, and TensorFlow. It also exposes students to a wide range of real-world deep learning applications across various domains.

Course Number	**:**	315432A
Course Title	**:**	**Natural Language Processing**
Credit Hours	**:**	2
Prerequisites	**:**	315230A

Natural Language Processing (NLP) focuses on the interaction of human languages with computers, specifically how to program computers to analyze and process large amounts of text. The course covers linguistic topics, language rules and structures, natural language processing, sentence construction in programming languages and their structures, flow control, text encoding, text normalization, understanding the structure of text sentences, summarizing text, information extraction, feature matrices, unique value analysis, automatic document summarization, and semantic analysis.

Course Number	**:**	315432L
Course Title	**:**	**Natural Language Processing Lab**
Credit Hours	**:**	1
Prerequisites	**:**	315432A

This course will learn students to work with natural language processing libraries such as NLTK (Natural Language Toolkit), TextBlob – a simple and user-friendly library for basic tasks, and AllenNLP – a research-oriented NLP library. It also exposes students to a wide range of real-world applications in natural language processing.

Course Number	**:**	315433
Course Title	**:**	**Data Visualization**
Credit Hours	**:**	3
Prerequisites	**:**	315204A

Design and create graphical representations of data based on the available data and the tasks required to be accomplished. Topics include data modeling, data processing, data exploration, linking between data properties and visualization properties, and dashboard development. The focus is on identifying patterns, trends, and differences in data across categories, space, and time. Students will learn to evaluate the effectiveness of visual representations and think critically about each design decision, such as color selection and visual encoding.

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Course Number	**:**	315440
Course Title	**:**	**Graduation Project**
Credit Hours	**:**	3
Prerequisites	**:**	Pass of 90 credit hours

The graduation project is designed to enhance the student's skills and ability to solve real-world problems, study and analyze them, and develop the necessary software to address these challenges. This is achieved through a comprehensive project that the student, as part of a team, will develop under the supervision of a faculty member. The student is required to fulfill the project's objectives and submit a final report. The project is then discussed and evaluated by a committee of faculty members.

Course Number	**:**	315450
Course Title	**:**	**Field Training**
Credit Hours	**:**	3
Prerequisites	**:**	Pass of 90 credit hours

This internship course is designed for students majoring in Data Science and Artificial Intelligence. The students will undergo practical training at a government or private institution under the supervision of an academic mentor. During the internship, students will apply the knowledge and skills acquired during their university studies. The hosting institution will be responsible for providing a pre-prepared report to evaluate the performance of the intern, based on the department's guidelines. This course aims to bridge the gap between academic learning and real-world application, allowing students to gain hands-on experience in their field of study.

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Elective Department Requirements (9 Credit Hours):

Course Number	**:**	315205A
Course Title	**:**	**Introduction to Web Design**
Credit Hours	**:**	2
Prerequisites	**:**	311101A

This course provides fundamental concepts in internet applications, web browsers, and the basics of web design. It covers web page languages, with a focus on XHTML. Students will learn about text, styles, colours, images, lists, tables, and encoding structures in XHTML. The course also includes an introduction to scripting languages such as VBScript and JavaScript. Students will explore web deployment, principles of web evaluation, and web page building tools like FrontPage and Dreamweaver.

Course Number	**:**	315205L
Course Title	**:**	**Introduction to Web Design Lab**
Credit Hours	**:**	1
Prerequisites	**:**	315205A

This course introduces students to HyperText Markup Language (HTML) for creating web pages and Cascading Style Sheets (CSS) for designing and formatting them. It also covers JavaScript for adding interactivity and dynamic functionality to web pages.

Course Number	**:**	315212A
Course Title	**:**	**Multimedia Systems**
Credit Hours	**:**	2
Prerequisites	**:**	311101A

This course covers the principles and modern technologies in designing multimedia systems, with a focus on gaining practical experience in this field. Topics include the design of multimedia systems, multimedia devices and software, and issues related to the representation, processing, and transmission of multimedia data such as text, graphics, audio, music, images, and video.

Course Number	**:**	315212L
Course Title	**:**	**Multimedia Systems Lab**
Credit Hours	**:**	1
Prerequisites	**:**	315212A

Through hands-on tasks and projects, students will gain practical experience in developing multimedia applications and applying techniques such as data processing, compression, and networking. By the end of the course, students will have a solid understanding of multimedia fundamentals and the ability to design and develop multimedia systems and applications.

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Course Number	**:**	315233
Course Title	**:**	**Introduction to computer Networks**
Credit Hours	**:**	3
Prerequisites	**:**	315211

Ideas and terminology of data communication, computer networks, physical design, logical design of computer networks, network architecture, and information transfer media used in computer networks. Open Systems Interconnection (OSI) Reference Model, TCP/IP Reference Model, Physical Layer, Data Link Layer, Network Layer, Passing Layer, Conversation Layer, Presentation Layer, Application Layer. The ALOHA protocol, CSMA protocols, computer local area networks, standard standards, IEEE protocols (Token Ring, Token Bus, and Ethernet), the basics of the physical layer, the data link layer, frame protocols, error detection and correction, routing algorithms, data flow control in networks, and congestion control algorithms in networks.

Course Number	**:**	315334
Course Title	**:**	**Data Management and Governance**
Credit Hours	**:**	3
Prerequisites	**:**	315230A

This course covers the fundamentals of data governance and management, including establishing a data governance strategy, leveraging data governance, implementing data governance, and managing, monitoring, and measuring data governance efforts. Students will learn about roles and responsibilities in data governance, the challenges of data governance, the distinction between data governance and data management.

Course Number	**:**	315335
Course Title	**:**	**Business Intelligence**
Credit Hours	**:**	3
Prerequisites	**:**	315330

Understanding the basics of business intelligence; an introduction and overview of business intelligence for supply chain and marketing, business intelligence and big data from the business perspective, understanding OLAP, developing dashboards, predictive analytics, descriptive analytics, creating a business intelligence project, data extraction, and creating queries and data extraction reports.

Course Number	**:**	315336A
Course Title	**:**	**Internet of Things**
Credit Hours	**:**	2
Prerequisites	**:**	315117

This course describes several issues related to the Internet of Things, including introduction to the Internet of Things, solution patterns for the Internet of Things, the IoT edge, the cloud, and IoT applications.

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Course Number	**:**	315336L
Course Title	**:**	**Internet of Things Lab**
Credit Hours	**:**	1
Prerequisites	**:**	315336A

This course introduces an introduction to scripting with Python and JavaScript, covering IoT data processing, cloud computing, API programming, and IoT data visualization.

Course Number	**:**	315435
Course Title	**:**	**Information Retrieval**
Credit Hours	**:**	3
Prerequisites	**:**	315220A

This course focuses on the components, design, and implementation of text-based information retrieval systems and various techniques for building information systems based on text analysis, indexing, and retrieval. Topics covered include text indexing, logical retrieval models, vector space retrieval models, and text extraction. The course also addresses text classification, evaluation, analysis, compression techniques, and methods for optimizing data indexing for large datasets, taking into consideration memory constraints and available space.

Course Number	**:**	315436A
Course Title	**:**	**Pattern Recognition**
Credit Hours	**:**	2
Prerequisites	**:**	315424

This course introduces the basics of creating computational algorithms for recognizing patterns within data of various forms and analyzing them. The course covers algorithms, fractal geometry, and classification methods such as random forests and deep learning approaches. State-of-the-art tools like Python, Tensor flow, and programming languages will be used to study patterns in nature, noisy data, and real-world sources such as images, social media, and biomedical signals.

Course Number	**:**	315436L
Course Title	**:**	**Pattern Recognition Lab**
Credit Hours	**:**	1
Prerequisites	**:**	315436A

This course covers a wide range of practical topics, including pattern recognition systems, preprocessing and feature extraction, supervised and unsupervised learning, object classification, and recognition.

Course Number	**:**	315437
Course Title	**:**	**Special Topics in Data Science**
Credit Hours	**:**	3
Prerequisites	**:**	Pass of 60 credit hours

The aim of this course is to introduce students to various areas within the field of data science. This is achieved by presenting new tools, techniques, and diverse research areas in the field of data science. The course covers domains and specializations that utilize data science for data analysis, knowledge extraction, and the application of various algorithms and tools in these domains.

Course Number	**:**	315438
Course Title	**:**	**Special Topics in Artificial Intelligence**
Credit Hours	**:**	3
Prerequisites	**:**	Pass of 60 credit hours

This course aims to introduce new and emerging topics in artificial intelligence (AI) and their applications in information technology. The specific content and requirements for this course are determined by the departmental council based on the latest developments and trends in the field of AI.

Course Number	**:**	315331
Course Title	**:**	**Data Mining and Warehousing**
Credit Hours	**:**	3
Prerequisites	**:**	315230A

This course covers fundamental concepts in data mining and data warehousing. Topics include knowledge discovery from databases, applications of data mining, techniques and models in data mining, issues related to privacy and ethics in data mining, major data mining methods, data warehouses, data cleaning, grouping, and classification. The course also explores recent developments in web data mining.

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