BACHELOR IN DATA SCIENCE

Main Language of Instruction:
French ○ English ☑ Arabic ○

Campus Where The Program Is Offered: Dubai

OBJECTIVES

The Bachelor in Data Science bridges mathematics and computer science. The program covers programming, data analysis, and big data engineering, alongside mathematical tools such as probability and statistics. Students will also gain expertise in artificial intelligence and machine learning to extract data and support decision-making. Through a comprehensive curriculum that combines cutting-edge technology, data-driven decision-making, and ethical practices, the program prepares students to become industry leaders who drive innovation, efficiency, and sustainable solutions.

PROGRAM LEARNING OUTCOMES (COMPETENCIES)

- Apply various mathematical techniques for processing problems related to massive quantities of data.
- Write computer programs in languages suitable for data science to collect, clean, and analyze data.
- Communicate the results of data analysis in oral, written, and visual form to both technical and non-technical audiences.
- Advocate for ethical decisions in the use of data.

PROGRAM REQUIREMENTS

240 credits: Required courses (208 credits) and USJ General Education Program (45 credits - may be part of the above category).

Required Courses (208 Cr.)
Advanced Programming with C++ (6 Cr.). Applied Linear Algebra (6 Cr.). Artificial Intelligence (6 Cr.). Calculus I (6 Cr.). Calculus II (6 Cr.). Calculus III (6 Cr.). Cloud and Digital Transformation (6 Cr.). Computer Programming I (4 Cr.). Computer Programming II (6 Cr.). Data Mining (6 Cr.). Data Protection (2 Cr.). Data Structures and Algorithms (4 Cr.). Data Visualization (6 Cr.). Descriptive Statistics (4 Cr.). Discrete Mathematics (5 Cr.). Elementary Mathematics I (6 Cr.). Elementary Mathematics II (6 Cr.). Ethics for Data Science (2 Cr.). Foundations of Data Science (4 Cr.). General Chemistry (5 Cr.). General Physics I (5 Cr.). General Physics II (5 Cr.). Graph Theory (6 Cr.). Inferential Statistics (6 Cr.). Internet Programming (4 Cr.). Internship I (3 Cr.). Internship II (3 Cr.). Introduction to Big Data (6 Cr.). Introduction to Programming with C++ (4 Cr.). Lab for R (4 Cr.). Marketing Data Science (5 Cr.). MATLAB for Data Science (6 Cr.). Matrix Computations (6 Cr.). Natural Language Processing (6 Cr.). Probability for Data Science (6 Cr.). Professional English (3 Cr.). Regression Models (4 Cr.). Relational Databases (6 Cr.). Statistical Analysis of Data (6 Cr.). Statistics for Data Science (6 Cr.). Web Application (6 Cr.).

USJ General Education Program (45 Cr.)

Code	Course Name	Credits
	Emirati Studies	**6**
584EMIRL1	Emirati Society	6
	ENGLISH	**5**
584ENGLL2	English Language	5
	ARABIC	**5**
584ARABL1	Arabic Language	5
	INNOVATION, ENTREPRENEURSHIP, AND SUSTAINABILITY	**13**

584MADSL8	Marketing Data Science	5
584EFDSL3	Ethics for Data Science	2
584IBDAL7	Introduction to Big Data	6
	HUMANITIES, SOCIAL SCIENCES	**10**
584HOAGL3	History of the Arabian Gulf	4
584HICSL3	High Impact Communication Skills	3
584FRENL2	Introduction to French Language	3
	QUANTITATIVE REASONING AND CRITICAL THINKING	**6**
584ECONL4	Principles of Economics	6

SUGGESTED STUDY PLAN

Semester 1

Code	Course Name	Credits
584MAT1L1	Elementary Mathematics I	6
584PHY1L1	General Physics I	5
584CHEML1	General Chemistry	5
584CPR1L1	Computer Programming I	4
584ARABL1	Arabic Language	5
584ENGLL2	English Language	5
	Total	**30**

Semester 2

Code	Course Name	Credits
584MAT2L2	Elementary Mathematics II	6
584DSTAL2	Descriptive Statistics	4
584CPR2L2	Computer Programming II	6
584PHY2L2	General Physics II	5
584EMIRL1	Emirati Society	6
584FRENL2	Introduction to French Language	3
	Total	**30**

Semester 3

Code	Course Name	Credits
584CAL1L3	Calculus I	6
584INPRL3	Internet Programming	4
584DMATL3	Discrete Mathematics	5
584FODSL3	Foundations of Data Science	4
584DPROL3	Data Protection	2
584EFDSL3	Ethics for Data Science	2
584HICSL3	High Impact Communication Skills	3
584HOAGL3	History of the Arabian Gulf	4
	Total	**30**

Semester 4

Code	Course Name	Credits
584LALGL4	Applied Linear Algebra	6
584CAL2L4	Calculus II	6
584PROBL4	Probability for Data Science	6
584RDATL4	Relational Databases	6
584ECONL4	Principles of Economics	6
	Total	**30**

Semester 5

Code	Course Name	Credits
584CAL3L5	Calculus III	6
584CPP1L5	Introduction to Programming with C++	4
584DSALL5	Data Structures and Algorithms	4
584LABRL5	Lab for R	4
584MCOML5	Matrix Computations	6
584STDSL5	Statistics for Data Science	6
	Total	**30**

Semester 6

Code	Course Name	Credits
584CPP2L6	Advanced Programming with C++	6
584ARINL6	Artificial Intelligence	6
584DVISL6	Data Visualization	6
584INT1L6	Internship I	3
584PENGL6	Professional English	3
584SADAL6	Statistical Analysis of Data	6
	Total	**30**

Semester 7

Code	Course Name	Credits
584DMINL7	Data Mining	6
584ISTAL7	Inferential Statistics	6
584IBDAL7	Introduction to Big Data	6
584MLABL7	MATLAB for Data Science	6
584WAPPL7	Web Application	6
	Total	**30**

Semester 8

Code	Course Name	Credits
584CDTRL8	Cloud and Digital Transformation	6
584GRTHL8	Graph Theory	6

584INT2L8	Internship II	3
584MADSL8	Marketing Data Science	5
584NLPRL8	Natural Language Processing	6
584REMOL8	Regression Models	4
	Total	**30**

COURSE DESCRIPTION

584HOAGL3 History of the Arabian Gulf 4 Cr.

This course examines the historical systems of the Arabian Gulf. Students will identify legal heritage from ancient systems present in current positive laws, explain the influence of social, religious, cultural, and economic factors on the emergence and development of law, and discuss the importance of written texts in societies seeking organization and clarity beyond traditional customs and norms.

584EMIRL1 Emirati Society 6 Cr.

This course examines the formation of human society and discusses the specific characteristics of Gulf societies, with a focus on the United Arab Emirates. Students will address development issues and their economic and social dimensions, including challenges arising from societal transformations. The course also develops students' critical and scientific thinking skills and enhances their language abilities.

584CPP2L6 Advanced Programming with C++ 6 Cr.

This course aims to:

- Define the fundamental principles of Object-Oriented Programming, including Abstraction, Encapsulation, Inheritance, and Polymorphism.
- Demonstrate how classes and objects are used in C++, including how to declare, define, and use them.
- Explain the concept of constructors and destructors, how they are used in C++, and how they relate to object lifecycle management.

584LALGL4 Applied Linear Algebra 6 Cr.

By the end of this course, students will be able to:

- Write a linear system in matrix form, solve matrix equations using Gauss Elimination and backward substitution, manipulate block matrices, perform matrix operations, compute the inverse of square matrices and solve linear systems using the matrix inverse method.
- Use different approaches to compute determinants of square matrices of various dimensions, understand, and apply the properties of determinants, describe how the determinant of a matrix and its inverse are related and use determinants to calculate the inverse of a matrix.
- Define a vector space and subspace, find the null space, find row and column spaces of a matrix, determine whether a set of vectors is linearly independent, whether it is a basis for a vector space, determine the dimension of a vector space and find the coordinates of a vector with respect to different bases.
- Identify eigenvalues and eigenvectors of 2x2 and 3x3 matrices, state the properties of eigenvalues and eigenvectors of symmetric matrices, perform diagonalization of matrices, use eigenvectors to represent a linear transformation with respect to a particularly nice basis and apply eigenvalues techniques to solve systems of linear differential equations.
- Use inner products to determine angles between vectors and to assess the orthogonality of vectors as well as to solve other common problems arising from different fields of application.
- Recognize the appropriate tools of linear algebra to solve applied problems. Students will use these analytical tools to solve application problems in a variety of settings related to physics, data science, digital engineering and business.

584ARABL1 Arabic Language 6 Cr.

This course treats language as a tool for expression in practical life. Students will select appropriate registers according to different communicative contexts, master the methodology of various writing types such as minutes, reports, statements, news, analysis, and commentary, and distinguish between them. They will write complete texts in Arabic while respecting linguistic and stylistic rules and will learn techniques such as summarizing, paraphrasing, and note-taking.

584ARINL6 Artificial Intelligence 6 Cr.

This course aims to:
- Define the social and intellectual context of artificial intelligence.
- Describe a variety of knowledge representation and heuristic programming techniques including intelligent agents, search methods, and games playing.
- Explain some techniques used in AI specialist areas: decision trees, learning algorithms, and deep learning algorithms.
- Illustrate the working knowledge of a common AI programming language: use Logic programming in AI applications and understand the relationship between logic and Prolog.
- Use predicate logic for representing knowledge.

584CAL1L3 Calculus I 6 Cr.

By the end of this course, students will be able to:
- Compute limits, derivatives, and integrals of functions, including trigonometric and complex functions.
- Apply limits, derivatives, and integrals to analyze and solve problems involving rates of change, continuity, and curve sketching.
- Use calculus tools such as the chain rule, differentiation rules, and substitution methods to solve applied problems in fields like physics, biology, business, and economics.
- Solve complex number problems, including transformations between algebraic, trigonometric, and exponential forms, and finding roots of complex numbers.

584CAL2L4 Calculus II 6 Cr.

By the end of this course, students will be able to:
- Model and solve problems using sequences and series.
- Learn an exhaustive range of discrete structures for data scientists.
- Program MATLAB package designed for computations pertaining to sequences, series, & parametric and polar curves.
- Approximate a function around a point (Taylor & Maclaurin).
- Evaluate limits, continuity and differentiability of multivariable functions.
- Identify local and absolute extrema of a simple surface.
- Analyze and interpret parametric equations.
- Convert from Cartesian to polar coordinates.
- Analyze 3-D geometric figures.

584CAL3L5 Calculus III 6 Cr.

By the end of this course, students will be able to:
- Define and apply partial derivatives and chain rule in multivariable functions.
- Solve problems involving multiple integrals in various coordinate systems.
- Calculate line integrals and understand their applications.
- Apply Green's theorem, Stokes' theorem, and the divergence theorem to solve problems in vector calculus.
- Solve second-order linear differential equations and analyze their applications in science and engineering.

584CDTRL8 Cloud and Digital Transformation 6 Cr.

By the end of this course, students will be able to:
- Present the fundamentals of cloud computing and its integration with big data.
- Use cloud services to process and manage large datasets effectively.

- Develop Big Data environments on cloud platforms like AWS.
- Apply best practices in managing cloud-based data solutions with security and cost efficiency in mind.

584CPR1L1 Computer Programming I 4 Cr.

By the end of this course, students will be able to:
- Design an algorithm to solve a specific problem.
- Translate pseudocode to computer programs using Python language.
- Execute and debug a computer program using Python language.

584CPR2L2 Computer Programming II 6 Cr.

By the end of this course, students will be able to:
- Write a Python program to solve a mathematical problem.
- Determine the appropriate data structure to store data.
- Analyze data using Python specific libraries.

584DMINL7 Data Mining 6 Cr.

By the end of this course, students will be able to:
- Design relational databases optimized for business data analytics, including query optimization and transaction management.
- Implement scalable data processing architectures using parallel databases, MapReduce, and distributed storage systems.
- Analyze real-time data streams and calculate low-latency analytical results for timely decision-making.
- Manage and analyze complex data models, including tree-structured and graph-based data.
- Apply advanced data management systems to support machine learning and hybrid workloads using tools like Spark and Google Cloud Dataflow.

584DPROL3 Data Protection 2 Cr.

By the end of this course, students will be able to:
- Define the functions, key terms, and principles of data protection.
- Explain legal and regulatory frameworks governing data protection such as the GDPR.
- Identify data protection risks and implement a risk management framework to mitigate them.
- Describe different cryptographic techniques and security measures used to protect personal data.
- Identify the lawful grounds for processing personal data and comply with regulations.

584DSALL5 Data Structures and Algorithms 4 Cr.

By the end of this course, students will be able to:
- Define and apply various data structures and algorithms in C++.
- Analyze algorithmic complexity and make informed decisions about algorithm selection.
- Write C++ programs that utilize pointers, recursion, and different data structures.
- Apply sorting techniques and understand their trade-offs.
- Apply and manipulate linked lists, stacks, queues, binary trees, and binary search trees.

584DVISL6 Data Visualization 6 Cr.

By the end of this course, students will be able to:
- Create and interpret data visualizations for effective communication.
- Identify and analyze patterns within large data sets to derive meaningful insights.
- Design visual and verbal narratives to convey data-driven findings clearly and persuasively.
- Use visualization tools to create applications for managing and analyzing big data flows.
- Discuss data insights with clarity to support decision-making and answer complex questions.

584DSTAL2 Descriptive Statistics 4 Cr.

By the end of this course, students will be able to:
- Calculate measures of central tendency and measures of dispersion and interpret their meaning.
- Organize data in frequency tables and represent them using appropriate graphs.
- Apply descriptive and deductive statistical methods to study the association between two numerical variables (linear regression) and to analyze their correlation.

584DMATL3 Discrete Mathematics 5 Cr.

By the end of this course, students will be able to:
- Apply concepts of mathematical logic for analyzing propositions and proving theorems.
- Demonstrate the ability to write and evaluate a proof or outline the basic structure of and give examples of each proof technique described.
- Use sets for solving applied problems and use the properties of set operations algebraically.
- Investigate functions as relations and their properties.
- Define and use the Quotient-Remainder Theorem (Division Algorithm) and construct divisibility arguments.
- Apply the Euclidean Algorithm.

584MAT1L1 Elementary Mathematics I 6 Cr.

By the end of this course, students will be able to:
- Use the vocabulary of sets: Lower bound, upper bound, smallest element, largest element, etc.
- Perform set operations: intersection, union, inclusion, complement, etc.
- Calculate combinations and permutations.
- Analyze graphs.
- Define curves in two and three-dimensions.
- Identify the basic properties of complex numbers.

584MAT2L2 Elementary Mathematics II 6 Cr.

By the end of this course, students will be able to:
- Define a sequence and analyze its nature.
- Study common functions: polynomial, rational, irrational, trigonometric, exponential, logarithmic, and power functions.
- Study various aspects of a function: Calculate limits and derivatives, analyze monotonicity.
- Calculate and interpret definite integrals and antiderivatives of standard functions.

584ENGLL2 English Language 5 Cr.

By the end of this course, students will be able to:
- Apply writing mechanics such as capitalization, punctuation, and grammatical accuracy.
- Develop unified and coherent essays of different rhetorical patterns.
- Apply the skills of process writing to develop a well-organized academic essay.
- Integrate reading skills with writing to critically analyze meaning and express ideas clearly.
- Develop the ability to understand written texts by scanning and skimming and applying different strategies in analyzing the text.
- Apply note-taking techniques.
- Prepare effective public speeches by overcoming speech anxiety.

584EFDSL3 Ethics for Data science 2 Cr.

By the end of this course, students will be able to:
- Define ethical principles and approaches, and their relevance to data science.
- Describe the importance of data privacy and informed consent in tackling privacy concerns.
- Identify and implement the steps of the Responsible Data Science (RDS) framework.
- Explain the necessity of model interpretability and AI fairness in ethical data science.
- Apply the code of ethics and professional conduct in the field of data science.

584FODSL3 Foundations of Data Science 4 Cr.

By the end of this course, students will be able to:
- Define the fundamental concepts and processes in Data Science.
- Apply exploratory data analysis (EDA) and basic data manipulation.
- Explain databases and their role in data management.
- Describe the basics of data mining, machine learning, and big data.
- Demonstrate skills in data visualization, focusing on best practices and effective storytelling.

584CHEML1 General Chemistry 5 Cr.

By the end of this course, students will be able to:
- Use chemical names, symbols, and formulas to identify and represent substances accurately.
- Recognize and categorize different types of chemical reactions.
- Represent chemical reactions accurately by using balanced chemical equations.
- Apply gas laws to solve problems involving the behavior of gases.
- Describe the arrangement of electrons in atomic orbitals and explain the role of electron configuration in chemical properties.
- Distinguish between various types of chemical bonds, including ionic, covalent, and metallic bonding.
- Predict molecular shapes using bonding theories and the VSEPR model.
- Determine quantitative relationships in simple homogeneous equilibrium systems.
- Explain energy transformations that occur during chemical reactions and their implications by performing calculations with the thermodynamic functions, enthalpy, entropy, and free energy.
- Describe acidic and basic solutions and their reactions both qualitatively and quantitatively.
- Apply principles of oxidation-reduction to balance oxidation reduction reactions, and to understand and analyze electrochemical cells.

584PHY1L1 General Physics I 5 Cr.

By the end of this course, students will be able to:
- Apply principles of measurement and analyze experimental uncertainties.
- Describe and analyze kinematic and dynamic motion in one and two dimensions.
- Apply Newton's laws and principles of conservation of energy and momentum to solve real-world problems.
- Analyze rotational motion and simple harmonic motion in mechanical systems.
- Describe basic thermodynamic processes, including heat transfer and entropy.
- Use software such as Avistep, ImageJ, Python, etc. for basic data analysis, including graphing and visualization, to interpret experimental data.

584PHY2L2 General Physics II 5 Cr.

By the end of this course, students will be able to:
- Analyze electric fields, potentials, and circuits using Coulomb's law and Kirchhoff's laws.
- Apply principles of magnetic fields and electromagnetic induction to solve physics problems.
- Explain the properties of electromagnetic waves and their role in communication and data transmission.
- Describe and analyze optical systems, applying principles of reflection, refraction, and lens optics.
- Present introductory quantum mechanics concepts, including wave-particle duality and the photoelectric effect.
- Use tools like PSPICE for circuit simulations and software like ImageJ, Avistep, and Python for data processing.

584GRTHL8 Graph Theory 6 Cr.

By the end of this course, students will be able to:
- Define the basics of graph theory and the well-known operational research problems that can be modeled and solved using graphs (e.g. shortest path, max-flow, minimum cost spanning tree, coloring).
- Model and solve real-world problems using graph tools.
- Analyze complex networks.
- Apply Markov chains to solve stochastic problems.
- Use linear programming to model and solve decision and optimization problems.
- Use numerical tools to solve graph and operational research problems.

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- Use linear programming to model and solve decision and optimization problems.
- Use numerical tools to solve graph and operational research problems.

584HICSL3 High Impact Communication Skills 3 Cr.

By the end of this course, students will be able to:
- Understand different approaches to self-awareness, self-efficacy and self-leadership to enhance their intra and inter-personal communication skills;
- Develop emotional intelligence and self-regulation to gain control of their thoughts, emotions, physiology and actions;
- Enhance their positive thinking, self-confidence and gravitas;
- Understand the impact of verbal and non-verbal cues and use them purposefully to communicate and influence efficiently;
- Portray an executive presence and build credibility to capture the audience.

584ISTAL7 Inferential Statistics 6 Cr.

By the end of this course, students will be able to:
- Recognize and define a statistical model.
- Develop estimators for unknown parameters, analyze their properties, compare different estimators, and assess their efficiency.
- Compute confidence intervals for unknown parameters, including asymptotic confidence intervals.
- Perform statistical tests, both parametric and non-parametric, and make decisions based on the test results.

584INPRL3 Internet Programming 4 Cr.

By the end of this course, students will be able to:
- Define the basics of HTML markup language and its structure
- Understand the client's needs to deliver an ergonomic website, usable and user-friendly
- Use HTML tags to create basic web page structure, including headings, paragraphs, lists, and links, while respecting the requirements of the semantic web and SEO.
- Insert and format multimedia content like images, using HTML tags.
- Describe CSS syntax and its role in styling web pages.
- Use CSS to format text, change fonts, colors, and backgrounds.
- Use CSS to create layouts and positioning elements on the web page.
- Describe responsive design and media queries.

584INT1L6 Internship I 3 Cr.

By the end of this course, students will be able to:
- Apply Data Science Knowledge: Demonstrate the ability to apply statistical analysis, machine learning, data mining techniques, and ethical considerations in real-world data science projects.
- Utilize Programming Skills: Implement data processing solutions using programming languages such as R, Python, or C++ to handle raw data and extract insights.
- Execute Full Data Science Projects: Manage all phases of a data science project, from data collection and preprocessing to analysis, ethical data use, and interpretation of results.

584INT2L8 Internship II 3 Cr.

By the end of this course, students will be able to:
- Apply Data Science Knowledge: Demonstrate the ability to apply statistical analysis, machine learning, data mining techniques, and ethical considerations in real-world data science projects.
- Utilize Programming Skills: Implement data processing solutions using programming languages such as R, Python, or C++ to handle raw data and extract insights.
- Execute Full Data Science Projects: Manage all phases of a data science project, from data collection and preprocessing to analysis, ethical data use, and interpretation of results.

584IBDAL7 Introduction to Big Data 6 Cr.

By the end of this course, students will be able to:
- Describe the difference between regular and big data.
- Analyze data in different scenarios.
- Explain databases parameters and alterations.
- Exploit domains of application.
- Define and apply all the setup phases.
- Indicate multiple types of databases.
- Apply multiple frameworks for better decision making.
- Use these analytical and technical tools to solve application problems in a variety of settings like medical, marketing, online user experience, agricultural, etc.

584FRENL2 Introduction to French Language 3 Cr.

By the end of this course, students will be able to:
- Express clearly, effectively and accurately in simple and correct French about himself/herself and his/her surroundings.
- Construct simple sentences in French using accurate grammar and syntax.
- Differentiate between formal and informal speech registers in French.
- Write short paragraphs in French on simple topics.
- Demonstrate understanding of spoken French by responding to it either in writing or orally.

584CPP1L5 Introduction to Programming with C++ 4 Cr.

By the end of this course, students will be able to:
- Write simple C++ programs, understand syntax, and debug code.
- Utilize variables, operators, and input/output operations.
- Apply conditional statements and loops to control program flow.
- Design and use functions, both predefined and user-defined.
- Manipulate arrays and work with multidimensional arrays.
- Explain basic string operations.

584LABRL5 Lab for R 4 Cr.

By the end of this course, students will be able to:
- Describe the fundamentals of R programming: Install, set up, and utilize the R environment for data analysis, exploring key concepts such as data types, structures, subsetting, and indexing.
- Apply statistical methods and data visualization: Perform descriptive and inferential statistical analyses using R, leveraging R's libraries to create customized, impactful visualizations for effective data communication.
- Master advanced data manipulation techniques: Efficiently reshape, merge datasets, and manipulate data using R's advanced techniques, including the use of the dplyr package.
- Develop dynamic reports and web applications: Create reproducible reports with R Markdown and build interactive web applications using Shiny, applying R to real-world datasets and case studies in data-driven projects.

584MADSL8 Marketing Data Science 5 Cr.

By the end of this course, students will be able to:
- Define various marketing data science models.
- Develop proficiency in Attribution Modeling, MMM, and Bayesian approaches.

- Analyze and interpret marketing data for insights.
- Make informed, data-driven decisions to optimize marketing efforts.

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584MLABL7 MATLAB for Data Science 6 Cr.

By the end of this course, students will be able to:
- Understand MATLAB for Data Science: Gain a clear understanding of how MATLAB can be utilized in the context of data science, including its capabilities, functions, and applications.
- Manipulate and Pre-process Data: Master the techniques of importing, cleaning, and transforming data, ensuring its suitability for analysis and modeling.
- Implement Machine Learning Models: Develop proficiency in using MATLAB's built-in machine learning toolbox to create predictive and classification models, and understand the principles of various algorithms.
- Evaluate Model Performance: Learn to assess model performance using appropriate metrics, implement cross-validation techniques, and understand the concepts of overfitting and underfitting.
- Deploy Models to Enterprise Systems: Acquire the skills to deploy machine learning models created in MATLAB to enterprise computing systems, including standalone applications and web services.
- Conduct Exploratory Data Analysis: Utilize MATLAB's statistical and visualization tools to perform exploratory data analysis and derive insights from data.
- Apply Advanced Techniques: Explore advanced topics such as deep learning, transfer learning, and natural language processing using MATLAB's toolboxes.
- Address Ethical Considerations: Recognize and address ethical concerns related to bias, fairness, and privacy in data science and machine learning applications.
- Work on Real-world Projects: Engage in hands-on projects and case studies that simulate real-world data science scenarios, applying MATLAB skills to solve practical problems.
- Stay Abreast of Trends: Understand emerging trends in data science and machine learning, and explore the integration of MATLAB with cutting-edge technologies.

584MCOML5 Matrix Computations 6 Cr.

By the end of this course, students will be able to:
- Explain the theory and applications of numerical linear algebra.
- Apply matrix factorizations to solve linear systems efficiently.
- Analyze stability and perturbations in numerical computations.
- Solve structured linear equation and eigenvalue problems.
- Perform large-scale singular value decomposition using various techniques.
- Identify polynomial eigenvalue problems and their solutions.

584NLPRL8 Natural Language Processing 6 Cr.

By the end of this course, students will be able to:
- Define Natural Language Processing and explain its significance in the field of Artificial Intelligence.
- Apply key NLP techniques including Named Entity Recognition, Sentiment Analysis, and Topic Modeling in real-world scenarios.
- Use various preprocessing methods such as tokenization, stemming, and lemmatization to prepare textual data for analysis.
- Demonstrate proficiency in using NLP tools and libraries such as NLTK, spaCy, Gensim.
- Outline the complete workflow of building an NLP model, including data collection, preprocessing, feature extraction, model training, and evaluation.
- Apply the latest advancements in NLP, such as Transformers (e.g., BERT, GPT-3), to enhance model performance and achieve state-of-the-art results.

584ECONL4 Principles of Economics 6 Cr.

By the end of this course, students will be able to:
- Demonstrate an understanding of the concepts and principles of political economy.
- Define the current economic systems.
- Determine the equilibrium price and quantity in the markets based on demand and supply.
- Evaluate the effects of government regulation on market outcomes.
- Explain economic policies' instruments and analyze the impact of monetary and fiscal policies on output growth, unemployment, and inflation.
- Analyze economic graphs.
- Identify the most important economic problems and approaches to tackle them.

584PROBL4 Probability for Data Science 6 Cr.

By the end of this course, students will be able to:
- Analyze and interpret descriptive statistics, including measures of central tendency, variability, and data visualization techniques.
- Define and apply probability concepts: calculate probabilities using sample spaces, events, conditional probability, and apply Bayes' Theorem and counting techniques.
- Use random variables and probability distributions: model real-world problems using discrete and continuous distributions such as binomial, Poisson, normal, and exponential distributions.
- Apply key theorems in probability: explain and use the Central Limit Theorem, the Law of Large Numbers, and other statistical tools, in preparation for more advanced courses in statistics.

584PENGL6 Professional English 3 Cr.

By the end of this course, students will be able to:
- Master English terminology used in professional contexts, including the data science sector.
- Perform practical tasks relevant to the data science industry.

584REMOL8 Regression Models 4 Cr.

By the end of this course, students will be able to:
- Compare the differences among various models.
- Select the appropriate model according to a given situation.
- Estimate and use parameters.

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584RDATL4 Relational Databases 6 Cr.

By the end of this course, students will be able to:
- Define the fundamental concepts of databases and the relational model.
- Design databases to meet the requirements of a given information system.
- Create and manage databases using SQL.
- Apply techniques for effective database management and optimization.
- Use database management systems in practical scenarios.

584SADAL6 Statistical Analysis of Data 6 Cr.

By the end of this course, students will be able to:
- Define and apply various statistical analysis techniques using R.
- Perform hypothesis testing and interpret p-values.
- Apply ANOVA and non-parametric tests to different scenarios.

- Perform linear regression and interpret regression results.
- Apply multivariate data analysis techniques for data exploration.
- Apply statistical methods to real-world datasets and communicate findings effectively.

584STDSL5 Statistics for Data Science 6 Cr.

By the end of this course, students will be able to:
- Calculate and apply measures of location and measures of dispersion using R language.
- Apply discrete and continuous probability distributions to various data analysis problems using R language.
- Perform hypothesis testing, calculate confidence interval for a population parameter for single sample and two sample cases, and define the concept of p-values.
- Employ non-parametric tests such as the Chi-Square test for Independence as well as Goodness of Fit.
- Compute and interpret the results of Bivariate Regression and Correlation Analysis, for forecasting and practice these studies using R language.

584WAPPL7 Web Application 6 Cr.

By the end of this course, students will be able to:
- Define the foundational concepts of web development, including HTML, CSS, and JavaScript, and describe the front-end technologies that underpin modern web applications.
- Describe the server-side scripting languages and backend development frameworks such as Python with Flask or Django, and design and implement the server-side components of data-driven web applications.
- Apply database integration in web applications, while managing and querying data efficiently. Discuss relational databases and define the principles of database design for effective data storage and retrieval.
- Present data effectively through web-based visualizations, describe popular data visualization libraries and tools, and create compelling and informative graphics for diverse data sets.
- Define the principles of web security with a specific focus on securing data and user interactions in web applications. Address ethical considerations related to data privacy and security in the context of web development.
- Integrate web applications with data science tools and frameworks, facilitating seamless interaction with analytical models and data processing pipelines.
- Deploy web applications and explain strategies for ensuring scalability to accommodate increasing data volumes and user loads.