

Artificial Intelligence and Data Sciences Engineering Degree

Preparatory Cycle

Year 1 - Semester 1 (1CP)

- **Foundational Mathematics:** Introduction to essential mathematical concepts for computer science, including discrete mathematics, sets, functions, and mathematical reasoning.
- **Data Structures and Algorithms 1:** Basic data organization methods and fundamental algorithms, covering arrays, linked lists, stacks, queues, and algorithm complexity analysis.
- **Digital Systems:** Introduction to digital logic, Boolean algebra, number systems, and basic circuit design principles.
- **Information Technology Essentials:** Overview of computing fundamentals, hardware components, software types, and basic information systems concepts.
- **English 1:** Development of academic English skills with focus on technical vocabulary and communication in computing contexts.
- **Critical Thinking and Creativity Skills:** Methods for problem analysis, logical reasoning, and creative solution development in technological contexts.

Year 1 - Semester 2 (1CP)

- **Object Oriented Programming:** Introduction to object-oriented programming paradigms, concepts, and design principles with practical applications.
- **Introduction to Linux:** Fundamentals of Linux operating system, command-line operations, file system management, and basic shell scripting.
- **Linear Algebra:** Study of vector spaces, matrices, determinants, eigenvalues, and applications in computer science.
- **Mathematical Analysis 1:** Principles of calculus, limits, continuity, differentiation, and their applications in computing.
- **Introduction to Statistics:** Basic statistical concepts, probability distributions, data analysis techniques, and statistical inference.
- **English 2:** Advanced academic English focusing on technical writing, presentation skills, and professional communication.

Year 2 - Semester 3 (2CP)

- **Data Structures and Algorithms 2:** Advanced data structures and algorithms including trees, graphs, hash tables, and algorithmic strategies.
- **Mathematical Logic:** Formal logic systems, propositional and predicate calculus, proof techniques, and logic programming foundations.
- **Mathematical Analysis 2:** Advanced calculus concepts including integration techniques, series, and multivariable functions.
- **Databases:** Database design principles, relational models, SQL, normalization, and database management systems.
- **Probability:** Probability theory, random variables, probability distributions, and stochastic processes for computer science.
- **Web Development:** Client-side and server-side web programming, HTML, CSS, JavaScript, and web application frameworks.
- **Introduction to Business:** Basic principles of business management, organizational structures, and business processes in the tech industry.

Year 2 - Semester 4 (2CP)

- **Theory of Computing:** Theoretical foundations of computer science, automata theory, formal languages, and computability.
- **Operating Systems:** Operating system architecture, process management, memory management, file systems, and system security.
- **Computer Architecture:** Computer organization, processor design, memory hierarchy, I/O systems, and performance evaluation.
- **Statistical Inference:** Advanced statistical methods, hypothesis testing, confidence intervals, and statistical modeling.
- **Introduction to AI:** Foundations of artificial intelligence, search algorithms, knowledge representation, and introduction to machine learning.
- **Mathematical Analysis 3:** Complex analysis, differential equations, and their applications in computational problems.
- **Electronic Circuits Labs:** Practical experience with electronic components, circuit design, and digital systems implementation.

Second Cycle

Year 3 - Semester 5 (1CS)

- **Data Mining:** Methods for discovering patterns in large datasets, including clustering, classification, and association rule mining.
- **Operations Research:** Mathematical optimization techniques for decision-making, resource allocation, and system efficiency.
- **Stochastic Modelling and Simulation:** Probabilistic modeling methods, simulation techniques, and applications in system analysis.
- **Software Engineering:** Software development lifecycle, requirements analysis, design methodologies, testing, and project management.
- **Networks and Protocols:** Computer network fundamentals, architectures, protocols, and network security principles.
- **Mobile Development:** Programming for mobile platforms, app development frameworks, and mobile user experience design.
- **Entrepreneurship and Innovation:** Principles of innovation, startup creation, business model development, and technology venture management.

Year 3 - Semester 6 (1CS)

- **Machine Learning:** Supervised and unsupervised learning algorithms, model evaluation, and practical implementation of ML systems.
- **Numerical Methods and Optimisation:** Computational methods for solving mathematical problems, optimization algorithms, and numerical analysis.
- **Time Series Analysis and Classification:** Methods for analyzing sequential data, time series forecasting, and sequence classification.
- **Advanced Databases:** Advanced database concepts including database optimization, non-relational databases, and data warehousing.
- **Computer and Network Security:** Security principles, cryptography, network defense, vulnerability assessment, and security protocols.
- **Group Project:** Collaborative software development project emphasizing teamwork, agile methodologies, and practical implementation.
- **Project Management:** Project planning, scheduling, resource allocation, risk management, and professional project delivery methods.

Year 4 - Semester 7 (2CS)

- **Natural Language Processing:** Computational techniques for analyzing, understanding, and generating human language text.

- **Deep Learning:** Neural network architectures, deep learning frameworks, and applications in computer vision and natural language.
- **Human Computer Interaction:** User interface design principles, usability engineering, user experience, and interface evaluation methods.
- **Wireless Communication Networks and Systems:** Wireless technologies, protocols, network design, and mobile communication systems.
- **Introduction to Mobile Robotics:** Fundamentals of robotics, sensing, navigation, path planning, and robot programming.
- **Internship Project:** Industry-based practical experience applying theoretical knowledge in real-world settings.
- **AI and Ethics:** Ethical considerations in AI development, fairness, transparency, accountability, and societal impacts.
- **Selected Topics in AI/Technology:** Current and emerging topics in artificial intelligence and computing technologies.

Year 4 - Semester 8 (2CS)

- **Computer Vision:** Image processing, feature extraction, object detection, image understanding, and visual recognition systems.
- **Big Data Analytics & Visualization:** Techniques for processing and analyzing massive datasets, data visualization, and big data technologies.
- **Reinforcement Learning:** Decision-making algorithms, reward systems, policy optimization, and applications in autonomous systems.
- **Speech Processing:** Speech recognition, synthesis, speaker identification, and audio signal processing techniques.
- **High Performance Computing:** Parallel computing, distributed systems, performance optimization, and scalable algorithm design.
- **Enterprise Computing:** Enterprise architecture, business information systems, ERP, and enterprise application integration.
- **Academic Communication and Research:** Research methodologies, scientific writing, literature review, and academic presentation skills.

Year 5 - Semesters 9 & 10 (3CS)

- **Final Year Project:** Comprehensive capstone project demonstrating mastery of computer science concepts through independent research and development.