Bachelor of Science in Artificial Intelligence Course Description

Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
ST 101	None	Calculus I	
The Calculus and Analytical Geometry course is a comprehensive study of foundational mathematical concepts and techniques essential for understanding and solving a wide range of mathematical and scientific problems. Topics include basic topics in analytical geometry, functions and models, limits and derivatives, differentiation rules, applications of differentiation, integrals and applications of integration, techniques of integration, differential equations, parametric equations and polar coordinates, partial derivatives, and multiple integrals.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
ST 102	ST 101	Linear Algebra	
The Linear Algebra course offers students a robust foundation in mathematical concepts and problem-solving skills. Topics include linear equations in linear algebra, matrix algebra, determinants, vector spaces, eigenvalues and eigenvectors, orthogonality and least squares, symmetric matrices and quadratic forms, the geometry of vector spaces, optimization, and finite-state Markov chains.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
ST 103	CIS 101	Fundamentals of Computer Programming	
This course is tailored to familiarize students with the core principles of programming through the use of the C++ language. Topics include basic ideas of the C++ language, fundamental types of data, working with fundamental data types, making decisions, arrays and loops, pointers and references, working with strings, defining functions, vocabulary types, function templates, modules, and namespaces, operator overloading, inheritance, polymorphism, class templates, and move semantics.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
ST 200	102	Introduction to Statistics	
This course serves as an introduction to the fundamental principles of statistics, providing students with essential tools for data analysis and interpretation. Topics include describing data, summarizing and graphing, basic concepts of probability, rules of probability, discrete random variables, continuous random variables, sampling distributions, hypothesis testing, correlation and regression, analysis of variance, and ethics.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
ST 203	ST 103	Database Management Systems	
This course covers an overview of database principles and architectures, including the relational, hierarchical, network, and object-oriented models. Topics include database systems, data models, normalization of database tables database, advanced SQL, advanced database concepts, database performance tuning and query optimization, distributed database management systems, business intelligence and data warehouses, big data and NoSQL, database connectivity and web technologies, and database administration and security. It covers essential concepts related to database maintenance, performance tuning, and optimization, ensuring that students are equipped to manage databases effectively over time. The course also includes a 2-hour-per-week laboratory component to reinforce theoretical learning with practical application.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
ST 204	ST 103	Data Structures and Algorithms	
This course serves as an introduction to the fundamental concepts of Data Structures and Algorithms and their practical applications in the realm of computer operations. Topics include data structures, sorting algorithms, Big O Notation, code optimization strategies (with and without Big O), performance optimization for optimistic scenarios, efficient lookup using hash tables, elegant code development with stacks and queues, recursive programming techniques, dynamic programming, algorithms for speed partitioning, node-based data structures, accelerated operations with binary search trees, and maintaining priorities through heaps.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
ST 205	CIS 101	Networking and Information Security	
This course provides a comprehensive exploration of Networking and Information Security fundamentals. Key topics covered			

include an Overview of Networks, ethernet Basics and Advanced Ethernet, Wireless LANs, and Other LANs, Links and Packets, Abstract Sliding Windows and IP version 4, IPv4 Companion Protocols, IPv6, and Routing-Update Algorithms Large-Scale IP Routing, UDP Transport, TCP Transport Basics and TCP Issues and Alternatives, TCP Reno and Congestion Management and Dynamics of TCP, Newer TCP Implementations and Queuing and Scheduling, Token Bucket Definition, Network Management and SNMP, Security, Public-Key Encryption and Mininet, Network Simulations (ns-2, ns-3).			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
ST 207	ST 103	Multimedia Technology	
This course delves into the realm of multimedia and interactive technologies, encompassing the processes of digitizing and manipulating images, audio, and video materials. Topics include graphics and image data representations, color in image and video, fundamental concepts in video, digital video, digital audio, multimedia data compression, variable-length coding (VLC), lossy compression algorithms, image compression standards, video compression techniques, modern video coding standards (H.264, H.265, and H.266), and audio compression techniques.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
ST 208	ST 200	Probability Theory	
This course serves as an in-depth exploration of probability theory, covering fundamental concepts and advanced applications essential for understanding uncertainty and randomness in various fields. Topics include basic measure theory, independence, generating functions, integral, moments and laws of large numbers, convergence theorems, conditional expectations, martingales and optional sampling theorems, martingale convergence theorems and their applications, probability measures on product spaces, characteristic functions and the central limit theorem, Markov chains, Brownian motion, and stochastic differential equations.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
ST 301	ST 102	Discrete Structures and Their Applications	
This course provides a foundational exploration of discrete structures and their practical applications in computer science, mathematics, and various other fields. Discrete structures are essential for solving complex problems, making decisions, and designing algorithms. Topics include logical thinking, relational thinking, recursive thinking, quantitative thinking, analytical thinking, and thinking through applications.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
ST 305	ST 103	Advanced Computer Programming	
This course is meticulously crafted to impart students with a profound grasp of Advanced Computer Programming with Python, enabling them to create sophisticated applications. Topics include procedural Python examples, modeling physical objects with object-oriented programming, mental models of objects and the meaning of “self” managing multiple objects, introduction to Pygame, object-oriented Pygame, Pygame GUI widgets and encapsulation, polymorphism, inheritance, managing memory used by objects and card games, timers animation, scenes: scenes, full game: dodger, and design patterns and wrap-up.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
ST 306	ST 204	Parallel and Distributed Programming	
This course provides a comprehensive introduction to the world of Parallel and Distributed Programming, equipping students with the knowledge and practical skills necessary to harness the full potential of modern computing systems. Topics include building multithreaded programs, working with multiprocessing and mpi4py library, asynchronous programming with AsyncIO, realizing parallelism with distributed systems, maximizing performance with GPU programming using CUDA, embracing the parallel computing revolution, scaling data science applications with Dask, exploring the potential of AI with parallel computing, hands-on applications of parallel computing, and future trends and opportunities in parallel computing			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
ST 308	ST 303	Knowledge Management Systems	
This course provides a comprehensive exploration of Knowledge Management Systems (KMS), offering a conceptual foundation and practical insights into managing organizational knowledge effectively. Topics include a conceptual approach to knowledge management, an overview and trends in knowledge management, knowledge management: processes and models, the virtuous km cycle, a global approach to managing knowledge, the key processes for KM: the daisy model			

knowledge management system: a case study of Sonatrach, national oil company, Algeria, knowledge management system standardization: an overview, knowledge management international standards: International Organization for Standardization (ISO) 9001, 30401, and International Atomic Energy Agency (IAEA) safety standards, artificial intelligence and knowledge management, evaluation of knowledge management system, and emerging trends in knowledge management.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
ST 407	ST 205	Cybersecurity	
This course provides an overview of cybersecurity principles, exploring the significance of cybersecurity in contemporary contexts. Topics include technique and human beings, risk management, cryptography, applied cryptography, communication and applications networks, network security, security in operating systems, software security, incident handling and system availability, attack types, and law and ethics.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
ST 408	ST 205	Digital Forensics	
This course provides students with a comprehensive understanding of the principles, tools, and techniques used in digital forensic. Topics include introduction to digital forensics, legal considerations and search authority, the investigation process, recognizing and collecting digital evidence, preservation of evidence/on scene triage, hash values and file hashing, creating a disk image, keyword and grep searches, network basics, reporting and peer review, and real-world digital forensics case studies.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
ST 409	ST 205	Cloud Computing Concepts	
This course introduces students to the fundamentals of cloud computing and software development for cloud platforms. The key topics include Cloud Fundamentals and the Cloud Continuum, Infrastructure as a Service (IaaS) and Platform as a Service (PaaS), Cloud Economics, Managing Cloud Workloads and Services, Improving Security, Governance, and Cloud Reliability, Business Considerations, and Practical Application of Cloud Computing for Innovative Design.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
ST 411	AI 303	Blockchain and Applications	
This course provides a comprehensive exploration of blockchain technology, covering its fundamental principles, architecture, real-world applications, and advanced topics. Topics include blockchain architecture, unblocking the blockchain, blockcloud: blockchain as a cloud service, a deep dive into blockchain consensus algorithms, blockchain computing technology: challenging security and privacy issues, decentralization in blockchain and its impact on identity, threat to the current blockchain cryptosystems due to the advancement of quantum computers, digital India digital economy using blockchain technology, and blockchain-based secure evidence- management police assistance system.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
AI 101	CIS 101	Introduction to Artificial Intelligence	
This introductory course in Artificial Intelligence (AI) offers a comprehensive exploration of the fundamental concepts, theories, and practical applications in the field of AI. Topics include intelligent agents, problem-solving and search algorithms, informed search and exploration and constraint satisfaction problems, logical agents and first-order logic, knowledge representation and reasoning, machine learning, artificial neural networks, natural language processing, computer vision, robotics, philosophy, ethics, and safety of AI, and the future of AI.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
AI 201	AI 101	Fundamentals of Natural Language Processing	
This course establishes a strong foundation in Natural Language Processing (NLP), covering essential concepts and principles. Topics include information search, information extraction, author profiling as a machine-learning task, linguistic feature engineering for author profiling, sentiment analysis using sentiment lexicons, data-driven approaches to sentiment analysis, topic analysis, topic modeling, named-entity recognition, and practical application of NLP in real-world scenarios.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
AI 202	AI 101	Fundamental of Machine Learning	

This comprehensive course offers a deep dive into the field of machine learning, providing both theoretical foundations and practical applications. Topics include introduction to machine learning supervised learning algorithms, support vector machines (SVM), logistic regression, unsupervised learning algorithms, dimensionality reduction, ensemble methods, artificial neural network (ANN) and deep learning, practical machine learning applications, semi-supervised learning, reinforcement learning, and ethical and fair machine learning.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
AI 206	AI 201, AI 202	Computer Vision Systems	
This course serves as a comprehensive introduction to the realm of computer vision, providing an overarching view of this field that bridges the gap between image processing and artificial intelligence. Topics include image formation, image processing, Fourier transforms, pyramids and wavelets, model fitting and optimization, variational methods and regularization, image alignment and stitching, motion estimation, layered motion, computational photography, and 3D reconstruction.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
AI 302	AI 202	Advanced Techniques in Machine Learning	
The advanced techniques in machine learning course offers a comprehensive exploration of advanced topics in machine learning, equipping students with a deep understanding of cutting-edge techniques and their real-world applications. Topics include advanced deep learning and neural networks, natural language processing (NLP), time series analysis and forecasting, transfer learning and domain adaptation, advanced interpretability and explainability, ensemble learning advanced reinforcement learning algorithms, reinforcement learning, advanced computer vision, advanced applications, and ethical considerations and fairness in machine learning.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
AI 303	AI 201, AI 202	Application of AI to Energy Transition	
The course delves into the application of artificial intelligence in the context of energy transition. Topics include large-scale building thermal modeling based on artificial neural networks, automated demand side management in buildings, a multi-agent approach to energy optimization for demand-response ready buildings, a review on non-intrusive load monitoring approaches based on machine learning, neural networks and statistical decision making for fault diagnosis in energy conversion systems, support vector machine classification of current data for fault diagnosis and similarity-based approach for failure prognosis in wind turbine systems, health indices in energy systems, review on health indices extraction and trend modeling for remaining useful life estimation, how machine learning can support cyberattack detection in smart grids, neurofuzzy approach for control of smart appliances for implementing demand response in price-directed electricity utilization, using model-based reasoning for self-adaptive control of smart battery systems, data-driven predictive flexibility modeling of distributed energy resources, applications of artificial neural networks in the context of power systems.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
AI 304	AI 202	Neural Networks and Deep Learning	
This course provides a comprehensive exploration of neural networks and deep learning, covering a range of topics essential for understanding and applying this cutting-edge technology. Topics include the Rosenblatt perceptron, gradient-based learning, sigmoid neurons and backpropagation, fully connected networks applied to multiclass classification, convolutional neural networks applied to image classification, predicting time sequences with recurrent neural networks, long short-term memory, text auto completion LSTM and BEAM Search, neural language models and word embedding, and sequence-to-sequence networks and natural language translation.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
AI 307	ST 203, ST 204	Data Mining	
The Data Mining course offers an in-depth exploration of the principles, methods, and techniques used in uncovering hidden patterns, knowledge, and valuable insights from large datasets. Topics include data mining and machine learning, getting to know your data, data preprocessing, data warehousing and online analytical processing, data cube technology, mining frequent patterns, associations, and correlations, advanced pattern mining, classification, classification: advanced methods, cluster analysis: basic concepts and methods, advanced cluster analysis, outlier detection, and data mining trends and research frontiers.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3

AI 309	ST 301	Fuzzy Logic	
This course provides a thorough initiation into the realm of Fuzzy Logic. Topics include a brief introduction and history, a review of Boolean algebra, crisp sets and sets and more sets, fuzzy sets and sets and more sets, language, linguistic variables, sets and hedges, fuzzy inference and approximate reasoning, Fuzzification and Defuzzification, fuzzy logic applications, moving to threshold logic, and moving to perceptron logic.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
AI 310	AI 302, AI 303	Research in AI	
This interdisciplinary course offers an in-depth exploration of cutting-edge technologies that harness the power of Artificial Intelligence (AI), Machine Learning (ML), and the Internet of Things (IoT) to tackle contemporary challenges. Throughout this course, students will focus on innovative solutions in various domains, gaining practical insights and skills in areas such as smart home automation, assistive technology for the visually impaired, AI in education, secure online voting, digital agriculture, digital healthcare, emotion recognition and music, medical diagnosis, real estate predictions, healthcare predictive models, medical imaging, rural development, mental health prediction, and optimized advertising. Students will engage in a dynamic learning experience that combines lectures, published research papers, and practical applications. By the course's end, students will have acquired a comprehensive skill set and competency in developing AI-driven solutions and leveraging advanced technologies to address real-world challenges in diverse domains.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
AI 401	AI 310	Robotics	
This robotics course provides a comprehensive exploration of robotics, equipping students with the knowledge and skills to understand, design, and control robotic systems. Topics include classification of robotic manipulators, the geometry of robots, rotational transformations, forward kinematics, velocity kinematics, inverse kinematics, dynamics, and motion planning, control of manipulators, independent joint model, nonlinear and multivariable control, force control, vision-based control, and feedback linearization.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
AI 402	AI 206	Human Computer Interaction	
This course in Human-Computer Interaction (HCI) explores the critical relationship between humans and technology with a focus on designing user-friendly and effective digital interfaces. Topics include human-computer interaction, the psychology of usable things, usability engineering, know the user, usability benchmarking, goal-oriented interaction design, prototyping, usability inspection methods, usability testing methods, usability in practice, visual design and typography, icon design, a brief history of HCI, and The future of HCI.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
AI 403	AI 307	Data Science and Analytics	
This course is designed to provide students with a profound understanding and practical skills in the dynamic field of Data Science and Analytics. Topics include intersection of data science, analytics, and business analytics (BA), exploring business analytics and business intelligence (types, objectives, and differences), understanding data, data types, and data-related terms, data analysis tools for data science and analytics: data analysis using excel, statistical concepts for data science, descriptive analytics visualizing data using graphs and charts, numerical methods for data science applications, applications of probability in data science, discrete probability distributions applications in data science, sampling and sampling distributions: central limit theorem, estimation, confidence intervals, hypothesis testing, basics of machine learning (ML), and R statistical programming software for data science.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
AI 404	AI 310	Advanced Topics in AI	
This course is designed to provide an in-depth exploration of various advanced topics and applications within the field of artificial intelligence (AI). This course delves into a wide range of topics, offering students the opportunity to expand their knowledge and expertise in AI. Topics include game theory and mechanism design, decision-making in uncertain environments, practical applications of machine learning, distributed problem solving, social choice and preference aggregation, mechanism design and auctions, multiagent learning and cooperative game theory, computer vision, and image processing, natural language processing, robotics and AI integration, deep learning and neural networks, reinforcement learning, and ethics and AI: implications and responsibilities			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
AI 405	AI 302, AI 303	Pattern Recognition Systems	

This course on pattern recognition systems provides students with a deep understanding of the principles and techniques used in recognizing patterns in various types of data. Topics include overview of a pattern recognition system and evaluation in imbalanced problems, domain-independent feature extraction and the complete Principal Component Analysis (PCA) algorithm, classification, support vector machines (SVM), ensemble learning and random forests, unsupervised learning techniques, neural networks and deep learning, deep computer vision using convolutional neural networks, image processing techniques such as segmentation and feature extraction, face image processing and analysis, time series forecasting models such as Multi-Layer Perceptron, Convolutional Neural Network, and Long Short Term Memory.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
AI 406	AI 401	Autonomous Robotics	
This course is designed to provide students with the opportunity to learn about Autonomous Robotics. Topics include introduction to autonomous robotics, localization and mapping, sensors and perception, robot kinematics and dynamics, robot control and navigation, machine learning for robotics, human-robot interaction, robot hardware and platforms, autonomous vehicles and drones, robotic vision and image processing, advanced robotics projects, multi-robot systems and swarm robotics, mobile robot programming laboratory, advanced robotic perception and robot ethics and societal implications.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
AI 410	ST 205, ST 207	AI and Internet of Things (IoT)	
This course provides students with profound insights into AI and the Internet of Things (IoT). Topics include Introduction to AI and IoT Integration IoT Architecture and Protocols, Sensors and Data Collection in IoT, IoT Networking and Communication IoT and Machine Learning, Edge AI and its role in IoT Systems, Machine Learning Algorithms for IoT Data Analysis and Prediction, Reinforcement learning for IoT control and optimization, AI-driven anomaly detection and security in IoT, IoT security, privacy, and ethics, and innovation and regulatory compliance in IoT security.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
AI 495	Completion of 90 Credit Hours	AI Internship	
This course is designed to provide students with a unique opportunity to bridge the gap between academic learning and real-world professional experiences. Through a structured workplace environment, students will gain invaluable hands-on experience, enabling them to apply their academic knowledge to practical work situations. This exposure to real-world dynamics aims to help students develop a deeper understanding of the distinctions between the obligations and responsibilities encountered in their personal lives and those they will face in a professional working context.			
Course Code	Pre-requisite(s)	Course Name	Credit Hours 3
AI 499	Completion of 90 Credit Hours	Artificial Intelligence Capstone	
This course is the capstone for the Bachelor of Artificial Intelligence. Students are required to plan, design, build, and test a high functionality project in coordination with a project supervisor. The student should use the experience and knowledge gained from preceding courses taken earlier to improvise and build an AI-based application that has great potential of being transformed into a commercial asset. The project requires a written proposal, a proposal presentation, and a final presentation. By emphasizing sustainability in the Artificial Intelligence Capstone course, the program ensures that students are not only proficient in innovative AI solutions but also conscious of the environmental and ethical implications of their work.			