ARTIFICIAL INTELLIGENCE APPLICATIONS (Course 2)
COURSE CODE: 68K1

COURSE DESCRIPTION: Artificial Intelligence Applications builds on the foundational concepts introduced in *Introduction to Artificial Intelligence*, focusing on how data, algorithms, and computing systems are used to design and evaluate AI solutions. Students work with real-world data, machine learning models, and industry-relevant tools to build, test, and refine AI-driven applications across domains. The course emphasizes responsible AI use, including ethical, legal, security, and privacy considerations.

OBJECTIVE: Given the necessary equipment, software, supplies, and facilities, the student will be able to successfully complete the following core standards for courses that grant one unit of credit.

PREREQUISITE: Introduction to Artificial Intelligence (57M0) and Algebra 1 (or equivalent)

COMPUTER REQUIRED: One computer per student

CREDIT: 1 unit (120 hours)

RECOMMENDED GRADE LEVEL: 10-11

IAI.A. COMPUTING SYSTEMS

Unit Description: C2 solution designers and users understand the significance of various computing systems. The following accountability criteria are considered essential for students in the Artificial Intelligence program of study.

IAI.A1. Students will analyze the utilization of computing devices and investigate advancements in AI.

IAI.A1.1.2 Utilize a common troubleshooting process to identify software problems that involve the interpretation of error messages and common system malfunctions.
IAI.A1.2.1 Utilize hardware and/or software to solve levelappropriate (domain-specific) problems.
IAI.A1.2.2 Identify applications, libraries, and software packages (e.g., MATLAB, R, Python, GNU, OCTAVE, or other open-source libraries) utilized within AI and machine learning (ML) industries.
IAI.A1.3.1 Identify and use applications, libraries and software packages utilized within AI and ML industries specifically used for deep learning.
IAI.A1.4.1 Design solutions for domain-specific problems utilizing appropriate AI and ML software and hardware.

IAI.A2. Students will solve relevant problems and design AI solutions using appropriate components, including software and hardware that contribute to computing devices.

IAI.A2.1.3 Recommend modifications for existing computing devices and software to improve functionality and the user experience.
IAI.A2.1.4 Develop a solution to a given problem using appropriate hardware and software (e.g., sensor devices, Wi-Fi capabilities, specialized displays, runtime modules, operating systems, application programming interfaces (APIs).
IAI.A2.3.3 Write a program for an embedded or robotic system that makes a decision

based on sensor/user input, controls mechanics of the robot, and completes a "human" task (e.g., delivers items, opens a door for someone, solves a puzzle, etc.).
IAI.A2.5.2 Justify hardware and software selections for structured data sets that rely on the collection of data from sensors.
IAI.A2.5.3A Justify hardware and software selections for unstructured data sets that rely on the collection of data from voice recognition devices or camera data.
IAI.A2.5.3B Merge or join multiple data sources in order to synthesize to a single data set using matrix or vector strategies to impute missing data.

IAI.B. DATA AND ANALYTICS

Unit Description: AI solution designers and users understand how data is collected, analyzed, stored, and used. The following accountability criteria are considered essential for students in the Artificial Intelligence program of study.

IAI.B1. Students will evaluate various data collection methods, data storage tools, data analysis tools and data representation tools.

IAI.B1.1.3 Explain how different collection methods and tools influence the amount and quality of the data that is observed and recorded.
IAI.B1.2.3 Select methods of data organization and storage (e.g. local, portable or cloud storage), considering factors such as cost, speed, reliability, accessibility, privacy and integrity.
IAI.B1.3.2 Translate between various methods of data representation (i.e., analog, digital, ASCII, binary).
IAI.B1.3.3 Analyze, utilize, and visually represent static data.

IAI.B2. Students will construct a computational model using large data sets.

IAI.B2.1.3A Create data sets to explore a real-world (domain-specific) scenario or support a claim.
IAI.B2.1.3B Define Big Data and describe how it is used in AI.
IAI.B2.1.3C Describe how AI uses data to make predictions or decisions.
IAI.B2.2.3 Use appropriate data analytics to validate predictions/outcomes (e.g., correlation coefficients, R2 , AUC, Precision, Recall, Specificity, Confusion Matrix, P-Value, F-Score etc.)
IAI.B2.3.3 Evaluate the limitations of a computational model and the accuracy of inferences.

IAIB3. Students will choose data types and data structures based on functionality, storage, and performance tradeoffs.

IAIB3.1.3 Determine when external data structures (e.g., databases, flat files) are appropriate and incorporate them in programs.

IAI.C. ALGORITHMS AND PROGRAMMING

Unit Description: AI solution designers and users understand how data is used in both algorithms and programming design. The following accountability criteria are considered essential for students in the Artificial Intelligence program of study.

IAI.C1. Students will create, evaluate, and modify algorithms to express an idea or solve a problem.

IAI.C1.1.1 Describe and use the types of algorithms used for classification (e.g., decision trees, NN, logistic regression).

IAI.C1.1.2 Describe and use the types of algorithms used for regression (e.g., decision trees, NN, linear regression).

IAI.C1.1.4 Select the appropriate algorithm to address a domain-specific problem and justify the solution.

IAI.C1.2.1 Identify machine learning techniques (Algorithms) that allow the computer to learn behaviors without explicit programming.

IAI.C1.2.2 Model and explain how machine learning algorithms are learning "patterns" in data to construct internal representations that encode the relationship between inputs and outputs and result in a model for reasoning.

IAI.C1. 3.2A Design, build and test level-appropriate algorithms that use linear regressions and describe existing outliers in the context of the programming solution.

IAI.C1.3.2B Use decision trees and linear regressions to make predictions and classifications.

IAI.C1.3.3 Design, build and test level-appropriate algorithms that use value analysis and sentiment analysis (e.g., language data sets, books, images, traffic examples) to make predictions, for classification and segmentation.

IAI.C1.4.2A Illustrate the flow of execution of algorithms in level-appropriate programs utilizing structured data and ML libraries (e.g., scikit).

IAI.C1.4.2B Design level-appropriate algorithms using structured data sets and ML libraries.

IAI.C1.5.1 Use a systematic approach to detect and resolve errors in a given algorithm.

IAI.C2. Students will divide a task into sets of functional units that can be reused to compose a complex solution.

IAI.C2.1.2 Decompose and explain tasks associated with structured data sets (e.g., Pandas) into smaller, reusable parts to facilitate the design, implementation, and review of programs.

IAI.C2.2.2 Design and build a complex solution to a problem that incorporates reusable code e.g., student-created, application programming interfaces (APIs), libraries) to

expedite the programming associated with structured data sets.

IAI.C3. Students will plan, build, test, refine and document programs using text-based coding languages to solve problems with varying degrees of difficulty.

IAI.C3.1.2 Plan and develop programs when given structured data sets using a process that incorporates development, feedback, and refinement for accuracy.

IAI.C3.1.3 Plan and develop programs when given unstructured data sets using a process that incorporates development, feedback, and refinement for accuracy.

IAI.C3.2.1 Evaluate a program through a review process (e.g., code review, beta testing, pilot group).

IAI.C3.2.2A Use common evaluation tools associated with structured data sets (e.g., R^2, accuracy, recall, precision, F1 Score, confusion matrix) and make refinements to improve accuracy.

IAI.C3.2.2B Describe the existence of outliers associated with the given structured data set and evaluation results, expressing how the existing outliers will be used to improve program accuracy.

IAI.C3.2.3A Use common evaluation tools associated with structured data sets (e.g., R2, mean squared error, accuracy recall) and make refinements to improve accuracy.

IAI.C3.2.3B Describe the existence of outliers associated with given unstructured data set and evaluation results, expressing how the existing outliers will be used to improve program accuracy.

IAI.C3.3.1 Identify and use appropriate documentation methods while developing programs (e.g., inline comments, procedure header, purposeful naming).

IAI.C3.3.2 Document programs that use non-user-created resources (e.g., code, media, libraries) giving attribution to the original creator.

IAI.C3.3.3 Document programs in order to make them easier to follow, test, and debug.

IAI.D. IMPACTS OF COMPUTING

Unit Description: AI solution designers and users understand the history and evolution of AI solutions, including both the benefits to society and global impact of their use. The following accountability criteria are considered essential for students in the Artificial Intelligence program of study.

IAI.D1. Students will research and analyze historical and current computing and AI applications, describing their global impact.

IAI.D1.1.1 Research advancing and emerging technologies (e.g., artificially intelligent agents, blockchain, extended reality, Internet of Things (IoT), machine learning, robotics).

IAI.D1.1.2 Research cutting-edge technologies that incorporate artificial intelligence

and machine learning as a core component of its decision-making processes (e.g., autonomous vehicles, recommended purchase suggestions, speech recognition).

IAI.D1.1.3 Research potential future outcomes, both positive and negative, of artificial intelligence and machine learning.

IAI.D1.3.2 Discuss the advantages and disadvantages of advancing and emerging technologies over time (e.g., the impacts of artificial intelligence, virtual reality, and biometrics on productivity, job loss, inventions, quality of life, and globalization).

IAI.D2. Students will evaluate the evolving legal and ethical tradeoffs that shape computing and AI practices.

IAI.D2.1.1 Research and describe legal and ethical implications of computing and AI solutions.

IAI.D2.1.3 Justify intended and unintended outcomes of computing and AI solutions (e.g., internal, and external activities including social media/online search use, purchase/use history, geolocation).

IAI.D2.1.4 Distinguish among ethical, unethical, legal, and illegal computing and AI practices (e.g., fair-use, illegal music/video downloads, sharing copyrighted pictures/videos, black-hat hacking, white-hat hacking, AI design with intended bias).

IAI.D2.2.1 Define and compare the ethical and legal implications of AI.

IAI.D2.2.3 Analyze real-world Artificial Intelligence scenarios to determine the ethical and legal implications.

IAI.E. PRIVACY AND SECURITY

Unit Description: AI solution designers and users understand security and privacy protocols associated with AI solutions and the importance of safeguarding data throughout its use. The following accountability criteria are considered essential for students in the Artificial Intelligence program of study.

IAI.E1. Students will research security and privacy protocols associated with AI and ML solutions and apply the protocols to protect the data throughout the processes.

IAI.E1.1.2 Discuss security and privacy issues that relate to AI applications.

IAI.E1.1.3 Research the security vulnerabilities of machine learning models and ways to mitigate them.

IAI.E1.2.2A Evaluate the issues related to privacy and security in the development and use of AI and ML models.

IAI.E1.2.2B Research the ethical, security, and privacy issues that affect data gathering, storage and overall data quality that can contribute to bias in a model.

IAI.E1.2.3 Evaluate methods of direct and indirect AI interaction, such as using AI-enabled systems, contributing data to a dataset, and trading privacy and security for access to an AI tool.