Artificial Intelligence & Data Science

Course Objective & Course Outcome

Sub: Discrete Mathematics (210241)

CO No.	Course Objective	Course Outcome
1	To introduce students to understand, explain, and apply the foundational mathematical concepts at the core of computer science.	Formulate problems precisely, solve the problems, apply formal proof techniques, and explain the reasoning clearly.
2	To understand use of set, function and relation models to understand practical examples, and interpret the associated operations and terminologies in context.	Apply appropriate mathematical concepts and skills to solve problems in both familiar and unfamiliar situations including those in real-life contexts.
3	To acquire knowledge of logic and proof techniques to expand mathematical maturity.	Design and analyse real world engineering problems by applying set theory, propositional logic and to construct proofs using mathematical induction.
4	To learn the fundamental counting principle, permutations, and combinations.	Specify, manipulate and apply equivalence relations; construct and use functions and apply these concepts to solve new problems.
5	To study how to model problem using graph and tree.	Calculate numbers of possible outcomes using permutations and combinations; to model and analyze computational processes using combinatorics.
6	To learn how abstract algebra is used in coding theory.	Model and solve computing problem using tree and graph and solve problems using appropriate algorithms.
7		Analyze the properties of binary operations, apply abstract algebra in coding theory and evaluate the algebraic structures.

Sub: Fundamentals of Data Structures (210242)

CO No.	Course Objective	Course Outcome
1	To understand the standard and abstract data representation methods	Design the algorithms to solve the programming problems, identify appropriate algorithmic strategy for specific application, and analyze the time and space complexity.
2	To acquaint with the structural constraints and advantages in usage of the data.	Discriminate the usage of various structures, Design/Program/Implement the appropriate data structures; use them in implementations of abstract data types and Identity the appropriate data structure in approaching the problem solution.
3	To understand various data structures, operations on it and the memory requirements	Demonstrate use of sequential data structures-Array and Linked lists to store and process data.
4	To understand various data searching and sorting methods.	Understand the computational efficiency of the principal algorithms for searching and sorting and choose the most efficient one for the application.
5	To understand various algorithmic strategies to approach the problem solution.	Compare and contrast different implementations of data structures (dynamic and static).
6		Understand, Implement and apply principles of data structures-stack and queue to solve computational problems.

Sub: Object Oriented Programming (210243)

CO No.	Course Objective	Course Outcome
1	To learn the object-oriented programming paradigm, focusing on the definition and use of classes along with the fundamentals of object-oriented design	Apply constructs- sequence, selection and iteration; classes and objects, inheritance, use of predefined classes from libraries while developing software.
2	To learn the syntax and semantics of the C++ programming language.	Design object-oriented solutions for small systems involving multiple objects.
3	To understand the concept of data abstraction and encapsulation, how to design C++ classes for code reuse, how to implement copy constructors and class member functions, to overload functions and operators in C++.	Use virtual and pure virtual function and complex programming situations.
4	To learn how inheritance and virtual functions implement dynamic binding with polymorphism.	Apply object-oriented software principles in problem solving.
5	To learn how to design and implement generic classes with C++ templates and how to use exception handling in C++ programs.	Analyze the strengths of object-oriented programming.
6		Develop the application using object oriented programming language (C++).

Sub: Computer Graphics (210244)

CO No.	Course Objective	Course Outcome
1	Remembering: To acquaint the learner with the basic concepts of Computer Graphics.	Identify the basic terminologies of Computer Graphics and interpret the mathematical foundation of the concepts of computer graphics.
2	Understanding: To learn the various algorithms for generating and rendering graphical figures.	Apply mathematics to develop Computer programs for elementary graphic operations.
3	Applying: To get familiar with mathematics behind the graphical transformations.	Illustrate the concepts of windowing and clipping and apply various algorithms to fill and clip polygons.
4	Understanding: To understand and apply various methods and techniques regarding projections, animation, shading, illumination and lighting.	Understand and apply the core concepts of computer graphics, including transformation in two and three dimensions, viewing and projection.
5	Creating: To generate Interactive graphics using OpenGL.	Understand the concepts of color models, lighting, shading models and hidden surface elimination.
6		Create effective programs using concepts of curves, fractals, animation and gaming.

Sub: Operating Systems (217521)

CO No.	Course Objective	Course Outcome
1	To understand functions of operating system	CO1: Enlist functions of OS and types of system calls
2	To learn and understand process, resource and memory management.	CO2: Apply process scheduling algorithms to solve a given problem
3	To learn and understand file and I/O management.	CO3: Illustrate deadlock prevention, avoidance and recovery
		CO4: Explain memory management technique
		CO5: Illustrate I/O and file management policies
		CO6: Describe Linux process management

Sub: Data Structures Laboratory (217522)

CO No.	Course Objective	Course Outcome
1	To understand basic techniques and strategies of algorithm analysis, the memory requirement for various data structures like array, linked list, stack, queue etc using concepts of python and C++ programming language.	Use algorithms on various linear data structure using sequential organization to solve real life problems
2		Analyze problems to apply suitable searching and sorting algorithm to various applications.
3		Analyze problems to use variants of linked list and solve various real life problems.
4		Designing and implement data structures and algorithms for solving different kinds of problems.

Sub: OOP and Computer Graphics Laboratory (217523)

CO No.	Course Objective	Course Outcome
1	To understand basics of Computer Graphics, apply various methods and techniques for implementing line- circle drawing, projections, animation, shading, illumination and lighting using concepts of Object Oriented Programming.	Understand and apply the concepts like inheritance, polymorphism, exception handling and generic structures for implementing reusable programming codes.
2		Analyze the concept of file and apply it while storing and retrieving the data from secondary storages.
3		Analyze and apply computer graphics algorithms for line-circle drawing, scan conversion and filling with the help of object oriented programming concepts.
4		Understand the concept of windowing and clipping and apply various algorithms to fill and clip polygons.
5		Apply logic to implement, curves, fractals, animation and gaming programs.

Sub: Operating Systems Laboratory (217524)

CO No.	Course Objective	Course Outcome
1	To learn and understand process, resource and memory management	**CO1:** Choose the best CPU scheduling algorithm for a given problem instance
2	To understand shell scripting and shell programming	**CO2:** Demonstrate interprocess communication
3		**CO3:** Apply deadlock avoidance algorithm
		CO4: Compare performance of page replacement algorithms
		CO5: Demonstrate the fundamental UNIX commands & system calls

Sub: Business Communication Skills (217525)

CO No.	Course Objective	Course Outcome
1	To facilitate Holistic growth	Express effectively through verbal/oral communication and improve listening skills
2	To make the engineering students aware, about the importance, the role and the content of business communication skills	Write precise briefs or reports and technical documents.
3	To develop the ability of effective communication through individual and group activities	Prepare for group discussion / meetings / interviews and presentations.
4	To expose students to right attitudinal and behavioural aspects and to build the same through various activities	Explore goal/target setting, self-motivation and practicing creative thinking.
5		Operate effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership qualities.

Sub: Humanity and Social Science (217526)

CO No.	Course Objective	Course Outcome
1	To facilitate Holistic growth	Aware of the various issues concerning humans and society
2	To Educate about Contemporary, National and International affairs	Aware about their responsibilities towards society.
3	To bring awareness about the responsibility towards society	Sensitized about broader issues regarding the social, cultural, economic and human aspects, involved in social changes.
4	To give an insight about the emergence of Indian society and the relevance of Economics	Able to understand the nature of the individual and the relationship between self and the community.
5		Able to understand major ideas, values, beliefs, and experiences that have shaped human history and cultures.

Sub: Audit Course 3 (Green Construction and Design) (217527-I)

CO No.	Course Objective	Course Outcome
1	To motivate students for undertaking green construction projects, technical aspects of their design, obstacles to getting them done, and future directions of the field.	**CO1: Understand** the importance of environment friendly society.
2	To increase awareness of green construction issues, so that students will know the range of existing knowledge and issues	**CO2: Apply** primary measures to reduce carbon emissions from their surroundings.
3	Proper use of energy, water and other resources without harming environment	**CO3: Learn** role of IT solutions in design of green buildings.
4	To reduce waste pollution and Environment Degradation.	**CO4: Understand** the use of software systems to complete statutory compliances involved in the design of a new home or office building through green construction
5		

Sub: Audit Course 3 (Social Awareness and Governance Program) (217527-II)

CO No.	Course Objective	Course Outcome
1	To Increase community awareness about social issues and to promote the practice of good governance in both private and public institutions, through policy advocacy and awareness creation in order to ensure proper utilization of public resources and good service delivery.	**CO1: Understand** social issues and responsibilities as member of society.
2	Increase community awareness on health, education, and human rights.	**CO2: Apply** social values and ethics in decision making at social or organizational level
3	Transferring costs of social activities to other various segments of society.	**CO3: Promote** obstacles in national integration and role of youth for National Integration
4	To enhance youth participation in decision-making, democracy and economic develop	**CO4: Demonstrate** basic features of Indian Constitution
5	To Increase community awareness about social issues and to promote the practice of good governance in both private and public institutions, through policy advocacy and awareness creation in order to ensure proper utilization of public resources and good service delivery.	

Sub: Audit Course 3 (Environmental Studies) (217527-III)

CO No.	Course Objective	Course Outcome
1	Understanding the importance of ecological balance for sustainable development.	**CO1: Comprehend** the importance of ecosystem and biodiversity.
2	Understanding the impacts of developmental activities and mitigation measures.	**CO2: Correlate** the human population growth and its trend to the environmental degradationand develop the awareness about his/her role towards

		environmental protection and prevention
3	Understand and realize the multi-disciplinary nature of the environment, its components, and inter-relationship between man and environment	**CO3: Identify** different types of environmental pollution and control measures
4	Understand the relevance and importance of the natural resources in the sustenance of life on earth and living standard	**CO4: Correlate** the exploitation and utilization of conventional and non-conventional resources

Sub: Audit Course 3 (Smart Cities) (217527-IV)

CO No.	Course Objective	Course Outcome
1	To identify urban problems	**CO1: Understand** the dynamic behavior of the urban system by going beyond the physical appearance and by focusing on representations, properties and impact factors
2	To study Effective and feasible ways to coordinate urban technologies.	**CO2: Explore** the city as the most complex human-made organism with a metabolism that can be modeled in terms of stocks and flows
3	To study models and methods for effective implementation of Smart Cities	**CO3: Knowledge** about data-informed approaches for the development of the future city, basedon crowd sourcing and sensing
4	To study new technologies for Communication and Dissemination.	**CO4: Knowledge** about the latest research results in for the development and management offuture cities
5	To study new forms of Urban Governance and Organization.	**CO5: Understand** how citizens can benefit from data-informed design to develop smart and responsive cities

Sub: Audit Course 3 Foreign Language- Japanese (Module 1) (217527-V)

CO No.	Course Objective	Course Outcome
1	To meet the needs of ever-growing industry with respect to language support.	**CO1:** Will have ability of basic communication.
2	To get introduced to Japanese society and culture through language.	**CO2:** Will have the knowledge of Japanese script.
		CO3: Will get introduced to reading, writing and listening skills
		CO4: Will develop interest to pursue professional Japanese Language course.

Semester IV

Sub: Statistics (217528)

CO No.	Course Objective	Course Outcome
1	Demonstrate knowledge of probability and the standard statistical distributions.	CO1: Identify the use of appropriate statistical terms to describe data
		CO2: Use appropriate statistical methods to collect, organize, display, and analyze relevantdata.
		CO3: Use distribution functions for random variables
		CO4: Distinguish between correlation coefficient and regression
		CO5: Understand tests for hypothesis and its significance

Sub: Internet of Things (217529)

CO No.	Course Objective	Course Outcome
1	Understand the Basic Digital Electronics and microprocessors.	**CO1:** Have a thorough understanding of the structure, function and characteristics of computer systems and Understand the structure of various number systems and its application in digital design.
2	To introduce students with the architecture and operation of typical microprocessors and microcontrollers and its interfacing	**CO2:** Develop the skill set to build IoT systems and sensor interfacing.
3	Understand the definition and significance of the Internet of Things.	**CO3:** Explain the concept of Internet of Things and identify the technologies that make up theinternet of things
4	Interface and deploy analog and digital sensors.	**CO4:** Analyze trade-offs in interconnected wireless embedded device networks. SelectAppropriate Protocols for IoT Solutions
5	To learn real world application scenarios of IoT along with its societal and economic impactusing case studies.	**CO5:** Design a simple IoT system comprising sensors by analyzing the requirements of IoTApplication
		CO6: Identify the Application of IoT in automation of Commercial and Real-World examples

Sub: **Data Structures and Algorithms (210252)**

CO No.	Course Objective	Course Outcome
1	To develop a logic for graphical modelling of the real-life problems.	**CO1: Identify and articulate** the complexity goals and benefits of a good hashing scheme for real-world applications.
2	To suggest appropriate data structure and algorithm for graphical solutions of the problems.	**CO2: Apply** non-linear data structures for solving problems of various domain.
3	To understand advanced data structures to solve complex problems in various domains.	**CO3: Design and specify** the operations of a nonlinear-based abstract data type and implement themin a high-level programming language.
4	To operate on the various structured data	**CO4: Analyze** the algorithmic solutions for resource requirements and optimization
5	To build the logic to use appropriate data structure in logical and computational solutions.	**CO5: Use** efficient indexing methods and multiway search techniques to store and maintain data.
6	To understand various algorithmic strategies to approach the problem solution.	**CO6: Use** appropriate modern tools to understand and analyze the functionalities confined to the secondary storage.

Sub: Software Engineering (210253)

CO No.	Course Objective	Course Outcome
1	To learn and understand the principles of Software Engineering.	**CO1: Analyze** software requirements and formulate design solution for a software.
2	To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements.	**CO2: Design** applicable solutions in one or more application domains using software engineering approaches that integrate ethical, social, legal and economic concerns.
3	To apply design and testing principles to software project development.	**CO3: Apply** new software models, techniques and technologies to bring out innovative and
4	To understand project management through life cycle of the project.	novelistic solutions for the growth of the society in all aspects and evolving into their continuous professional development.
		CO4: Model and design User interface and component-level.
		CO5: Identify and handle risk management and software configuration management.
		CO6: Utilize knowledge of software testing approaches, approaches to verification and validation.
		CO7: Construct software of high quality – software that is reliable, and that is reasonably easy to understand, modify and maintain efficient, reliable, robust and cost-effective software solutions

Sub: Management Information Systems (217530)

CO No.	Course Objective	Course Outcome
1	To understand concepts of Management Information System and Business intelligence forMIS.	**CO1: Explain** the concepts of Management Information System and Business intelligence for MIS.
2	To recognize the need of an information system in today's global business with tools andtechnologies.	**CO2: Illustrate** the need of information systems in global business and ethical issues.
3	To identify IT infrastructure components and to study security in the Information System.	**CO3: List** the IT infrastructure components and **explain** security in the Information System.
4	To understand the importance of project management and the international information system.	**CO4: Demonstrate** the importance of project management and **extend** its use in the internationalinformation system.
5	To understand the concepts of decision support systems for business applications.	**CO5: Illustrate** the concepts of decision support systems for business applications.
6	To understand artificial intelligence and data science for Management Information System	**CO6: Relate** artificial intelligence and data science for Management Information System.

Sub: Internet of Things Laboratory (217531)

CO No.	Course Objective	Course Outcome
1	Hardware platforms and operating systems commonly used in IoT systems.	CO1: Understand IOT Application Development using Raspberry Pi/ Beagle board/ Arduino board
2	Help the students in providing a good learning environment and also work with real time problems faced in day to day life.	CO2: Develop and modify the code for various sensor-based applications using wireless sensor modules and working with a variety of modules like environmental modules.
		CO3: Make use of Cloud platform to upload and analyse any sensor data

Sub: Data Structures and Algorithms Laboratory (217532)

CO No.	Course Objective	Course Outcome
1	To **understand** practical implementation and usage of nonlinear data structures for solving problems of different domain.	**CO1: Understand** the ADT/libraries, hash tables and dictionary to design algorithms for a specific problem.
2	To strengthen the ability to identify and **apply** the suitable data structure for the given real-world problems.	**CO2:** Choose most appropriate data structures and **apply** algorithms for graphical solutions of the problems.
3	To **analyse** advanced data structures including hash table, dictionary, trees, graphs, sorting algorithms and file organization	**CO3: Apply** and **analyse** nonlinear data structures to solve real world complex problems.
		CO4: Apply and **analyze** algorithm design techniques for indexing, sorting, multi-way searching, file organization and compression.
		CO5: Analyse the efficiency of most appropriate data structure for creating efficientsolutions for engineering design situations

Sub: Project Based Learning II (217533)

CO No.	Course Objective	Course Outcome
1	To develop critical thinking and problem-solving ability by exploring and proposing solutions to realistic/social problem	**CO1:** Identify the real-life problem from societal need point of view
2	To Evaluate alternative approaches, and justify the use of selected tools and methods.	**CO2:** Choose and compare alternative approaches to select most feasible one
3	To emphasizes learning activities that are long-term, inter-disciplinary and student-centric.	**CO3:** Analyze and synthesize the identified problem from technological perspective
4	To engages students in rich and authentic learning experiences.	**CO4:** Design the reliable and scalable solution to meet challenges
5	To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.	**CO5:** Evaluate the solution based on the criteria specified
6	To develop an ecosystem that promotes entrepreneurship and research culture among the students.	**CO6:** Inculcate long life learning attitude towards the societal problems

Sub: Code of Conduct (217534)

CO No.	Course Objective	Course Outcome
1	To promote ethics, honesty and professionalism.	**CO1: Understand** the basic perception of profession, professional ethics, various moral and social issues, industrial standards, code of ethics and role of professional ethics in engineering field.
2	To set standards that are expected to follow and to be aware that If one acts unethically what are the consequences.	**CO2: Aware** of professional rights and responsibilities of an engineer, responsibilities of an engineer for safety and risk benefit analysis.
3	To provide basic knowledge about engineering Ethics, Variety of moral issues and Moral dilemmas, Professional Ideals and Virtues	**CO3: Understand** the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
4	To provide basic familiarity about Engineers as responsible Experimenters, Research Ethics, Codes of Ethics, Industrial Standards, Exposure to Safety and Risk, Risk Benefit Analysis	**CO4: Acquire** knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives.
5	To have an idea about the Collegiality and Loyalty, Collective Bargaining, Confidentiality, Occupational Crime, Professional, Employee, Intellectual Property Rights	

Audit Course 4 (217535)

Sub: Water Management (217535-I)

CO No.	Course Objective	Course Outcome
1	To develop understanding of water recourses.	**CO1: Understand the** global water cycle and its various processes
2	To study global water cycle and factors that affect this cycle.	**CO2: Understand** climate change and their effects on water systems
3	To analyze the process for water resources and management.	**CO3: Understand Drinking** treatment and quality of groundwater and surface water
4	To study the research and development areas necessary for efficient utilization and management of water recourses.	**CO4: Understand** the Physical, chemical, and biological processes involved in watertreatment and distribution.

Sub: Intellectual Property Rights and Patents (217535-II)

CO No.	Course Objective	Course Outcome
1	To encourage research, scholarship, and a spirit of inquiry	**CO1: Understand** the fundamental legal principles related to confidential information, copyright, patents, designs, trademarks and unfair competition
2	To encourage students at all levels to develop patentable technologies.	**CO2: Identify, apply** and **assess** principles of law relating to each of these areas ofintellectual property
3	To provide environment to the students of the Institute for creation, protection, and commercialization of intellectual property and to stimulate innovation.	**CO3: Apply** the appropriate ownership rules to intellectual property you have been involvedin creating

Sub: The Science of Happiness(217535-III)

CO No.	Course Objective	Course Outcome
1	To understand the feeling of happiness	**CO1: Understand** what happiness is and why it matters to you
2	To study the sources of positive feelings	**CO2: Learn** how to increase your own happiness
3	To analyze the anatomy of the happiness system	**CO3: Understand** of the power of social connections and the science of empathy
4	To study the effect of thoughts and emotions on the happiness system	**CO4: Understand** what is mindfulness and its real-world applications

Sub: Yoga and Meditation(217535-IV)

CO No.	Course Objective	Course Outcome
1	To impart knowledge about the basic technique and practice of yoga, including instruction in breath control, meditation, and physical postures	**CO1: Understand** philosophy and religion as well as daily life issues will be challenged and enhanced.
2	To gain an intellectual and theoretical understanding of the principles embodied in the Yoga Sutras, the Bhagavad-Gita, and other important texts and doctrines	**CO2: Enhances** the immune system.
3	Relaxation and stress reduction, Personal insight and self-understanding, Personal empowerment, Gaining wisdom and spiritual discernment	**CO3:** Intellectual and philosophical understanding of the theory of yoga and basic related Hindu scriptures will be developed.
4	Awakening the abilities or powers of the Super conscious mind	**CO4:** Powers of concentration, focus, and awareness will be heightened

Sub: Foreign Language (Japanese) (217535-V) Module 2

CO No.	Course Objective	Course Outcome
1	To meet the needs of ever-growing industry with respect to language support.	CO1: have ability of basic communication.
2	To get introduced to Japanese society and culture through language.	CO2: have the knowledge of Japanese script.
3		CO3: get introduced to reading, writing and listening skills
4		CO4: develop interest to pursue professional Japanese Language course