

**PROGRAM NAME: B. SC. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**  
**Program Code: 28A**

**Graduate attributes:**

GA1	Domain Knowledge	<b>Knowledge</b>
GA2	Domain Analysis	
GA3	Design and Development of Solutions	
GA4	Communication Skills	<b>Skills</b>
GA5	Innovative and Entrepreneurial Skills	
GA6	Leadership and Management Skills	
GA7	Individual and Team Work	<b>Attitude</b>
GA8	Ethical and Social Responsibility	
GA9	Life-long Learning	

**PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)**

<b>The B.Sc. Artificial Intelligence and Machine Learning</b> program describe accomplishments that graduates are expected to attain within five to seven years after graduation	
<b>PEO1</b>	Expertized with the principles of Artificial Intelligence and problem solving, inference, perception, knowledge representation, and learning
<b>PEO2</b>	Exhibit high standards with regard to application of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models
<b>PEO3</b>	Investigate with a machine learning model for simulation and analysis and explore the scope, potential, limitations, and implications of intelligent systems.

## PROGRAMME SPECIFIC OUTCOMES (PSOs)

<b>After the successful completion of B.Sc. Artificial Intelligence and Machine Learning program the students are expected to</b>	
<b>PS01</b>	Exhibit good domain knowledge and completes the assigned responsibilities effectively and efficiently in par with the expected quality standards for Artificial Intelligence and Machine Learning professional
<b>PS02</b>	Apply the technical and critical thinking skills in the discipline of Artificial Intelligence and machine learning to find solutions for complex problems.
<b>PS03</b>	Design and develop research-based solutions for complex problems in artificial intelligence and machine learning industry through appropriate consideration for the public health, safety, cultural, societal, and environmental concerns.
<b>PS04</b>	Establish the ability to Listen, read, proficiently communicate and articulate complex ideas with respect to the needs and abilities of diverse audiences.
<b>PS05</b>	Provide innovative ideas to instigate new business ventures in the hospitality industry

## PROGRAMME OUTCOMES (POs)

<b>On successful completion of the B.Sc. Artificial Intelligence and Machine Learning</b>	
<b>P01</b>	Exhibit good <b>domain knowledge</b> and completes the assigned responsibilities effectively and efficiently in par with the expected quality standards.
<b>P02</b>	Apply <b>analytical and critical thinking</b> to identify, formulate, analyze, and solve complex problems in order to reach authenticated conclusions
<b>P03</b>	<b>Design and develop research based solutions</b> for complex problems with specified needs through appropriate consideration for the public health, safety, cultural, societal, and environmental concerns.
<b>P04</b>	Establish the ability to <b>Listen, read, proficiently communicate and articulate complex ideas</b> with respect to the needs and abilities of diverse audiences.
<b>P05</b>	<b>Deliver innovative ideas to instigate new business ventures</b> and possess the qualities of a good entrepreneur
<b>P06</b>	Acquire the qualities of a <b>good leader and engage in efficient decision-making.</b>
<b>P07</b>	Graduates will be able to undertake any responsibility as an <b>individual/member of multidisciplinary teams and have an understanding of team leadership</b>
<b>P08</b>	Function as <b>socially responsible individual</b> with ethical values and accountable to ethically validate any actions or decisions before proceeding and actively contribute to the societal concerns.
<b>P09</b>	Identify and <b>address own educational needs</b> in a changing world in ways sufficient to maintain the competence and to allow them to contribute to the advancement of Knowledge
<b>P010</b>	<b>Demonstrate knowledge and understanding of management principles</b> and apply these to one own work to manage projects and in multidisciplinary environment.

## COURSE OUTCOME(CO's)

### SEMESTER - I

#### COURSE NAME: OBJECT ORIENTED PROGRAMMING IN C++

#	Course Outcome	
C01	Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects	K1
C02	Demonstrate the various basic programming constructs like decision making statements. Looping statements and functions	K2
C03	Explain the object oriented concepts like overloading, inheritance, polymorphism, virtual functions, constructors and destructors	K3
C04	Explain the various file stream classes; file types, usage of templates and exception handling mechanisms.	K3
C05	Compare the pros and cons of procedure oriented language with the concepts of object oriented language	K5
C06	Develop programs incorporating the programming constructs of object oriented programming concepts	K5

#### COURSE NAME: PROGRAMMING IN LAB C++

#	Course Outcome	
C01	Apply the various basic programming constructs like decision making statements. Looping statements, functions, concepts like overloading, inheritance, polymorphism, virtual functions, constructors and destructors	K3
C02	Illustrate the concept of Virtual Classes, inline functions and friend functions	K4
C03	Compare the various file stream classes; file types, usage of templates and exception handling mechanisms.	K5
C04	Compare the pros and cons of procedure oriented language with the concepts of object oriented language	K5

#### COURSE NAME: DATA STRUCTURES

#	Course Outcome	
C01	Define the concept of Data structure and list the various classifications of data structures.	K1
C02	Demonstrate how arrays, stacks, queues, linked lists, trees, heaps, Graphs and Hash Tables are represented in the main memory and various operations are performed on those data structures.	K2
C03	Illustrate the various file organizations like Sequential, Random and Linked organizations.	K2

C04	Discover the real time applications of the various data structures	<b>K3</b>
C05	Design algorithms for various sorting and searching techniques	<b>K4</b>

**COURSE NAME: DISCRETE MATHEMATICS**

#	Course Outcome	
C01	Understand discrete mathematical preliminaries and apply discrete mathematics in formal representation of various computing constructs	<b>K1</b>
C02	Demonstrate an understanding of relations ,functions, Combinatorics and lattices	<b>K2</b>
C03	Apply the techniques of discrete structures and logical reasoning to solve a variety of problems and write an argument using logical notation	<b>K3</b>
C04	Analyze and construct mathematical arguments that relate to the study of discrete Structures	<b>K3</b>
C05	Develop and model problems with the concepts and techniques of discrete mathematics.	<b>K5</b>

**SEMESTER - II**

**COURSE NAME: JAVA PROGRAMMING**

#	Course Outcome	
C01	Recite the history of JAVA and its evolution	<b>K1</b>
C02	Explain the various programming language constructs, object oriented concepts like overloading, inheritance, polymorphism, Interfaces , threads, exception handling and packages	<b>K2</b>
C03	Illustrate the concepts of Applets, files and the concept of stream classes.	<b>K3</b>
C04	Outline the benefits and applications of objects oriented programming concepts and defend how JAVA differs from other programming languages	<b>K3</b>
C05	Judge the pros and cons of other object oriented language with the concepts of JAVA	<b>K4</b>

**COURSE NAME: PROGRAMMING LAB- JAVA**

#	Course Outcome	
C01	Apply the various basic programming constructs of JAVA like decision making statements. Looping statements, overloading, inheritance, polymorphism, constructors and destructors	<b>K3</b>
C02	Illustrate the concepts of threading and multi-threading	<b>K4</b>
C03	Design programs using various file stream classes; file types, and frames	<b>K4</b>

**COURSE NAME: INTERNET BASICS LABORATORY**

#	Course Outcome	
C01	Apply the predefined procedures to create Gmail account, check and receive messages	<b>K3</b>
C02	Apply the predefined procedures to perform various basic operations on internet	<b>K3</b>
C03	Utilize various Google applications like docs, Google classroom, Google drive, Google forms, Google meet and slides	<b>K3</b>

**COURSE NAME: APPLIED MATHEMATICS**

#	Course Outcome	
C01	Demonstrate the concepts of Numbers, Quantification, sets, logical reasoning , probability and calculus	<b>K2</b>
C02	Apply the learned concepts to solve various mathematical problems related to the Domain	<b>K3</b>
C03	Apply various laws related to logarithms and sets to solve various mathematical problems	<b>K4</b>
C04	Solve problems related to permutation, combinations, mathematical and logical reasoning and calculus.	<b>K5</b>

**SEMESTER - III**

**COURSE NAME: PYTHON PROGRAMMING**

#	Course Outcome	
C01	Apply the various basic programming constructs like operators, expressions, decision making statements and Looping statements	<b>K2</b>
C02	Summarize the concept of lists, tuples , functions and error handling	<b>K2</b>
C03	Apply the concept of Decision making statements, looping constructs , functions for solving basic programs	<b>K3</b>
C04	Analyze the concepts of Lists, tuples and error handling mechanisms	<b>K4</b>
C05	Evaluate a program incorporating all the python language constructs	<b>K5</b>

**COURSE NAME: PYTHON PROGRAMMING LAB**

#	Course Outcome	
C01	Apply the concept of Decision making statements, looping constructs , functions for solving basic programs	<b>K3</b>
C02	Analyze the concepts of Lists, tuples and error handling mechanisms	<b>K4</b>
C03	Evaluate a program incorporating all the python language constructs	<b>K5</b>

**COURSE NAME: FUZZY LOGIC AND NEURAL NETWORKS**

#	Course Outcome	
1	Explain the basic concepts of fuzzy sets and fuzzy logic	<b>K2</b>
2	Understanding of the basic mathematical elements of the theory of fuzzy sets.	<b>K2</b>
3	Explain the fundamentals and history of neural networks	<b>K2</b>
4	Outline about the mapping and recurrent networks	<b>K2</b>
5	Analyze the applications of fuzzy logic and neural network for various applications	<b>K3</b>

**COURSE NAME: DESIGN AND ANALYSIS OF ALGORITHMS**

#	Course Outcome	
C01	Explain the importance of algorithm analysis and the notation used	<b>K2</b>
C02	Apply the various frameworks for analyzing recursive and non-recursive algorithms to find the time complexity	<b>K3</b>
C03	Illustrate the various algorithm design techniques like divide and conquer, greedy algorithms, brute force and dynamic programming	<b>K4</b>
C04	Illustrate the various iterative method like Simplex Method, Maximum-Flow Problem, Maximum Matching in Bipartite Graphs, Stable marriage Problem..	<b>K4</b>
C05	Compare the P, NP, NP –Complete and NP-Hard type of problems	<b>K4</b>
C06	Compare algorithms by calculating their time efficiency using the prescribed Framework	<b>K5</b>

**COURSE NAME: SKILL BASED SUBJECT – I INTERNET OF THINGS(IOT)**

#	Course Outcome	
C01	Explain the definition and usage of the term -Internet of Things   in different contexts	<b>K2</b>
C02	Understand the key components that make up an IoT system	<b>K2</b>
C03	Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack	<b>K3</b>
C04	Apply the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis	<b>K3</b>
C05	Discover where the IoT concept fits within the broader ICT industry and possible future trends	<b>K4</b>

**SEMESTER - IV**

**COURSE NAME: ARTIFICIAL INTELLIGENCE AND KNOWLEDGE REPRESENTATION**

#	Course Outcome	
C01	Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.	<b>K2</b>
C02	Understanding about the basic concepts of Software agents ad representation of Knowledge	<b>K2</b>
C03	Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.	<b>K2</b>
C04	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.	<b>K3</b>

**COURSE NAME: R PROGRAMMING**

#	Course Outcome	
C01	Understand the basics in R programming in terms of constructs, control statements, string functions	<b>K2</b>
C02	Understand the use of R for Big Data analytics	<b>K2</b>
C03	Apply R programming for Text processing	<b>K3</b>
C04	Appreciate and apply the R programming from a statistical perspective	<b>K3</b>



**COURSE NAME: R PROGRAMMING LAB**

#	Course Outcome	
C01	Understand the basics in R programming in terms of constructs, control statements, string functions	K2
C02	Understand the use of R for Big Data analytics	K2
C03	Apply R programming for Text processing	K3
C04	Appreciate and apply the R programming from a statistical perspective	K3

**COURSE NAME: MACHINE LEARNING- BASICS**

#	Course Outcome	
C01	Understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.	K2
C02	Understanding of the strengths and weaknesses of many popular machine learning approaches.	K2
C03	Explain about the concepts of computational learning theory and dimensionality Reduction	K2
C04	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.	K3

**COURSE NAME: SKILL BASED COURSE II: CAPSTONE PROJECT WORK**

#	Course Outcome	
C01	Illustrate a real world problem and identify the list of project requirements	K3
C02	Judge the features of the project including forms, databases and reports	K5
C03	Design code to meet the input requirements and to achieve the required output	K6
C04	Compose a project report incorporating the features of the project	K6

**SEMESTER - V**

**COURSE NAME: MACHINE LEARNING TECHNIQUES**

#	Course Outcome	
C01	Understand the basic concepts and techniques of Machine Learning.	K2
C02	Explain the regression methods, classification methods, clustering methods.	K2
C03	Understand the inference and learning algorithms for the hidden Markov model.	K2
C04	Demonstrate Dimensionality reduction Techniques	K2
C05	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.	K3

**COURSE NAME: MACHINE LEARNING LAB**

#	Course Outcome	
C01	Understand the basic concepts and techniques of Machine Learning.	K2
C02	Explain the regression methods, classification methods, clustering methods.	K2
C03	Understand the inference and learning algorithms for the hidden Markov model.	K2
C04	Demonstrate Dimensionality reduction Techniques	K2
C05	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.	K3

**COURSE NAME: DEEP LEARNING**

#	Course Outcome	
C01	Understand the basic concepts and techniques of Deep Learning.	K2
C02	To understand and apply the Machine learning principles	K2
C03	To study the deep learning architectures	K2
C04	Explore and create deep learning applications with tensor flow	K3

**COURSE NAME: ELECTIVE – I BUSINESS DATA ANALYTICS**

#	Course Outcome	
C01	Understand and critically apply the concepts and methods of business analytics	K2
C02	Demonstration the various methodologies of descriptive statistics	K2
C03	Understanding of modeling uncertainty and statistical inference	K2
C04	Understanding of analytical frameworks	K2

**COURSE NAME: ELECTIVE – I SOCIAL NETWORK ANALYSIS**

#	Course Outcome	
C01	Understand a broad range of network concepts and theories.	K2
C02	Appreciate how network analysis can contribute to increasing knowledge about diverse aspects of society.	K2
C03	Use a relational approach to answer questions of interest to them (i.e. be able to apply 'network thinking').	K3
C04	Analyse social network data using various software packages.	K3
C05	Present results from social network analysis, both orally and in writing.	K5

**COURSE NAME: ELECTIVE – I SOFTWARE AGENTS**

#	Course Outcome	
C01	Understanding the fundamentals of agents and agent programming paradigms.	K2
C02	Discussing the basics of java agents.	K2
C03	Learning the concepts of multivalent systems.	K2
C04	Understanding the concepts of intelligent software agents.	K2
C05	Understanding the agents and security.	K2

**COURSE NAME: SKILL BASED SUBJECT 3: ETHICAL HACKING**

#	Course Outcome	
C01	Explain the importance of security and various types of attacks	K2
C02	Understand the concepts of scanning and system hacking	K2
C03	Explain about penetration testing and its methodology	K2
C04	Identify the various programming languages used by security professional	K4

**SEMESTER - VI**

**COURSE NAME: NATURAL LANGUAGE PROCESSING**

#	Course Outcome	
C01	Understand the fundamental concepts and techniques of natural language processing (NLP)	K2
C02	Understanding of the models and algorithms in the field of NLP.	K2
C03	Demonstrate the computational properties of natural languages and the commonly used algorithms for processing linguistic information.	K2
C04	Understanding semantics and pragmatics of languages for processing	K2

**COURSE NAME: NATURAL LANGUAGE PROCESSING LAB**

#	Course Outcome	
C01	Understand the fundamental concepts and techniques of natural language processing (NLP)	K2
C02	Understanding of the models and algorithms in the field of NLP.	K2
C03	Demonstrate the computational properties of natural languages and the commonly used algorithms for processing linguistic information.	K2
C04	Understanding semantics and pragmatics of languages for processing	K2

**COURSE NAME: PROJECT WORK LAB**

#	Course Outcome	
C01	Formulate a real world problem and develop its requirements develop a design solution for a set of requirements	<b>K3</b>
C02	Test and validate the conformance of the developed prototype against the original requirements of the problem	<b>K5</b>
C03	Work as a responsible member and possibly a leader of a team in developing software solutions	<b>K3</b>
C04	Express technical ideas, strategies and methodologies in written form. Self-learn new tools, algorithms and techniques that contribute to the software solution of the project	<b>K1- K4</b>
C05	Generate alternative solutions, compare them and select the optimum one	<b>K6</b>

**COURSE NAME: ELECTIVE -II ARTIFICIAL NEURAL NETWORK AND FUZZY SYSTEMS**

#	Course Outcome	
C01	Explain the concepts of neural networks and , fuzzy logic	<b>K2</b>
C02	Understanding of the basic mathematical elements of the theory of fuzzy sets.	<b>K2</b>
C03	Understanding the differences and similarities between fuzzy sets and classical sets Theories	<b>K2</b>
C04	Solve problems that are appropriately solved by neural networks and fuzzy logic	<b>K3</b>

**COURSE NAME: ELECTIVE -II WEB APPLICATION SECURITY**

#	Course Outcome	
C01	Illustrate about the concept of HTML,DHTML, CSS and Java Script	<b>K2</b>
C02	Explain the history, characteristics, technologies, concepts, usage in web2.0 and web 3.0	<b>K2</b>
C03	Apply the core concepts of web applications to create web pages	<b>K3</b>
C04	Apply the concepts of servers side programming	<b>K3</b>

**COURSE NAME: ELECTIVE -II FUNDAMENTALS OF ROBOTICS**

#	Course Outcome	
C01	Describe the different physical forms of robot architectures.	<b>K2</b>
C02	Explain about the actuators and characteristics of actuating system	<b>K2</b>
C03	Demonstrate to mathematically describe a kinematic robot system.	<b>K2</b>
C04	Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty.	<b>K3</b>

**COURSE NAME: ELECTIVE -III EMBEDDED SYSTEMS**

#	Course Outcome	
C01	Understand hardware and software design requirements of embedded systems.	<b>K2</b>
C02	Explain about the architecture of microprocessor and operating systems in embedded Systems	<b>K2</b>
C03	Analyze the embedded systems' specification and develop software programs.	<b>K4</b>
C04	Evaluate the requirements of programming Embedded Systems, related software architectures and tool chain for Embedded Systems.	<b>K5</b>

**COURSE NAME: ELECTIVE -III PRINCIPLES OF SECURE CODING**

#	Course Outcome	
C01	Explain about the secure software development life cycle	<b>K2</b>
C02	Understand the secure coding techniques	<b>K2</b>
C03	Demonstrate the threat modeling process and benefits	<b>K2</b>
C04	Explain about the database and web specific issues	<b>K2</b>

**COURSE NAME: ELECTIVE -III OPEN SOURCE SOFTWARE**

#	Course Outcome	
C01	Explain about the need and importance of open source software	<b>K2</b>
C02	Demonstrate the concepts of open source software's	<b>K2</b>
C03	Apply the programming constructs of MySQL, PHP, Python and PERL to create programs	<b>K3</b>
C04	Develop small programs using open source software's	<b>K3</b>

**COURSE NAME: SKILL BASED SUBJECT 4: CAPSTONE PROJECT WORK PHASE II**

#	Course Outcome	
C01	Select appropriate input, output, form and table design	<b>K3</b>
C02	Design code to meet the input requirements and to achieve the required output	<b>K6</b>
C03	Compose a project report incorporating the features of the project	<b>K6</b>