B.Sc Computer Science with Data Science
COURSE OUTCOMES (COs)

On completion of the course students will be able to

COURSE COMPONENT	COURSE	COURSEOUTCOME
CORE THEORY –I	**INTRODUCTION TO DATA SCIENCE**	**CO1:** Understand the significance of data, its types and the evaluation of data and also understand the key characteristics of Big Data **CO2:** Demonstrate the basic concepts of variables ,expressions and Illustrate the concept of functions and control structures **CO3:** Acquire knowledge about various special data formats and its related methods **CO4:** Analyse the characteristics of Numpy and Pandas libraries and illustrate how to load, manage, and explore data from datasets . **CO5:** Demonstrate the techniques for effective visualization and presentation of data.
CORE PRACTICAL-I	**DATA SCIENCE USING PYTHON LAB**	**CO1:**Demonstrate proficiency in handling of loops and creation of functions. **CO2:** Identify the methods to create and manipulate lists, tuples,and dictionaries and also perform string manipulations. **CO3:** Interpret the concepts of Object-Oriented Programming as used in Python **CO4:**Discover the commonly used operations involving regular expressions, file system and merging datasets. Implement aggregation and grouping operations on datasets.
CORE THEORY – II	**JAVA AND DATA STRUCTURE**	**CO1:** Understand the basic concepts of Java programming and its significance of operators and control statements **CO2:** Describe the fundamentals of object-oriented programming including defining classes, objects, invoking methods to create applications **CO3:** Acquire knowledge about interfaces, packages, multithreading and exceptions **CO4:** Recognize the implementation of lists, stacks ,queue and their use in algorithms

		CO5: Demonstrate the representation of trees and graph data structures
CORE PRACTICAL –II	**DATA STRUCTURES USING JAVA LAB**	**CO1:** Implement linear and non-linear data structure operations. **CO2:** Understand the different operations of search trees **CO3:** Implement graph traversal algorithm
CORE THEORY-III	**RELATIONAL DATABASE MANAGEMENT SYSTEM**	**CO1:** Describe the concepts of database technologies, Model Entity Relationship with E-R diagrams and the classification of ER model. **CO2:** Be familiar with the relational database theory according to Codd's rules, and be able to write relational algebra expressions and calculus for queries. **CO3:** Design database schema considering normalization and relationships within database and also can summarize the transaction processing mechanisms. **CO4:** Be able to write SQL commands for data definition and data manipulation in query processing. **CO5:** Develop triggers, procedures, user defined functions, packages and design PLSQL Programs.
CORE PRACTICAL –III	**PL/SQL LAB**	**CO1:** Implement the DDL, DML Commands and Constraints. **CO2:** Implement queries, sub queries and using aggregate functions to retrieve information from database. **CO3:** Develop PL/SQL block for exception handling, cursors, packages and triggers. **CO4:**Design and develop simple database applications.
CORE THEORY– IV	**DATA ANALYTICS**	**CO1:** To introduce the concepts of Big Data and to handle missing data in the real world data sets by choosing appropriate methods. **CO2:** To summarize the data using basic statistics and visualize the data using basic graphs and plots. **CO3:**To apply exploratory techniques for understanding multivariate data by summarizing it through statistical methods and graphical methods.

		CO4: To identify the outliers if any in the data set and choose appropriate feature selection and dimensionality reduction for data pre-processing. **CO5:** To develop and evaluate model using predictive analytics and data visualization.
CORE PRACTICAL –IV	**DATA ANALYTICS LAB**	**CO1:** Understand and use python data science libraries as a tool for data analytics. **CO2:** Create visualizations for the statistical results using python. **CO3:** Handle preprocessing and the transformation of data. **CO4:** Generate regression models and correlation analysis.
CORE THEORY-V	**OPERATING SYSTEM**	**CO1:** To understand the fundamental concepts of operating system and to compare the performance of Scheduling Algorithms. **CO2:** To describe the synchronization of process and the methods of handling deadlocks. **CO3:**To recognize the memory management policies. **CO4:** To analyze the paging replacement algorithms and free space management in file system. **CO5:** To demonstrate I/O management and system security techniques.
CORE THEORY-VI	**COMPUTER NETWORKS**	**CO1:** To summarize the different network models. **CO2:** To describe the wireless transmission and evaluate error detection and correction methods. **CO3:** To explain the data link layer protocols. **CO4:** To analyze the routing algorithms and protocols of network layer. **CO5:** To demonstrate the services and connection management of transport layer.
CORE THEORY-VII	**DATA VISUALIZATION**	**CO1:** To conduct exploratory data analysis using Tableau Analytics Platform. **CO2:**To use knowledge of perception and cognition to evaluate visualization design alternatives.

		CO3: To apply data transformations such as aggregation and filtering for visualization. **CO4:** To design and evaluate color palettes and maps for visualization based on principles of perception. **CO5:** To use Python to develop interactive visualizations.
CORE PRACTICAL –V	**DATA VISUALIZATION - LAB**	**CO1:**To identify the insights in data and prepare data for visualization. **CO2:** To create several different charts and maps using Tableau. **CO3:** To work with Aggregate and Logical Functions. **CO4:** To create ad-hoc reports, data visualizations, and dashboards using Tableau Desktop
ELECTIVE THEORY-I	**NATURAL LANGUAGE PROCESSING**	**CO1:** To describe the fundamental concepts and techniques of natural language processing. **CO2:** To distinguish among the various techniques, taking into account the assumptions, strengths, and weaknesses of each. **CO3:** To use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions. **CO4:**To grasp the basic concepts of syntax and parsing techniques. **CO5:** To analyze large volume text data generated from a range of real-world applications.
ELECTIVE THEORY-I	**MOBILE APPLICATION DEVELOPMENT FOR MACHINE LEARNING**	**CO1:** To understand the basic concepts of Android App Development with Machine Learning. **CO2:** To provide suggestions as well as recommendations for search requests. **CO3:**To analyze the user behavior patterns. **CO4:**To convert a Machine Learning model to TensorFlow Lite. **CO5:** To suggest apps which will reduce human interference.
ELECTIVE THEORY-I	**INTRODUCTION TO REINFORCEMENT LEARNING**	**CO1:** To understand basic exploration methods and the exploration/exploitation tradeoff **CO2:** To analyze the statistical learning techniques where an agent explicitly takes actions and interacts with the world.

		CO3: To explain the importance and challenges of learning agents that make decisions. **CO4:**To summarize the value functions, as a general-purpose tool for optimal decision-making. **CO5:** To implement dynamic programming as an efficient solution approach to an industrial control problem.
ELECTIVE PRACTICAL –I	**NATURAL LANGUAGE PROCESSING LAB**	**CO1:** To describe the concepts of morphology, syntax, semantics, discourse & pragmatics of natural language. **CO2:** To demonstrate understanding of the relationship between NLP and statistics & machine learning. **CO3:** To discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, parts-of-speech tagging, parsing and semantic analysis. **CO4:** To develop systems for various NLP problems with moderate complexity.
ELECTIVE PRACTICAL –I	**MOBILE APPLICATION DEVELOPMENT FOR MACHINE LEARNING - LAB**	**CO1:** To develop components and different layout for mobile application development framework for android. **CO2:** To develop simple GUI application with the use of Built in components and widgets. **CO3:** To create databases to store application data locally. **CO4:** To test and show the results on emulators or on physical handheld devices.
ELECTIVE PRACTICAL –I	**REINFORCEMENT LEARNING - LAB**	**CO1:** To solve basic and advanced reinforcement learning techniques. **CO2:** To identify and apply suitable learning techniques for different problem situations. **CO3:** To implement different algorithms for decision problems. **CO4:** To evaluate and set up computational experiments.
CORE THEORY-VIII	**CLOUD COMPUTING**	**CO1:** To understand the basic concepts in Cloud Computing. **CO2:** To explore the architecture of Cloud Computing. **CO3:** To explain and apply levels of services of Cloud.

		CO4: To describe the security aspects in the cloud. **CO5:** To summarize the applications of cloud computing.
CORE THEORY-IX	**INTERNET OF THINGS**	**CO1:** To explain the concepts and the use of Devices, Gateways and Data Management in IoT. **CO2:** To determine the market perspective and the vision of IoT from a global context. **CO3:** To describe the reference model and architecture of IoT. **CO4:** To design IoT applications in different domain and analyze their performance. **CO5:** To implement basic IoT applications on embedded platforms.
CORE THEORY-X	**MACHINE LEARNING**	**CO1:** To explain the basic concepts of machine learning. **CO2:** To implement different machine learning algorithm techniques . **CO3:** To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models. **CO4:** To apply appropriate data sets to the Machine Learning algorithms. **CO5:** To identify and evaluate models generated from data.
CORE PRACTICAL –VI	**MACHINE LEARNING LAB**	**CO1:** To implement and evaluate the regression models using different algorithms. **CO2:** To identify and implement various classification algorithms for appropriate problems. **CO3:** To design and evaluate the unsupervised models through python in built functions. **CO4:** To develop the code for association rule learning.
ELECTIVE THEORY-II	**INFORMATION SECURITY**	**CO1:** To acquire the knowledge of attacks, security goals in information security. **CO2:** To test and evaluate security in systems and networks. **CO3:** To use methods for planning and designing secure systems. **CO4:** To apply techniques and tools for secure system deployment and operation.

		CO5: To perform continuous testing, assessment and updating of system security.
ELECTIVE THEORY-II	**NETWORK SECURITY**	**CO1:**To describe network security services and mechanisms. **CO2:** To design and develop solutions for technical issues related to networking and security problems. **CO3:**To identify infrastructure components including devices, topologies, protocols, systems software, management and security. **CO4:** To apply footprinting, scanning, enumeration and similar techniques to discover network and system vulnerabilities. **CO5:** To understand security issues related to networking vulnerabilities, firewalls, intrusion detection systems.
ELECTIVE THEORY-II	**BLOCK CHAIN TECHNOLOGY**	**CO1:** To state the basic concepts of block chain. **CO2:** To paraphrase the list of consensus. **CO3:** To demonstrate and interpret the working of Hyper ledger Fabric. **CO4:** To implement SDK composer tool. **CO5:** To explain the Digital identity for government.