Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Information Technology

Choice Based Credit System (CBCS) in the light of NEP-2020

B.Tech (CSE-Artificial Intelligence IBM)

SEMESTER-V (2023-27)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME					L	T	P	CREDITS
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTCS501N	**DCC**	**Theory of Computation**	**60**	**20**	**20**	**0**	**0**	**3**	**1**	**0**	**4**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. To introduce concepts in automata theory and theory of computation.
2. To identify different formal language classes and their relationships.
3. To design grammars and recognizers for different formal languages.

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Ability to relate practical problems to languages, automata, and computability.
2. Ability to demonstrate an increased level of mathematical sophistication.
3. Ability to apply mathematical and formal techniques for solving problems.

SYLLABUS

UNIT I — 10 HOURS

Introduction: Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other, Myhill-Nerode Theorem.

UNIT II — 9 HOURS

Regular Expression (RE): Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden's Theorem, Non-Regular Languages, Pumping Lemma for regular Languages. Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.

UNIT III — 8 HOURS

Context Free Grammar (CFG) and Context Free Languages (CFL): Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure properties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.

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BTCS501N	DCC	Theory of Computation	60	20	20	0	0	3	1	0	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

UNIT IV **8 HOURS**

Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG.

UNIT V **10 HOURS**

Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to undecidability, undecidable problems about TM, NP hard and NP complete problem, Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory.

TEXTBOOKS:

1. J. E. Hopcraft, R. Motwani and J. D. Ullman, Introduction to Automata Theory, Languages, and Computation, 3rd Ed., Pearson, 2013.
2. P. Linz, S. H. Rodger, An Introduction to Formal Languages and Automata, 7th Ed., Jones & Bartlett Learning, 2023.

REFERENCE:

1. J. C. Martin, Introduction to Languages and Theory of Computations, 4th Ed., Tata McGraw Hill, 2010.
2. C. Papadimitriou, and C. L. Lewis, Elements of the Theory of Computation, PHI, 1997.
3. Michael Sipser, Introduction to Theory of Computation, 3th Ed., Cengage Learning, 2013.
4. K. L. P Mishra & N. Chandrasekaran, Theory of Computer Science, 3th Ed., PHI Learning, 2006

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BTIBM505N	DCC	Data Security	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. To introduce the fundamental concepts, principles, and terminology of data security.
2. To develop the ability to classify and manage data based on its sensitivity, criticality, and impact on business operations.
3. To familiarize students with the concepts and challenges of Big Data Security.
4. To provide in-depth knowledge of IBM Guardium.
5. To enhance practical understanding the application of Python and IBM Guardium.

COURSE OUTCOMES:

After the successful completion of this course students will be able to:

1. Define and explain key terms and concepts related to data security.
2. Classify different types of data based on sensitivity and business impact.
3. Understand the concept of Big Data Security from a global context.
4. Describe the features and functionalities of IBM Guardium.
5. View real life case studies and application of python in industry.

SYLLABUS

UNIT I — 7 HOURS

Introduction to Big Data and Data Security Basics: Overview of Big Data, use cases of Big Data, Introduction to Data Security, Data Management, Importance of Data Security, Enterprise Level Damage Due to any Data Breach, Prevention of Data Breaches, CIA Triad, Data Securing Controls, Common Data Security Pitfalls, Data Discovery and Classification, Data Encryption, Data Anonymization, Tokenization, Risk Assessment, Data Auditing, Data Real Time Alerting, Data Minimization

UNIT II — 8 HOURS

Web Application Security:

Web Application Security, Importance of Web Application Firewall, Vulnerability scanning tools and techniques, Difference between VA & PT, Introduction to OWASP top 10 & SANS 25.

UNIT III — 8 HOURS

Data Security Compliance and Standards: Understanding PII, PHI data and Sensitive Data, Data Security Compliance and Standards, GDPR, Potential Drawbacks of Failing to Comply with GDPR, GDPR Readiness, GDPR Principles, Building Blocks to Prepare for GDPR, GDPR Notification Deadline for a Data Breach, Data Protection by Design, HIPAA, SOX Act, PCI, ISO 27000 Series, Data Protection Laws.

UNIT IV — 7 HOURS

Data Security Technologies and Solutions:

Data Security Technologies and Solutions, Data Protection Modernization, Securing Data during different Data-

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME					L	T	P	CREDITS
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BTIBM505N	DCC	Data Security	60	20	20	30	20	3	0	2	4

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Lifecycle Phases, Data Risk Manager, Data Security & Privacy Strategies

UNIT V **8 HOURS**

Guardium Data Protection and Monitoring Policies and Reporting

Understanding Guardium Data Protection, Guardium Solution Overview, Benefits of Big Infosphere Guardium, Monitor and audit all data activity, How IBM Guardium Data Protection for Databases Works, Understand Architecture and Deployment of Guardium, Databases security and Lifecycle, Monitoring Policies and Reporting, Audit data and Guardium Entities, Groups, Security Policies, Reports, Audit Process and Workflow, SIEM Integration, Self-Monitoring, Dashboards

TEXTBOOKS AND REFERENCE:

1. Implementing IBM InfoSphere Guardium by Walid Rjaibi, Packt Publishing, 2016, ISBN: 9781783283742

LIST OF PRACTICALS

1 Privacy Policy Analysis
2. Data Breach Response Simulation.
3. Privacy Compliance Audit Exercise
4. Cross-Border Data Transfer Exercise
5. Exploration of Guardium GUI.
6. Exploration of Guardium CLI and Guard-API.
7. User Access Management and Role Assignment.
8. Creating and Populating Groups in Guardium.
9. System View and Data Management
10. User Role Creation and Minimal Access Role
11. Data Access Policy
12. Creating and Installing a Simple Policy.
13. Create a simple Query and Report.
14. Auditing and Vulnerability Assessment

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BTIBM504N	**DCC**	**Reactive Architecture**	**60**	**20**	**20**	**30**	**20**	**3**	**0**	**2**	**4**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. To learn the fundamentals of reactive architecture
2. To understand where and why reactive systems are applicable
3. To gain knowledge about Akka ToolKit

COURSE OUTCOMES:

Upon completion of the subject, students will be able to

1. To describe the detailed structure of reactive systems.
2. To describe reactive manifesto and reactive principles
3. To understand Actor model, props in Akka tool kit.
4. To implement reactor pattern in node js.

SYLLABUS

UNIT I — 7 HOURS

Why Reactive: What is the problem that Reactive Architecture is attempting to solve, How does unresponsive software impact its users, What is the goal of Reactive Architecture. Reactive Principles, An introduction to the Reactive Manifesto, An explanation of the Reactive Principles.

UNIT II — 8 HOURS

Reactive Toolbox: MultiThreading, The Reactor Pattern, The Multi Reacter Pattern, Actor Model, Introduction to Akka Tool Kit, Akka Actor System, Props, Child Actor, Send Actor, Stop Actor, Reply Messages ,Forward Messages.

UNIT III — 6 HOURS

Reactive Systems vs Reactive Programming- What are Reactive Systems, What is Reactive Programming, How are Reactive Systems related to Reactive Programming, The Actor Model and its relationship to Reactive Systems.

UNIT IV — 9 HOURS

Putting Your Reactive Toolbox to Work-

Going from Services to Systems: Being Message Driven
Distributed Infrastructure
Orchestrated Cloud Infrastructure
Reactive Meets Machine Learning

Chairperson	Chairperson	Controller of Examination	Registrar
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BTIBM504N	**DCC**	**Reactive Architecture**	**60**	**20**	**20**	**30**	**20**	**3**	**0**	**2**	**4**

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UNIT V **8 HOURS**

Apache Kafta in Reactive Architecture: Asynchronous messaging backbone, Message retention and data persistence, Decoupling, Backpressure, Backpressure in Kafka Consumers, Backpressure in Alpakka Kafka Connector, Backpressure in MicroProfile Reactive Messaging

TEXTBOOKS:

1. IBM Coursware.

REFERENCE:

1. IBM Coursware.

LIST OF PRACTICALS:

1. Create a reactor pattern in node js.
2. Create multireactor pattern in node js.
3. Implement Actor model.
4. Implementations of Akka tell method.
5. Implementation of Akka Ask method.
6. Implementation of stopping top level actor in Akka using stop method.
7. Implement of stopping child actor in Akka.
8. Implementation of stopping Actor Sytem.
9. Implement props in Akka using akka.actor.Props.
10. Write program using Akka toolkit to forward message from one actor to another.

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BTIBM511N	**DSC**	**Big Data Technologies**	**60**	**20**	**20**	**30**	**20**	**3**	**0**	**2**	**4**

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COURSE OBJECTIVES:

The student will have ability to:

1. Big Data and its importance in business world
2. Focused on conceptualization and summarization of big data trivial data versus big data.
3. Big data computing technologies, Watson studio
4. Understand the challenges posed by distributed applications and how ZooKeeper is designed to Handle.

COURSE OUTCOMES:

After the successful completion of this course students will be able to:

1. Develop an understanding of the complete open-source Hadoop ecosystem and its near term future direction.
2. Understand the functions and features of HDP.
3. Understand the Map Reduce model v1 and review java code.

SYLLABUS

UNIT I — 10 HOURS

Introduction to Big Data: Develop an understanding of the complete open-source Hadoop ecosystem and its near-term future directions, compare and evaluate the major Hadoop distributions and their ecosystem components both their strengths and their limitations, hands-on experience with key components of various big data ecosystem components and roles in building a complete big data, solution to common business problems.

UNIT II — 9 HOURS

Hadoop and HDFS: The basic need for a big data strategy in terms of parallel reading of large data files and internode network speed in a cluster, Hadoop Distributed File System (HDFS), function of the NameNode and DataNodes in a Hadoop cluster, files are stored and blocks ("splits") are replicated. Hive, Sqoop.

UNIT III — 11 HOURS

Introduction to Hortonworks and its components

Apache Ambari: The purpose of Apache Ambari in the HDP stack, the overall architecture of Ambari and Ambari' relation to other services and components of a Hadoop cluster, the functions of the main components of Ambari, initiating start and stop services from Ambari Web Console.

Overview about Hortonworks Data Platform – HDP: The functions and features of HDP, the IBM value-add components, what IBM Watson Studio is, a brief description of the purpose of each of the value-add components.

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BTIBM511N	**DSC**	**Big Data Technologies**	**60**	**20**	**20**	**30**	**20**	**3**	**0**	**2**	**4**

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UNIT IV **7 HOURS**

Data Processing and Management

MapReduce and YARN: MapReduce model v1, the limitations of Hadoop 1 and MapReduce, review the Java code required to handle the Mapper class, Reducer class and the program driver needed to access MapReduce, the YARN model, compare Hadoop 2/YARN with Hadoop 1

UNIT V **8 HOURS**

ZooKeeper, Slider, and Knox: The challenges posed by distributed applications and how ZooKeeper is designed to handle them, the role of ZooKeeper within the Apache Hadoop infrastructure and the realm of Big Data management, the generic use cases and some real-world scenarios for ZooKeeper, the ZooKeeper services that are used to manage distributed systems, use the ZooKeeper CLI to interact with ZooKeeper services.

TEXTBOOKS:

1. Introduction to Infosphere BigInsights, IBM Career Education
2. Changing Business with Data Insight, IBM Career Education
3. Big Insights Analytics for Business Analysts, IBM Career Education
4. Tom White," Hadoop: The Definitive Guide Paperback – 2015" Shroff Publishers & Distributers Private Limited - Mumbai; Fourth edition (2015).
5. V. K. Jain (Author)," Big Data and Hadoop" Khanna Publishers; 1 edition (1 June 2015) .

REFERENCE:

1. Big Data: A Revolution That Will Transform How We Live, Work, and Think; Kenneth Cukier, Viktor Mayer-Schönberger; Mariner Books; Edition (2014).
2. Big Data: Using Smart Big Data, Analytics and Metrics to Make Better; Bernard Marr; Wiley; Edition 1st (2015).
3. Hadoop For Dummies, Dirk deRoos, For Dummies, 2014
4. Cohen et al."MAD Skills: New Analysis Practices for Big Data", 2009
5. Ullman, Rajaraman, Mining of Massive Datasets, Chapter 2.
6. Stonebraker et al., "MapReduce and Parallel DBMS's: Friends or Foes?", Communications of the ACM, January 2010
7. Dean and Ghemawat, "MapReduce: A Flexible Data Processing Tool", Communications of the ACM, January 2010.

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BTIBM511N	**DSC**	**Big Data Technologies**	**60**	**20**	**20**	**30**	**20**	**3**	**0**	**2**	**4**

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LIST OF PRACTICALS

1. Installing Hadoop, configure HDFS, Install Zookeeper , Pig Installation, Sqoop Installation, Hbase Installation
2. Configuring Hadoop
3. Running jobs on Hadoop
4. Working on HDFS
5. Hadoop streaming
6. Creating Mapper function using python.
7. Creating Reducer function using python
8. Python iterator and generators
9. Twitter data sentimental analysis using Flume and Hive
10. Business insights of User usage records of data cards.
11. Wiki page ranking with hadoop
12. Health care Data Management using Apache Hadoop ecosystem

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BTIBM512M	**SEC**	**Web Development (HTML, CSS, Javascript, Node JS, Node Red)**	**0**	**0**	**0**	**60**	**40**	**0**	**0**	**4**	**2**

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COURSE OBJECTIVES:

The student will have ability to:

1. Ability to create and style responsive web pages using HTML5 and CSS3.
2. Demonstrate proficiency in JavaScript for handling events and asynchronous operations.
3. Build server-side applications with Node.js and manage routing and APIs.
4. Implement RESTful APIs with Node.js and Express for efficient data handling.
5. Develop scalable and optimized web applications using React.js and its ecosystem.

COURSE OUTCOMES:

After the successful completion of this course students will be able to:

1. Understand the fundamentals of HTML and CSS for building responsive web pages.
2. Gain proficiency in JavaScript for dynamic content manipulation and DOM handling.
3. Learn the core concepts of Node.js for building scalable server-side applications.
4. Develop skills in creating RESTful APIs using Express.js in Node.js.
5. Master React.js for building interactive, component-based user interfaces.

SYLLABUS

UNIT I — 10 HOURS

Introduction to HTML and CSS: HTML basics: Elements, document structure, semantic, HTML, HTML5 features: Multimedia elements, forms, canvas, CSS basics: Selectors, properties, values, CSS box model, CSS layout techniques: Floats, positioning, Flexbox, Grid, Responsive web design principles and techniques, HTML5 semantic elements, multimedia elements, forms, CSS advanced techniques: Transforms, transitions, animations, filters, CSS preprocessors: SASS or LESS for efficient styling, Advanced CSS layout techniques: CSS Grid layout.

UNIT II — 8 HOURS

Introduction to javaScript: JavaScript fundamentals: Variables, data types, operators, control flow, JavaScript DOM manipulation: Selecting, modifying, creating elements dynamically, Event handling: Handling user interactions and browser events, Asynchronous JavaScript: Promises, async/await for handling asynchronous operations, Error handling in JavaScript: Try...catch statements, JavaScript ES6 features: Arrow functions, template literals, destructuring, spread syntax, JavaScript closures and scope, Working with the Document Object Model (DOM) in depth, JavaScript event delegation and bubbling, Client-side storage: Local Storage, Session Storage, Cookies.

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BTIBM512M	**SEC**	**Web Development (HTML, CSS, Javascript, Node JS, Node Red)**	**0**	**0**	**0**	**60**	**40**	**0**	**0**	**4**	**2**

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UNIT III — 8 HOURS

Introduction to Node.js: Overview of Node.js and its architecture, Understanding the event-driven and non-blocking I/O model, Setting up Node.js development environment, Understanding the Node.js module system(Inbuilt, external etc.), Introduction to the NPM, Basics of asynchronous programming, Creating a simple HTTP server and handling requests and responses, Working with file systems(fs), Handling errors and implementing basic error-handling strategies, Introduction to Express.js and setting up a simple web server using Express.

UNIT IV — 9 HOURS

Intermediate Node.js Techniques: Asynchronous code using Promises and async/await, Routing in Express.js to handle different endpoints, Middleware in Express, Introduction to RESTful API design and implementing basic APIs with Node.js, Working with JSON data and parsing incoming requests in Node.js, Environment variables in a Node.js application, Basic security practices such as input validation and handling, Introduction to creating and managing custom modules in Node.js, Handling form data and file uploads.

UNIT V — 10 HOURS

Introduction of React.js: Introduction to React.js: Components, props, state, JSX syntax, React component lifecycle: Mounting, updating, unmounting phases, React Router DOM for client-side routing and navigation, State management in React using Context API or Redux, React Hooks: useState, useEffect, useContext, custom hooks, React patterns and best practices: Container and Presentational components, Higher Order Components (HOCs), Styling in React with Chakra UI: Theming, styled components, responsive design, Form handling and validation in React, Handling asynchronous operations in React components, Optimizing React applications for performance.

TEXTBOOKS:

1. "Full-Stack Web Development with Vue.js and Node" by Aneeta Sharma.
2. "Learning JavaScript Design Patterns" by Addy Osmani.
3. "React Up & Running: Building Web Applications" by Stoyan Stefanov.
4. "Node.js, MongoDB and Angular Web Development" by Brad Dayley, Brendan Dayley, and Caleb Dayley.
5. "IBM Cognos 10 Report Studio: Practical Examples" by Filip Draskovic and Roger Johnso.

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BTIBM512M	**SEC**	**Web Development (HTML, CSS, Javascript, Node JS, Node Red)**	**0**	**0**	**0**	**60**	**40**	**0**	**0**	**4**	**2**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

LIST OF PRACTICALS

1. To create a responsive portfolio website using HTML5 and CSS3, showcasing your projects, skills, and contact information. Use Flexbox or Grid for layout and ensure the website is mobile-friendly.
2. To create an interactive registration form using HTML, CSS, and JavaScript with input validation and real-time feedback. Incorporate advanced styling techniques like CSS transitions and animations.
3. To develop a dynamic to-do list application using JavaScript for DOM manipulation. Implement features for adding, deleting, and marking tasks as completed, with data persistence using local Storage.
4. To build a simple web server using Node.js and Express.js, serving a static HTML page that dynamically displays the current date and time.
5. To develop a RESTful API with CRUD operations using Node.js, Express, and MongoDB. Implement endpoints for managing a collection of products and include error handling mechanisms.
6. To create a user authentication system using Node.js, Express, and JWT for login and registration. Protect routes requiring authentication and implement proper session management.
7. To build an interactive weather dashboard using JavaScript to fetch weather data from an external API (e.g., OpenWeatherMap) and display it based on the user's input, with responsive design.
8. To develop a full-stack blog application using Node.js, Express, MongoDB, and React. Implement CRUD functionality for blog posts, integrating the front-end React interface with the backend API.
9. To create a React task management app using either Context API or Redux for state management. Allow users to create tasks, assign priorities, and mark tasks as completed.
10. To design and implement an e-commerce product page using React for the frontend and Node.js for the backend API. Allow users to browse products, add items to a shopping cart, and view the total price.

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Information Technology

Choice Based Credit System (CBCS) in the light of NEP-2020

B.Tech (CSE-Artificial Intelligence IBM)

SEMESTER-V (2023-27)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME					L	T	P	CREDITS
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTIT508M	**SEC**	**No Sql and MongoDB**	**0**	**0**	**0**	**30**	**20**	**0**	**0**	**2**	**1**

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OUTCOMES:

After the successful completion of this course students will be able to:

CO1: Understanding NoSQL Database Concepts.

CO2: Demonstrate Proficiency in MongoDB Operations.

CO3: Investigate Advanced MongoDB Features.

CO4: Design Database and Data Modelling Skills.

CO5: Apply NoSQL development tools on Real-World Scenarios.

SYLLABUS

UNIT I — 8 HOURS

NoSQL Database: Types of NoSQL Database, Brief History of NoSQL Databases, NoSQL Database Features, Relational database vs NoSQL database example, Differences between RDBMS and NoSQL databases, NoSQL use cases, NoSQL Database Misconceptions.

UNIT II — 8 HOURS

Introduction to MongoDB: MongoDB Atlas, MongoDB and Document Object Model, CRUD Operation, MongoDB Aggregation, Using $match and $group Stages in a MongoDB Aggregation Pipeline, Using $sort and $limit Stages in a MongoDB Aggregation Pipeline, Using $project, $count, and $set Stages in a MongoDB Aggregation Pipeline, Using $out Stage in a MongoDB Aggregation Pipeline.

UNIT III — 9 HOURS

MongoDB Indexes: Using MongoDB Indexes in Collections, Creating a Single Field Index in MongoDB, Creating a Multikey Index in MongoDB, Working with Compound Indexes in MongoDB, Deleting MongoDB Indexes.

UNIT IV — 9 HOURS

Atlas Search: Using Relevance-Based Search and Search Indexes, creating a Search Index with Dynamic Field Mapping, Creating a Search Index with Static Field Mapping, Using $search and Compound Operators, Grouping Search Results by Using Facets.

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME					L	T	P	CREDITS
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UNIT V 7 HOURS

MongoDB Data Modelling: Types of data relationships, modelling, embedding data in documents, referencing data in documents, scaling data model, Using Atlas Tools for Schema Help, MongoDB transactions.

TEXTBOOKS:

1. MongoDB University, https://learn.mongodb.com.
2. Marko Aleksendric, Arek Borucki, Leandro Domingues. Mastering MongoDB 7.0 - Fourth Edition: Achieve data excellence by unlocking the full potential of MongoDB, 4th Edition. MongoDB Press.
3. Rachelle Palmer, Ben Perlmutter, Ashwin Gangadhar, Nicholas Larew, Sigfrido Narváez , Thomas Rueckstiess, Henry Weller, Richmond Alake, Shubham Ranjan. Building AI Intensive Python Applications: Create intelligent apps with LLMs and vector databases. 1st Edition. MongoDB Press.

List of Mini Projects

1. Build a Mini-Application: Create a sample application (e.g., a task manager, blog platform, or e-commerce site) using MongoDB as the database backend. Implement all CRUD functionalities and data modeling techniques learned in class.
2. Performance Benchmarking: Conduct performance tests comparing the execution time of queries on indexed versus non-indexed collections to understand the importance of indexing in MongoDB.

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore