Academic Council:16/11/2024

Item No:3.2

Parle Tilak Vidyalaya Association's

MULND COLLEGE OF COMMERCE (AUTONOMOUS)

|| आ नो भद्राः क्रतवो यन्तु विश्वतः ||

Syllabus for T.Y. Bachelor of Computer Applications

Programme: B.C.A.

BASED ON LEARNING OUTCOME CURRICULUM FRAMEWORK (LOCF)

Semester V

with effect from the academic year

2025 – 2026

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AC: **16/11/2024**
Item No: **3.2**

Parle Tilak Vidyalaya Association's
MULUND COLLEGE OF COMMERCE (AUTONOMOUS)

॥ आ नो भद्राः क्रतवो यन्तु विश्वतः ॥

Sr. No.	Heading	Particulars
1.	Title of the Programme	**Bachelor of Computer Applications**
2.	Eligibility for Admission	S.Y.BCA.
3.	Passing Marks	40%
4.	Ordinances / Regulations (if, any)	As applicable for all B.Sc. Programmes, University of Mumbai
5.	Number of years / Semesters	Three years – Six Semesters
6.	Level	~~P.G.~~ / U.G. /~~Diploma / Certificate~~ (Strike out which is not applicable)
7.	Pattern	~~Yearly /~~ Semester, Choice Based (Strike out which is not applicable)
8.	Status	New / ~~Revised~~
9.	To be implemented from Academic year	From the Academic Year **2025 – 2026**

Date: November 16, 2024
Name of the BoS Chairperson

Signature: _____
Dr. Hiren Dand
hiren.dand@mccmulund.ac.in

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Semester – 5			
Course Code	**Course Type**	**Course Title**	**Credits**
MCCSCT323	Major	C#.NET and ASP.NET Core	4
MCCSCT301	Major	AI and ML	4
MCCSCT401	Major (Choose any one)	MERN	4
MCCSCT303		Ethical Hacking	
MCCSCT306	Minor	Internet of Things	4
MCCSCT312	VSEC (Choose any one)	Linux Administration	4
MCCSCT410		Generative AI	
MCCSCTPRJ401	RP / OJT	Project	2
MCCOJTSCT302		OJT	
		Total Credits	**22**

OE/GE: Open Elective/ General Elective
AEC: Ability Enhancement Course
VEC: Value Education Course
IKS: Indian Knowledge System
SEC: Skill Enhancement Course
VSEC: Vocational & Skill Enhancement Course
RP/OJT: Research Project / On Job Training

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Contents

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Semester V

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MCCSCT323 C#.NET and ASP.NET Core

Bachelor of Computer Applications		**Semester – V**		
Course Name: C#.NET and ASP.NET Core		**Course Code: MCCSCT323**		
Vertical:		**Major**		
Periods per week (1 Period is 60 minutes)		**03**		
Practical per week (1 Period is 60 minutes)		**02**		
Credits		**04**		
Evaluation System		**Duration (in Hours)**	**Total Marks**	**Minimum Passing Marks**
Theory	**Continuous Internal Assessment**	**--**	**40**	**16**
	End Semester Examination	**2**	**60**	**24**
Practical	**Continuous Internal Assessment**	**--**	**20**	**8**
	End Semester Examination	**2**	**30**	**12**

Objectives of the Course:

1. Understand the core components and architecture of ASP.NET Core, including the application and utility frameworks, and the underlying ASP.NET Core platform.
2. Develop a real-world application using ASP.NET Core, focusing on key functionalities such as data management, navigation, cart functionality, and administration features.
3. Explore security and deployment aspects of ASP.NET Core, including implementing basic authorization policies, creating custom middleware, understanding URL routing, and utilizing platform features like configuration, logging, and exception handling.
4. Gain proficiency in working with data in ASP.NET Core, including caching data and responses, utilizing Entity Framework Core for data access, creating RESTful web services, and implementing advanced features like related data handling and content formatting.
5. Understand the concepts and techniques related to using controllers with views, Razor pages, view components, and tag helpers in ASP.NET Core, including modifying views, utilizing layout and partial views, and creating custom tag helpers.

Unit/Module	**Name**	**Lectures**
I	**Advanced C# Programming: Types, OOP, Operators, and Arrays**	**09**
II	**Advanced C# Concepts: Delegates, Collections, LINQ, and Exception Handling**	**09**
III	**Advanced C# Programming: Asynchronous, Parallel, Reflection, and File Handling**	**09**
IV	**Building and Deploying a Blazor eCommerce Application: From Data Management to Security**	**09**
V	**Advanced ASP.NET Core: URL Routing, Platform Features, and RESTful Web Services**	**09**
		45

R- Remember, U- Understand, A – Apply, AN- Analyze, EV- Evaluate, CR – Create

Unit /Module	Syllabus	Level of Knowledge Applicable as per Blooms Taxonomy
I	**Advanced C# Programming: Types, OOP, Operators, and Arrays** **A) Classes, Records, Structs and Tuples:** Creating and Types, Pass by Value or by Reference, Classes, Records, Structs, Enum Types, Tuples, ValueTuple, Deconstruction, Pattern Matching, Partial Types. **B) Object Oriented Programming with C#:** Object Orientation, Inheritance with Classes, Modifiers, Inheritance with Records, Interfaces, Generics **C) Operators and Casts:** Operators, Binary Operators, Type Safety, Operator Overloading, Comparing Objects for Equality, Implementing Custom Indexes, User-defined Conversions. **D) Arrays:** Multiple Objects of the Same Type, Simple Arrays, Multidimensional Arrays, Jagged Arrays, Array Class, Arrays as Parameters, Enumerators, Span with Arrays, Indices and Ranges, Array Pools, BitArray.	a) U,R,A b) U, R, A, AN, CR c) U,R,A,AN d) U, R, A, AN, CR
II	**Advanced C# Concepts: Delegates, Collections, LINQ, and Exception Handling** **A) Delegates, Lambdas, Events:** Referencing Methods, Delegates, Lambda Expressions, Events. **B) Collections:** Overview, Interfaces and Types, Lists, Stacks, Linked Lists, Sorted List, Dictionaries, Sets, Performance, Immutable collections. **C) Language Integrated Query:** LINQ Overview, Standard Query Operators, Parallel LINQ, Expression Tress, LINQ Providers. **D) Errors and exceptions:** Handling Errors, Predefined Exception Classes, Catching Exceptions, User-Defined Exception Classes.	a) U, R, AN, A b) U, R, AN, A c)R, U, A, AN d)U, R, AN, A
III	**Advanced C# Programming: Asynchronous, Parallel, Reflection, and File Handling** **A) Tasks and Asynchronous Programming:** Why Asynchronous Programming is Important?, Task-Based Async Pattern, Tasks, Error Handling, Cancellation of async Methods, Async Streams, Async with Windows Apps. **B) Reflections, metadata and surge generators:** Inspecting Code at Runtime and Dynamic Programming, Custom Attributes, Using Reflection, Using Dynamic Language Extensions for Reflection, ExpandoObject, Source generators.	a) R, U, A, AN b) R, U, A, CR

	C) Parallel Programing: Overview, Parallel Class, Tasks, Cancellation Framework, Channels, Timers, Threading issues, Interlocked, Monitor, SpinLock, WaitHandle, Mutex, Semaphore, Events, Barrier, ReaderWriterLockSlim, Locks with Await. **D) Files and Streams:** Overview, Managing the File System, Iterating Files, Working with Streams, Using Readers and Writers, Compressing Files, Watching File Changes, JSON Serialization, Using Files and Streams with the Windows Runtime.	c) U, R, AN, A d)R, U, AN, A
IV	**<u>Building and Deploying a Blazor eCommerce Application: From Data Management to Security</u>** **A) A Real Application: Creating the Projects:** Adding Data to the Application, Displaying a List of Products, Adding Pagination, Styling the Content. **B) Navigation and Cart:** Adding Navigation Controls, Building the Shopping Cart. **Completing the Cart:** Refining the Cart Model with a Service, Completing the Cart Functionality, Submitting Orders. **C) Administration:** Preparing Blazor Server, Managing Orders, Adding Catalog Management. **D) Security and Deployment:** Creating the Identity Database, Adding a Conventional Administration Feature, Applying a Basic Authorization Policy, Creating the Account Controller and Views, Testing the Security Policy, Preparing ASP.NET Core for Deployment	a) R, U, AN, A, CR b) R, U, AN, A c) R, U, AN, A d) R, U, AN, A
V	**<u>Advanced ASP.NET Core: URL Routing, Platform Features, and RESTful Web Services</u>** **A) URL Routing:** Introduction, Managing URL Matching, Advanced Routing Features. **Advanced Routing Features:** Introduction, Understanding Service Location and Tight Coupling, Using Dependency Injection, Using Service Lifecycles, Other Dependency Injection Features. **B) Platform Features:** Using the Configuration Service, Using the Logging Service, Using Static Content and Client-Side Packages, Using Cookies, Using Sessions, Working with HTTPS Connections, Handling Exceptions and Errors, Filtering Requests Using the Host Header. **C) Creating RESTful Web Services:** Understanding RESTful Web Services, Creating a Web Service Using the Minimal API, Creating a Web Service Using a Controller, Improving the Web Service. **D) Advanced Web Service Features:** Dealing with Related Data, Supporting the HTTP PATCH Method, Understanding Content Formatting, Documenting and Exploring Web Services	a) R, U, A. AN b) R, U, AN, A, CR c) R, U, AN, A, CR d)R, U, AN, A

List of Practical:		
Sr. No	**Syllabus**	**Level of Knowledge Applicable as per Blooms Taxonomy**
1.	Creating simple applications and testing applications.	U, A, AN, CR
2.	Creating Testing projects	U, A, AN, CR
3.	Creating Applications with data (CRUD).	U, A, AN
4.	a) Creating application using cart.	U, A, AN, CR
5.	Implementing Security to application.	U, A, AN, CR
6.	Working with URL routing and dependency injections.	U, A, AN, CR
7.	Creating Application with caching	U, R, A, AN, CR
8.	Creating RESTful services	U, R, A, AN, CR
9.	Creating applications with controllers and views	U, A, AN, CR
10.	Creating applications using Razor pages and Helper tags.	U, A, AN, CR

Learning Outcomes: After completion of Course, the learners will be able to:

1. Create and run ASP.NET Core applications using a chosen code editor, demonstrating proficiency in project creation, management, package handling, and debugging techniques.
2. Build a functional ASP.NET Core application that includes features like data display, pagination, shopping cart management, order submission, and administration capabilities.

3. Secure and deploy ASP.NET Core applications by configuring identity databases, applying authorization policies, implementing URL routing, utilizing platform features effectively, and handling exceptions and errors.
4. Develop ASP.NET Core applications that incorporate data caching, Entity Framework Core for data access, RESTful web services with proper content formatting, and advanced features such as handling related data and supporting HTTP PATCH method.
5. Develop ASP.NET Core applications that leverage controllers with views, utilize Razor pages for streamlined development, implement reusable view components, and create custom tag helpers for enhanced functionality and user experience

Books and References:

1. Freeman, A. (2022). Pro ASP.NET Core 6 (9th ed.). Apress.
2. Nagel, C. (2021). Professional C# and .NET. Wrox, Wiley.
3. Griffiths, I. (2022). Programming C# 10. O'Reilly.
4. Price, M. J. (2022). C# 10 and .NET 6 (6th ed.). Packt.
5. Kanjilal, J. (2019). Mastering C# 8. BPB.
6. Albahari, J., & Albahari, B. (2021). *C# 9.0 in a nutshell: The definitive reference* (1st ed.). O'Reilly Media.

Percentage of 6 categories of Blooms Taxonomy in question paper

	Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**	
% in Question Paper	20	20	20	15	10	15	100%

MCCSCT301 AI and ML

B. Sc (Computer Applications)		**Semester – V**		
Course Name: AI and ML		**Course Code: MCCSCT301**		
Vertical:		**Major**		
Periods per week (1 Period is 60 minutes)		**03**		
Practical per week (1 Period is 60 minutes)		**02**		
Credits		**04**		
Evaluation System		**Duration (in Hours)**	**Total Marks**	**Minimum Passing Marks**
Theory	**Continuous Internal Assessment**	**--**	**40**	**16**
	End Semester Examination	**2**	**60**	**24**
Practical	**Continuous Internal Assessment**	**--**	**20**	**8**
	End Semester Examination	**2**	**30**	**12**

Objectives of the Course:

1. Students will gain theoretical knowledge and practical skills essential for designing intelligent systems that can reason, learn, and make decisions under various conditions.
2. To understand various search algorithms, from uninformed to heuristic-based approaches, for solving AI-related problems like puzzles and pathfinding.
3. To explore propositional and first-order logic, Bayesian networks, and belief systems for decision-making in uncertain environments.
4. To learn different machine learning models, including neural networks, support vector machines, and statistical learning concepts to build intelligent applications.
5. Students will develop critical thinking and problem-solving skills by working on AI algorithms and optimization techniques.

Module	Name	Lectures
I	**Foundations of Artificial Intelligence and Intelligent Agents**	**09**
II	**Search Techniques and Problem Solving in AI**	**09**
III	**Adversarial Search and Logic in AI**	**09**
IV	**Uncertainty and Reasoning**	**09**
V	**Fundamentals of Machine Learning**	**09**
		45

R- Remember, U- Understand, A – Apply, AN- Analyze, EV- Evaluate, CR – Create

Unit/Module	Syllabus As per SSC framework of NEP	Level of Knowledge Applicable as per Blooms Taxonomy
I	**Foundations of Artificial Intelligence and Intelligent Agents** A. **Introduction:** What is Artificial Intelligence? Foundations of AI, history, Nyaya Philosophy (Logic and Categorization), Paninian Grammar (Linguistic Classification) , the state of art AI today. B. **Intelligent Agents:** Agents and environment, good behavior, nature of environment, the structure of agents. C. **Solving Problems by Searching:** Problem solving agents, examples problems: 8-state vacuum-world problem, 8-puzzle problem, N-Queens problem.	a) U, R b) U, R, AN c) U, R, A, AN, CR
II	**Search Techniques and Problem Solving in AI** **A. Searching Techniques:** Uninformed search: DFS, BFS, Uniform cost search, Depth Limited Search, Iterative Deepening first search, Bidirectional search, comparison of uninformed search strategies. Informed search strategies: Best First Search, A* search algorithm, memory bounded search, learning to do search better, heuristic functions. B. **Beyond Classical Search:** Hill Climbing search, Simulated Annealing, Constraint Satisfaction Programming: Crypto arithmetic, Map Coloring.	a) U, R, AN, A b) U, R, AN
III	**Adversarial Search and Logic in AI** A. **Adversarial Search:** Game Playing, Min-Max Search, Alpha Beta Pruning, state-of-the-art-of game programs. B. **Logical Agents:** Knowledge base agents, The Wumpus world, logic, Overview of propositional logic. C. **First Order Logic:** Syntax and semantics, using First Order Logic, Inference in First Order Logic: propositional vs. First Order, forward and backward chaining, resolution.	a) R, U, A, AN b) R, U, A c) U, R, AN, EV
IV	**Uncertainty and Reasoning** A. **Uncertainty and Reasoning:** Uncertainly, Representing Knowledge in an Uncertain Domain, Bayesian Network, Conditional Probability, Joint Probability, Bayes theorem, Belief Networks, Simple Inference in Belief Networks. Sequential decision problems.	a) R, U, AN, A
V	**Fundamental of ML** A. **Machine Learning:** Forms of Learning, Supervised Learning, Learning Decision Trees,	a) R, U, A. AN

	Evaluating and Choosing the Best Hypothesis, Theory of Learning, Regression and Classification with Linear Models, Artificial Neural Networks, Nonparametric Models, Support Vector Machines, Ensemble Learning, Statistical Learning, Introduction to deep learning concepts.	

AI and ML – Practical		
Sr. No.	**List of Practicals**	**Level of Knowledge Applicable as per Blooms Taxonomy**
1.	**Generate the state-space possibilities for the following problems** a. Water Jug Problem b. Number Puzzel	U, A, AN
2.	**Write the program to compute the following Uninformed Search** **Algorithms for suitable problem** a. Depth First Search b. Breadth First Search	U, A, AN
3.	**Write the program to compute the following Informed SearchSearch** **Algorithms for suitable problem** a. Hill Climbing b. A* Algorithm	U, A, AN
4.	**Write the program to compute the following Algorithms for suitable** **problem** a. Simulate solution for 4-Queen / N-Queen problem b. Constraint satisfaction problem: Map Coloring	U, A, AN
5.	**Write the program to compute the following Search Algorithms for suitable** **problem** a. Simulation of tic – tac – toe game using Min-Max Search b. Alpha Beta Pruning	U, A, AN
6.	**Write the program to compute the following Algorithms for suitable problem** a. Missionaries and Cannibals b. Shuffle Deck of cards.	U, A, AN
7.	**Write the program to demonstrate the following prolog-based programs:** a. Derive the predicate. (**for e.g.** Sachin is batsman, batsman is cricketer) - > Sachin is Cricketer. b. Prolog fundamentals	U, R, A, AN
8.	**Write a program which contains three predicates:** male, female, parent. Make rules for following family relations: father, mother, grandfather, grandmother, brother, sister, uncle, aunt, nephew and niece, cousin. **Question:**	U, R, A, AN

	a. Define: Clauses, Facts, Predicates and Rules with conjunction and disjunction b. Draw Family Tree.	
9.	**Write the program to compute the following Algorithms for suitable problem** a. Linear Regression b. Classification Problems	U, A, AN
10.	**Write the program to demonstrate the following** a. Simple neural network b. Support Vector Machine	U, A, AN

Learning Outcomes: After completion of Course, the learners will be able to:

1. Explain the fundamental concepts, history, and current advancements in Artificial Intelligence, along with the role of intelligent agents in AI systems.
2. Apply various uninformed and informed search strategies, including heuristic-based techniques, to solve complex problem-solving tasks efficiently.
3. Implement adversarial search strategies like Min-Max and Alpha-Beta pruning for AI-driven game playing and utilize logic-based reasoning for knowledge representation.
4. Analyse and construct Bayesian networks, belief systems, and probabilistic models for making decisions under uncertainty.
5. Analyse and build machine learning models, including supervised and unsupervised learning techniques, to solve real-world AI challenges.

Books & References:

1. Russell, S. J., & Norvig, P. (2020). *Artificial Intelligence: A Modern Approach* (4th ed.). Pearson.
2. Poole, D. L., & Mackworth, A. K. (2017). *Artificial Intelligence: Foundations of Computational Agents* (2nd ed.). Cambridge University Press.
3. Chris, B. (2019). Artificial Intelligence (1st ed)., End of Line Clearance Book.
4. Matilal, B. K. (1990). Logic, language, and reality: Indian philosophy (2nd ed.)., Delhi: Motilal Banarsidass Publishers Private.
5. Knight, K., & Rich, E. (2017). *Artificial Intelligence* (3rd ed.). McGraw-Hill.
6. Hastie, T., Tibshirani, R., & Friedman, J. (2013). *The Elements of Statistical Learning*. Springer.
7. Sebastian Klaas (2021), Neural Network for Beginners Paperback (1st ed.)., bpb.
8. Khemani, D. (2017). *A First Course in Artificial Intelligence* (1st ed.). TMH.
9. Kevin, K., & Elaine, R. (2017). Artificial Intelligence (3rd ed)., TM.
10. Eyal Wirsansky (2020), Hands-On Genetic Algorithms with Python: Applying Genetic Algorithms to Solve Real-world Deep Learning and Artificial Intelligence Problems (1st ed.)., Packt.
11. Charu C. Aggarwal (2018), Neural Networks and Deep Learning: A Textbook (1st ed.)., Springer.

Percentage of 6 categories of Blooms Taxonomy in question paper

	Remember	Understand	Apply	Analyze	Evaluate	Create	
% in Question Paper	20	20	25	25	05	05	100%

MCCSCT401 MERN

Bachelor of Computer Applications		**Semester – V**		
Course Name: MERN		**Course Code: MCCSCT401**		
Vertical:		**Major**		
Periods per week (1 Period is 60 minutes)		**03**		
Practical per week (1 Period is 60 minutes)		**02**		
Credits		**04**		
Evaluation System		**Duration (in Hours)**	**Total Marks**	**Minimum Passing Marks**
Theory	**Continuous Internal Assessment**	**--**	**40**	**16**
	End Semester Examination	**2**	**60**	**24**
Practical	**Continuous Internal Assessment**	**--**	**20**	**8**
	End Semester Examination	**2**	**30**	**12**

Objectives of the Course:

1. Students will learn how to build full-stack applications using modern web technologies, enabling them to create efficient, scalable, and interactive web applications.
2. The course integrates MongoDB for database management, Node.js for backend logic, and React for frontend development, providing a complete understanding of the MERN stack.
3. The course introduces different types of Hooks and React Context API, helping students manage application-wide state effectively.
4. The course covers callbacks, promises, async/await, and event emitters to help students write efficient, non-blocking code in Node.js.
5. Encourages practical implementation through project-based learning, including building APIs, managing databases, and creating dynamic UI components.

Unit/Module	Name	Lectures
I	MongoDB and Node.js Basics	09
II	Node.js Fundamentals and Asynchronous Programming	09
III	Introduction to React and JavaScript for React	09
IV	React with JSX and State Management	09
V	Enhancing React Components and Routing	09
		45

R- Remember, U- Understand, A – Apply, AN- Analyze, EV- Evaluate, CR – Create

Unit /Module	Syllabus As per SSC framework of NEP	Level of Knowledge Applicable as per Blooms Taxonomy
I	**MongoDB and Node.js Basics** A. **MongoDB:** MongoDB Basics, MongoDB CRUD operations. MongoDB Node.js Driver.	A. U, R, A, AN, CR
II	**Node.js Fundamentals and Asynchronous Programming** A. **Node.js:** A Rich Module Ecosystem, When To Use Node.js, When Node.js May Not Be The Best Choice, Front-end Vs. Back-end JavaScript, Diving In: Your First Node.js API, Serving JSON, Basic Routing, Dynamic Responses, File Serving, Express. B. **Async:** Callbacks, Promises, Async & Await, Event Emitters, Event Emitters, Streams.	A) U, R, AN, A B) U, R, AN, A
III	**Introduction to React and JavaScript for React** A. **Welcome to React:** A Strong Foundation, React's Past and Learning React: Second Edition Changes, Working with the Files, File Repository, React Developer Tools, Installing Node.js. B. **JavaScript for React:** Declaring Variables, The const Keyword, The let Keyword, Template Strings, Creating Functions,, Objects and Arrays, Destructuring Objects & Arrays, Object Literal Enhancement, The Spread Operator, Asynchronous JavaScript, Simple Promises, Classes, ES6 Modules CommonJS. C. **How React Works:** Page Setup, React Elements, ReactDOM, Children, React Components, React Components.	A) R, U, A, AN B) R, U, A, CR C) U, R, AN, A
IV	**React with JSX and State Management** A. **React with JSX:** React Elements as JSX, Mapping Arrays with JSX, Babel, Recipes as JSX, React Fragments, Intro to webpack, Creating the Project, Loading the Bundle, Source Mapping, Create React App. B. **React State Management:** Building a Star Rating Component, The useState Hook, State in Component Trees, Sending State Down a Component Tree, Sending Interactions Back up a Component Tree, Building Forms, Using Refs, Controlled Components, Creating Custom Hooks, Adding Colors to State, React Context, Placing Colors in Context, Retrieving Colors with useContext, Stateful Context Providers, Custom Hooks with Context.	A) R, U, AN, A, CR B) R, U, AN, A
V	**Enhancing React Components and Routing** A. **Enhancing Components with Hooks:** Introducing useEffect- When to useLayoutEffect, Rules to Follow with Hooks, Improving Code with useReducer, useReducer to Handle Complex State, improving	a. R, U, A. AN

	Component Performance, shouldComponentUpdate and PureComponent. B. **React Route:** Incorporating the Route, Router Properties, Nesting Routes, Using Redirects, Routing Parameters	b) R, U, AN, A, CR

MERN – Practical		
Sr. No.	**List of Practicals**	**Level of Knowledge Applicable as per Blooms Taxonomy**
1.	a. Perform CRUD operations by using Express with MongoDB b. Perform File(image/doc) Upload operation by using MongoDB	U, A, AN, CR
2.	Create Chat application by using Socket.IO	U, A, AN, CR
3.	Perform following operations in Node.js: a) Reading a file; b) Writing a file	U, A, AN
4.	Creating and Publishing Your Own Node Module	U, A, AN, CR
5.	Creating Server using express and handling HTTP methods.	U, A, AN, CR
6.	Connect Nodejs with MongoDB.	U, A, AN, CR
7.	a. Create TODO list by using react hooks with different components. A. Create and validate the user form in React.	U, R, A, AN, CR
8.	Fetch the API data and render the list on React app.	U, R, A, AN, CR
9.	In React submit the user data by using API.	U, A, AN, CR
10.	Implement routing using React Route.	U, A, AN, CR

Learning Outcomes: After completion of Course, the learners will be able to:

1. Gain proficiency in using MongoDB, performing CRUD operations, and integrating MongoDB with Node.js using the MongoDB Node.js driver.
2. Develop a strong understanding of Node.js modules, server-side scripting, RESTful API creation, and handling asynchronous programming using callbacks, promises, and async/await.
3. Learn essential JavaScript ES6 features and how they enhance React development, along with setting up the development environment and using React Developer Tools.
4. Utilize **React components, JSX, event handling, and state management** using **useState, Context API, and custom hooks** to build dynamic applications.
5. Analyze and apply React hooks to optimize performance, and handle routing efficiently using React Router for seamless navigation in web applications.

Books & References:

1. Banks, A., & Porcello, E. (2020). *Learning React: Modern Patterns for Developing React Apps* (2nd ed.). O'Reilly Media.
2. Guttman, D., & Murray, N. (2019). *Fullstack Node.js: The Complete Guide to Building Production Apps with Node.js*. Fullstack.io.
3. Herron, D. (2024). *Node.js Web Development* (5th ed.). Packt Publishing.
4. Schwab, S. (2020). *Learning React* (2nd ed.). O'Reilly Media.

5. Mongod, D., & Shire, K. (2016). *MongoDB: The Definitive Guide* (2nd ed.). O'Reilly Media.
6. Soni, M. (2020). *MERN Quick Start Guide: Build React-based Web Applications using MongoDB, Express, React, and Node.js*. Packt Publishing.
7. Doyle, S. (2019). *Node.js Design Patterns* (2nd ed.). Packt Publishing.
8. Lim, G. (2019). *Beginning Node.js, Express & MongoDB Development*. Independently published.
9. GoalKicker.com (2018). *React JS Notes for Professionals*. GoalKicker.com.
10. Ghayour, F. (2017). *U&I With React*. Leanpub.

Percentage of 6 categories of Blooms Taxonomy in question paper

	Remember	Understand	Apply	Analyze	Evaluate	Create	
% in Question Paper	20	20	20	15	10	15	100%

MCCSCT303 Ethical Hacking

Bachelor of Computer Applications		**Semester – V**		
Course Name: Ethical Hacking		**Course Code: MCCSCT303**		
Vertical:		**Major**		
Periods per week (1 Period is 60 minutes)		**03**		
Practical per week (1 period is 60 minutes)		**02**		
Credits		**04**		
Evaluation System		**Duration (in Hours)**	**Total Marks**	**Minimum Passing Marks**
Theory	**Continuous Internal Assessment**	**-**	**40**	**16**
	End Semester Examination	**2**	**60**	**24**
Practical	**Continuous Internal Assessment**	**-**	**20**	**8**
	End Semester Examination	**2**	**30**	**12**

Course Objectives:

1. Comprehensive understanding of ethical hacking, security concepts, vulnerability assessment, malware analysis, social engineering, wireless security, and web application protection.
2. Understand ethical hacking methodologies, reconnaissance techniques, security frameworks, and the skills required for penetration testing and ethical hacking.
3. Identify vulnerabilities, malware creation, and network exploitation.
4. Implement security architectures, encryption, and defensive strategies.
5. Equips students with ethical hacking skills, preparing them for certifications and careers in cybersecurity while developing proficiency in identifying and exploiting vulnerabilities in web applications and networks.

Module	Name	Lectures
I	Introduction to Ethical Hacking and Security Concepts	09
II	Network Scanning and Vulnerability Assessment	09
III	System Hacking and Malware Analysis	09
IV	Social Engineering and Wireless Security	09
V	Web Application Security and Defensive Architecture	09
		45

R- Remember, U- Understand, A – Apply, AN- Analyze, EV- Evaluate, CR – Create

Unit/ Module	Syllabus As per SSC framework of NEP	Level of Knowledge Applicable as per Blooms Taxonomy
I	**Introduction to Ethical Hacking and Security Concept** **A) Ethical Hacking:** Overview of Ethics, Overview of Ethical Hacking, Methodology of Ethical hacking. **B) Security Foundation:** The Triad, Risk, Policies & Standards & Procedures, Security Technology, Being Prepared. **C) Footprinting and Reconnaissance:** Open-Source Intelligence, Domain Name System, Passive Reconnaissance, Website Intelligence, Technology Intelligence.	A) R, U B) R, U C) R, U, A, AN
II	**Network Scanning and Vulnerability Assessment** **A) Scanning Networks:** Ping Sweeps, Port Scanning, Vulnerability Scanning, Packet Crafting and Manipulation. **B) Enumeration:** Service Enumeration, Remote Procedure Calls, Server Message Block, Simple Network Management Protocol, Simple Mail Transfer Protocol, Web-Based Enumeration.	A) R, U, A, AN, EV B) R, U, A, AN
III	**Exploiting Hacking and Malware Analysis** **A) System Hacking:** Searching for Exploits, System Compromise, Gathering Passwords, Password Cracking, Client-Side Vulnerabilities, Post Exploitation. **B) Malware:** Malware Types, Malware Analysis, Creating Malware, Malware Infrastructure, Antivirus Solutions. **C) Sniffing:** Packet Capture, Packet Analysis, Spoofing Attacks.	A) R, U, A, AN B) R, U, A, AN, CR C) R, U, A, AN
IV	**Social Engineering and Wireless Security** **A) Social Engineering:** Social Engineering, Physical Social Engineering, Phishing Attacks, Website Attacks, Wireless Social Engineering, Automating Social Engineering. **B) Wireless Security:** Wi-Fi, Bluetooth, Mobile Devices.	A) R, U, A, AN, EV B) R, U, A, AN
V	**Web Application Security and Defensive Architecture** **A) Attack and Defense:** Web Application Attacks, Denial of Service Attacks, Application Exploitation, Lateral Movement, Defense in Depth/ Defense in Breadth, Defensible Network Architecture. **B) Security Architecture and Design:** Data Classification, Security Models, Application Architecture, Security Architecture.	A) R, U, A, AN, EV B) R, U, A, AN, EV

Ethical Hacking – Practical		
Sr. No.	**List of Practicals**	**Level of Knowledge Applicable as per Blooms Taxonomy**
1	Google and Whois Reconnaissance	R, U, A, AN
2	Password Encryption and cracking with CrypTool and Cain and Abel	R, U, A, AN
3	Linux Network Analysis and ARP Poisoning	U, A, AN, EV
4	Port Scanning with NMap	R, U, A, AN
5	Network Traffic Capture and DoS Attack with Wireshark and Nemesy	R, U, A, AN
6	Persistent Cross-Site Scripting Attack	R, U, A, AN
7	Session Impersonation with Firefox and Tamper Data	U, A, AN
8	SQL Injection Attack	R, U, A, AN
9	Creating a Keylogger with Python	U, A, CR
10	Exploiting with Metasploit (Kali Linux)	U, A, AN

Learning Outcomes: After completion of the Course, the learners will be able to:

1. Understand the fundamentals of ethical hacking, security principles, reconnaissance techniques, and risk management strategies.
2. Perform network scanning, vulnerability assessment, and enumeration techniques to identify potential security threats.
3. Analyze system vulnerabilities, exploit hacking techniques, and understand malware creation, analysis, and mitigation strategies.
4. Explore social engineering tactics, phishing techniques, and wireless security vulnerabilities to enhance cybersecurity awareness.
5. Identify and mitigate web application attacks while implementing security architectures and defense mechanisms for secure networks.

Books and References:

1. Messier, R. (2019). CEHv10 certified ethical hacker study guide (1st ed.). Sybex.
2. Greeg, M. (2014). Certified ethical hacker (CEH) cert guide (1st ed.). Pearson.
3. Walker, M. (2020). CEH certified ethical hacker all-in-one exam guide (5th ed.). McGraw Hill.
4. Specialist, I. P. (2018). CEHv10: EC-Council certified ethical hacker complete guide with practice labs. Zaccheus Entertainment.
5. Simpson, M., Backman, K., & Corley, J. (2019). Hands-on ethical hacking and network defense (3rd ed.). Cengage Learning.
6. EC-Council. (2021). Ethical hacking and countermeasures: Attack phases (1st ed.). Cengage Learning.
7. Engebretson, P. (2013). The basics of hacking and penetration testing (2nd ed.). Syngress.
8. Skoudis, E., & Liston, T. (2006). Counter hack reloaded: A step-by-step guide to computer attacks and effective defenses (2nd ed.). Pearson Education.
9. Grimes, R. (2017). Hacking the hacker: Learn from the experts who take down hackers (1st ed.). Wiley.
10. McClure, S., Scambray, J., & Kurtz, G. (2012). Hacking exposed 7: Network security secrets and solutions (7th ed.). McGraw Hill.

Percentage of 6 categories of Blooms Taxonomy in question paper

	Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**	
% in Question Paper	20	25	20	20	10	05	100%

MCCSCT306 Internet of Things

Bachelor of Computer Applications		**Semester – V**		
Course Name: Internet of Things		**Course Code: MCCSCT306**		
Vertical:		**Minor**		
Periods per week (1 Period is 60 minutes)		**03**		
Practical per week (1 period is 60 minutes)		**02**		
Credits		**04**		
Evaluation System		**Duration (in Hours)**	**Total Marks**	**Minimum Passing Marks**
Theory	**Continuous Internal Assessment**	**-**	**40**	**16**
	End Semester Examination	**2**	**60**	**24**
Practical	**Continuous Internal Assessment**	**-**	**20**	**8**
	End Semester Examination	**2**	**30**	**12**

Course Objectives:

1. Provide a comprehensive understanding of the Internet of Things (IoT), covering its fundamental concepts, communication protocols, design principles, and real-world applications.
2. Covers IoT architecture, communication models, and protocols like TCP/IP, HTTP, and MQTT for efficient data exchange in IoT networks.
3. Introduces hardware platforms such as Arduino and Raspberry Pi, embedded programming, sensor integration, and cloud connectivity for IoT applications.
4. Explores IoT security challenges, data privacy issues, and ethical concerns related to data ownership, control, and sustainability.
5. Equips students with a strong foundation in IoT concepts, hands-on prototyping, embedded systems programming, security and privacy measures, business and startup opportunities, manufacturing processes, ethical considerations, and industry-relevant skills for career growth.

Module	**Name**	**Lectures**
I	**The Internet of Things: An Overview and Design Principles**	09
II	**Prototyping Concepts and Embedded Devices**	09
III	**Prototyping Physical and Online Components**	09
IV	**Embedded Code Techniques and Business Models**	09
V	**Manufacturing Processes and Ethical Consideration**	09
	Total	**45**

R- Remember, U- Understand, A – Apply, AN- Analyze, EV- Evaluate, CR – Create

Unit/ Module	Syllabus As per SSC framework of NEP	Level of Knowledge Applicable as per Blooms Taxonomy
I	**<u>The Internet of Things: An Overview and Design Principles</u>** A) **The Internet of Things: An Overview**: The Flavour of the Internet of Things, The "Internet" of "Things", The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things? B) **Design Principles for Connected Devices:** Calm and Ambient Technology, Magic as Metaphor, Privacy, Keeping Secrets, Whose Data Is It Anyway? Web Thinking for Connected Devices, Small Pieces, Loosely Joined, First-Class Citizens on The Internet, Graceful Degradation, and Affordances. C) **Internet Principles:** Internet Communications: An Overview, IP, TCP, The IP Protocol Suite (TCP/IP), UDP, IP Addresses, DNS, Static IP Address Assignment, Dynamic IP Address Assignment, IPv6, MAC Addresses, TCP and UDP Ports, An Example: HTTP Ports, Other Common Ports, Application Layer Protocols, HTTP, HTTPS: Encrypted HTTP, Other Application Layer Protocols.	A) R, U B) U, A, AN, EV C) R, U, A
II	**<u>Prototyping Concepts and Embedded Devices</u>** A) **Thinking About Prototyping:** Sketching, Familiarity, Costs versus Ease of Prototyping, Prototypes and Production, Changing Embedded Platform, Physical Prototypes and Mass Personalisation, climbing into the Cloud, Open Source versus Closed Source, Why Closed? Why Open? Mixing Open and Closed Source, Closed Source for Mass Market Projects, Tapping into the Community. B) **Prototyping Embedded Devices:** Electronics, Sensors, Actuators, Scaling Up the Electronics, Embedded Computing Basics, Microcontrollers, System-on-Chips, Choosing Your Platform, Arduino, developing on the Arduino, Some Notes on the Hardware, Openness, Raspberry Pi, Cases and Extension Boards, Developing on the Raspberry Pi, Some Notes on the Hardware, Openness.	A) R, U, A, AN, EV B) R, U, A, AN
III	**<u>Prototyping Physical and Online Components</u>** A) **Prototyping the Physical Design:** Preparation, Sketch, Iterate, and Explore, Nondigital Methods, Laser Cutting,	A) U, A, EV, CR

	Choosing a Laser Cutter, Software, Hinges and Joints, 3D Printing, Types of 3D Printing, Software, CNC Milling, Repurposing/Recycling. B) **Prototyping Online Components:** Getting Started with an API, Mashing Up APIs, Scraping, Legalities, writing a New API, Clockodillo, Security, implementing the API, Using Curl to Test, Going Further, Real-Time Reactions, Polling, Comet, Other Protocols, MQ Telemetry Transport, Extensible Messaging and Presence Protocol, Constrained Application Protocol.	B) R, U, A, EV, CR
IV	**<u>Embedded Code Techniques and Business Models</u>** A) **Techniques for Writing Embedded Code:** Memory Management, Types of Memory, Making the Most of Your RAM, Performance and Battery Life, Libraries, Debugging. B) **Business Models:** A Short History of Business Models, Space and Time, From Craft to Mass Production, The Long Tail of the Internet, Learning from History, The Business Model Canvas, Who Is the Business Model For? Models, Make Thing, Sell Thing, Subscriptions, Customization, be a Key Resource, Provide Infrastructure: Sensor Networks, take a Percentage, Funding an Internet of Things Startup, Hobby Projects and Open Source, Venture Capital, Government Funding, Crowdfunding, Lean Startups.	A) U, A, EV B) R, U, AN, EV, CR
V	**<u>Manufacturing Processes and Ethical Consideration</u>** A) **Moving to Manufacture:** What Are You Producing? Designing Kits, Designing Printed circuit boards, Software Choices, The Design Process, Manufacturing Printed Circuit Boards, Etching Boards, Milling Boards. Assembly, Testing, Mass-Producing the Case and Other Fixtures, Certification, Costs, Scaling Up Software, Deployment, Correctness and Maintainability, Security, Performance, User Community. B) **Ethics:** Characterizing the Internet of Things, Privacy, Control, Disrupting Control, Crowdsourcing, Environment, Physical Thing, Electronics, Internet Service, Solutions, The Internet of Things as Part of the Solution, Cautious Optimism, The Open Internet of Things Definition.	A) R, U, A, AN, EV, CR B) U, AN, EV

Internet of Things – Practical		
Sr. No.	**List of Practicals**	**Level of Knowledge Applicable as per Blooms Taxonomy**
0	Starting Raspbian OS, Familiarizing with Raspberry Pi Components and interface, Connecting to ethernet, Monitor, USB.	R, U, A
1	Displaying different LED patterns with Raspberry Pi.	R, U, A, CR
2	Displaying Time over 4-Digit 7-Segment Display using Raspberry Pi.	U, A, CR
3	Raspberry Pi Based Oscilloscope	R, U, A, AN, CR
4	Controlling Raspberry Pi with Telegram bot.	U, A, CR
5	Fingerprint Sensor interfacing with Raspberry Pi	R, U, A, CR
6	Raspberry Pi GPS Module Interfacing	A, CR
7	IoT based Web Controlled Home Automation using Raspberry Pi	U, A, AN, CR
8	Visitor Monitoring with Raspberry Pi and Pi Camera	U, A, AN, CR
9	Interfacing Raspberry Pi with RFID	R, U, A, CR
10	Installing Windows 10 IoT Core on Raspberry Pi	U, A

Learning Outcomes: After completion of the Course, the learners will be able to:

1. Understand IoT fundamentals, technologies, design principles, communication protocols, and security to develop efficient and scalable IoT solutions.
2. Design and implement IoT architectures and prototyping techniques using embedded systems, including Arduino, Raspberry Pi, sensors, actuators, gateways, cloud-based systems, and data analytics.
3. Gain proficiency in prototyping physical and online components using digital fabrication techniques, APIs, real-time communication protocols, and security considerations.
4. Develop embedded code with efficient memory management, debugging, and performance optimization while understanding IoT business models, funding, and commercialization strategies.
5. Learn manufacturing processes, PCB design, mass production techniques, and ethical considerations in IoT, including privacy, security, sustainability, and open-source development.

Books & References:

1. McEwen, A., & Cassimally, H. (2014). *Designing the Internet of Things* (1st ed.). Wiley.
2. Kamal, R. (2017). *Internet of Things – Architecture and Design* (1st ed.). McGraw-Hill.
3. Pfister, C. (2018). *Getting Started with the Internet of Things* (6th ed.). O'Reilly.
4. Greengard, S. (2015). *The Internet of Things* (1st ed.). MIT Press.
5. Bahga, A., & Madisetti, V. (2014). *Internet of Things: A Hands-On Approach* (1st ed.). VPT.

6. Margolis, M. (2020). *Arduino Cookbook* (3rd ed.). O'Reilly Media.
7. Monk, S. (2013). *Programming the Raspberry Pi: Getting Started with Python* (2nd ed.). McGraw-Hill Education.
8. Marwedel, P. (2021). *Embedded System Design: Embedded Systems Foundations of Cyber-Physical Systems* (3rd ed.). Springer.
9. Rose, K. (2014). *The Internet of Things: Enabling Technologies, Platforms, and Use Cases* (1st ed.). Wiley.
10. Pethuru, R., Anupama, C. R., & Vijay, M. (2017). *The Internet of Things: Enabling Technologies, Security and Social Implications* (1st ed.). CRC Press.

Percentage of 6 categories of Blooms Taxonomy in question paper

	Remember	Understand	Apply	Analyze	Evaluate	Create	
% in Question Paper	15	25	20	25	10	05	100%

MCCSCT312 Linux Administration

Bachelor of Computer Applications		**Semester – V**		
Course Name: Linux Administration		**Course Code: MCCSCT312**		
Vertical:		**VSEC**		
Periods per week (1 Period is 60 minutes)		**03**		
Practical per week (1 Period is 60 minutes)		**02**		
Credits		**04**		
Evaluation System		**Duration (in Hours)**	**Total Marks**	**Minimum Passing Marks**
Theory	**Continuous Internal Assessment**	**--**	**40**	**16**
	End Semester Examination	**2**	**60**	**24**
Practical	**Continuous Internal Assessment**	**--**	**20**	**8**
	End Semester Examination	**2**	**30**	**12**

Objectives of the Course:

1. Introduce Red Hat Enterprise Linux and the duties of a Linux system administrator. Familiarize with the Bash shell and basic file system management tasks.
2. Configure and manage storage, including partitions, logical volumes, file systems, snapshots, and encrypted volumes. Learn about networking, services, and runlevels.
3. Understand user and group management, including password management, external authentication sources, permissions, and access control lists.
4. Secure the server using iptables, including firewall configuration, advanced iptables settings, and cryptographic services for SSL and GPG.
5. Configure server features such as file sharing with NFS and Samba, DNS and DHCP services, setting up a mail server, configuring Apache web server, and Bash shell scripting.

Module	**Name**	**Lectures**
I	Mastering Red Hat Enterprise Linux: System Administration, Command Line, and Software Management	09
II	Configuring and Managing Linux Storage, Networking, and User Permissions	09
III	Securing, Cryptographic Services, and File Sharing Configuration on Linux Servers	09
IV	Configuring DNS, DHCP, Mail, and Apache Servers on Red Hat Enterprise Linux	09
V	Bash Scripting, High-Availability Clustering, and Automated Installation on Red Hat Linux	09
		45

R- Remember, U- Understand, A – Apply, AN- Analyze, EV- Evaluate, CR – Create

Unit	Syllabus	Level of Knowledge Applicable as per Blooms Taxonomy
I	**Mastering Red Hat Enterprise Linux: System Administration, Command Line, and Software Management** **A) Introduction to Red Hat Enterprise Linux:** Linux, Open Source and Red Hat, Origins of Linux, Distributions, Duties of Linux System Administrator. **B) Command Line:** Working with the Bash Shell, Getting the Best of Bash, Useful Bash Key Sequences, Working with Bash History, Performing Basic File System Management Tasks, Working with Directories, Piping and Redirection, Finding Files **C) System Administration Tasks:** Performing Job Management Tasks, System and Process Monitoring and Management, Managing Processes with ps, Sending Signals to Processes with the kill Command, using top to Show Current System Activity, Managing Process Niceness, Scheduling Jobs, Mounting Devices, Working with Links, Creating Backups, Managing Printers, Setting Up System Logging, Setting Up Rsyslog, Common Log Files, Setting Up Logrotate **D) Managing Software**: Understanding RPM, Understanding Meta Package Handlers, Creating Your Own Repositories, Managing Repositories, Installing Software with Yum, Querying Software, Extracting Files from RPM Packages	a)U, R, A, AN, CR b)U, R, AN c)U,R,AN, A d)U, R, AN, A, CR
II	**Configuring and Managing Linux Storage, Networking, and User Permissions** **A) Configuring and Managing Storage:** Understanding Partitions and Logical Volumes, Creating Partitions, Creating File Systems, File Systems Overview, Creating File Systems, Changing File System Properties, Checking the File System Integrity, Mounting File Systems Automatically Through fstab, Working with Logical Volumes, Creating Logical Volumes, Resizing Logical Volumes, Working with Snapshots, Replacing Failing Storage Devices, Creating Swap Space, Working with Encrypted Volumes **B) Connecting to the Network:** Understanding NetworkManager, Working with Services and Runlevels, Configuring the Network with NetworkManager, Working with system-config-network, NetworkManager Configuration Files, Network Service Scripts, Networking from the Command Line, Troubleshooting Networking, Setting Up IPv6, Configuring SSH, Enabling the SSH	a) U, R, AN, A b) U, R, AN, A

	Server, Using the SSH Client, Using PuTTY on Windows Machines, Configuring Key-Based SSH Authentication, Using Graphical Applications with SSH, Using SSH Port Forwarding, Configuring VNC Server Access **C) Working with Users, Groups, and Permissions:** Managing Users and Groups, Commands for User Management, Managing Passwords, Modifying and Deleting User Accounts, Configuration Files, Creating Groups, Using Graphical Tools for User, and Group Management, Using External Authentication Sources, the Authentication Process, sssd, nsswitch, Pluggable Authentication Modules, Managing Permissions, the Role of Ownership, Basic Permissions: Read, Write, and Execute, Advanced Permissions, Working with Access Control Lists, Setting Default Permissions with umask, Working with Attributes	c) U, R, AN,
III	**<u>Securing, Cryptographic Services, and File Sharing Configuration on Linux Servers</u>** **A) Securing Server with iptables:** Understanding Firewalls, Setting Up a Firewall with system-config-firewall, Allowing Services, Trusted Interfaces, Masquerading, Configuration Files, Setting Up a Firewall with iptables, Tables, Chains, and Rules, Composition of Rule, Configuration Example, Advanced iptables Configuration, Configuring Logging, The Limit Module, Configuring NAT **B) Setting Up Cryptographic Services:** Introducing SSL, Proof of Authenticity: The Certificate Authority, Managing Certificates with openssl, Creating a Signing Request, Working with GNU Privacy Guard, Creating GPG Keys, Key Transfer, Managing GPG Keys, Encrypting Files with GPG, GPG Signing, Signing RPM Files **C) Configuring Server for File Sharing:** What is NFS? Advantages and Disadvantages of NFS, Configuring NFS4, Setting Up NFSv4, Mounting an NFS Share, Making NFS Mounts Persistent, Configuring Automount, Configuring Samba, Setting Up a Samba File Server, Samba Advanced Authentication Options, Accessing Samba Shares, Offering FTP Services.	a) R, U, A, AN b) R, U, A, CR c) U, R, AN, A
IV	**<u>Configuring DNS, DHCP, Mail, and Apache Servers on Red Hat Enterprise Linux</u>** **A) Configuring DNS and DHCP:** Introduction to DNS, The DNS Hierarchy, DNS Server Types, The DNS Lookup Process, DNS Zone Types, Setting Up a DNS Server, Setting Up a Cache-Only Name Server, Setting Up a Primary Name Server, Setting Up a Secondary Name Server, Understanding DHCP, Setting Up a DHCP Server **B) Setting Up a Mail Server:** Using the Message Transfer Agent, the Mail Delivery Agent, the Mail User Agent,	a) R, U, AN, A, CR

	Setting Up Postfix as an SMTP Server, Working with Mutt, Basic Configuration, Internet Configuration, Configuring Dovecot for POP and IMAP **C) Configuring Apache on Red Hat Enterprise Linux:** Configuring the Apache Web Server, creating a Basic Website, Understanding the Apache Configuration Files, Apache Log Files, Working with Virtual Hosts, Securing the Web Server with TLS Certificates, Configuring Authentication, Setting Up Authentication with .htpasswd, Co	b) R, U, AN, A c) U, R, AN
V	**<u>Bash Scripting, High-Availability Clustering, and Automated Installation on Red Hat Linux</u>** **A) Introducing Bash Shell Scripting:** Introduction, Elements of a Good Shell Script, Executing the Script, Working with Variables and Input, Understanding Variables, Variables, Subshells, and Sourcing, Working with Script Arguments, Asking for Input, Using Command Substitution, Substitution Operators, Changing Variable Content with Pattern Matching, Performing Calculations, Using Control Structures, Using if...then...else, Using case, Using while, Using until, Using for, Configuring booting with GRUB. **B) High-Availability Clustering:** High-Availability Clustering, The Workings of High Availability, High-Availability Requirements, Red Hat High-Availability Add-on Software, Components, Configuring Cluster-Based Services, Setting Up Bonding, Setting Up Shared Storage, Installing the Red Hat High Availability Add-On, Building the Initial State of the Cluster, Configuring Additional Cluster Properties, Configuring a Quorum Disk, Setting Up Fencing, Creating Resources and Services, Troubleshooting a Nonoperational Cluster, Configuring GFS2 File Systems **C) Setting Up an Installation Server:** Configuring a Network Server as an Installation Server, Setting Up a TFTP and DHCP Server for PXE Boot, Installing the TFTP Server, Configuring DHCP for PXE Boot, Creating the TFTP PXE Server Content, creating a Kickstart File, Using a Kickstart File to Perform an Automated, Installation, Modifying the Kickstart File with, system-config-kickstart, Making Manual Modifications to the Kickstart File	a) R, U, A. AN b)R, U, AN, A, CR c) U, R, AN

List of Practical:		
Sr. No	**Syllabus**	**Level of Knowledge Applicable as per Blooms Taxonomy**
0	**Installation of RHEL 6.X**	U, A, AN, CR
1	**Graphical User Interface and Command Line Interface and Processes**	U, A, AN, CR
A	Exploring the Graphical Desktop	
B	The Command Line Interface	
C	Managing Processes	
2	**Storage Devices and Links, Backup and Repository**	U, A, AN
a	Working with Storage Devices and Links	
b	Making a Backup	
c	Creating a Repository	
3	**Working with RPMsm Storage and Networking**	U, A, AN, CR
A	Using Query Options	
B	Extracting Files From RPMs	
C	Configuring and Managing Storage	
D	Connecting to the Network	
4	**Working with Users, Groups, and Permissions**	U, A, AN, CR
5	**Firewall and Cryptographic services**	U, A, AN
A	Securing Server with iptables	
B	Setting Up Cryptographic Services	

6	**Configuring Server for File Sharing**	U, A, AN
A	Configuring NFS Server and Client	
B	Configuring Samba	
C	Configuring FTP	
7	**DNS, DHCP and Mail Server**	U, A, AN, CR
A	Configuring DNS	
B	Configuring DHCP	
C	Setting Up a Mail Server	
8	**Web Server**	U, A, AN, CR
A	Configuring Apache on Red Hat Enterprise Linux	
B	Writing a Script to Monitor Activity on the Apache Web Server	
C	Using the select Command	
9	**Shell Scripts and High-Availability Clustering**	U, A, AN, CR
A	Writing Shell Scripts	
B	Configuring Booting with GRUB	
C	Configuring High Availability Clustering	
10	**Setting Up an Installation Server**	U, A, AN, CR
A	Configuring Network Server as an Installation Server	
B	Setting Up a TFTP and DHCP Server for PXE Boot	

Learning Outcomes: After completion of Course, the learners will be able to:

1. Gain proficiency in Red Hat Enterprise Linux administration, including working with the Bash shell, performing file system management tasks, and understanding basic system administration duties.
2. Develop skills in storage configuration, networking, and service management. Learn to configure and manage logical volumes, snapshots, encrypted volumes, and network services.
3. Acquire knowledge and practical experience in user and group management, including password management, external authentication, permissions, and access control lists.
4. Implement server security measures using iptables, including firewall configuration, advanced settings, and cryptographic services for SSL and GPG.

5. Demonstrate proficiency in configuring and managing server features, including file sharing with NFS and Samba, DNS and DHCP services, mail server setup, Apache web server configuration, and Bash shell scripting.

Books and References:

1. van Vugt, S. (2013). Red Hat Enterprise Linux 6 administration. John Wiley & Sons.
2. Collings, T., & Wall, K. (n.d.). Red Hat Linux networking and system administration (3rd ed.). Wiley.
3. Soyinka, W. (n.d.). Linux administration: A beginner's guide (5th ed.). Tata McGraw-Hill.
4. Negus, C. (2020). Linux Bible (10th ed.). Wiley.
5. Nemeth, E., Snyder, G., Hein, T., Whaley, B., & Mackin, D. (2017). Unix and Linux system administration handbook (5th ed.). Pearson Education.
6. Sobell, M. G. (2020). A practical guide to Fedora and Red Hat Enterprise Linux (8th ed.). Pearson.

Percentage of 6 categories of Blooms Taxonomy in question paper

	Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**	
% in Question Paper	20	20	20	15	10	15	100%

MCCSCT410 Generative AI

Bachelor of Computer Applications		**Semester – V**		
Course Name: Generative AI		**Course Code: MCCSCT410**		
Vertical:		**VSEC**		
Periods per week (1 Period is 60 minutes)		**03**		
Practical per week (1 Period is 60 minutes)		**02**		
Credits		**04**		
Evaluation System		**Duration (in Hours)**	**Total Marks**	**Minimum Passing Marks**
Theory	**Continuous Internal Assessment**	**--**	**40**	**16**
	End Semester Examination	**2**	**60**	**24**
Practical	**Continuous Internal Assessment**	**--**	**20**	**8**
	End Semester Examination	**2**	**30**	**12**

Objectives of the Course:

1. Recall the key concepts of generative AI and its applications across industries.
2. Explain the principles behind generative models, including GANs and VAEs, and their real-world applications.
3. Apply generative AI techniques to creative fields like art, music, and design while addressing ethical considerations.
4. Analyze the impact of generative AI on business innovation and evaluate the challenges and future directions of GANs.
5. Build and deploy generative models using cloud platforms (AWS, Azure, Google Cloud) for real-world applications.

Unit/Module	**Name**	**Lectures**
I	**Exploring the Evolution and Impact of Generative AI Across Industries**	**09**
II	**Fundamentals and Applications of Generative Models: Principles, Techniques, and Real-World Impact**	**09**
III	**Generative AI in Creative Industries: Applications, Ethics, and Future Trends**	**09**
IV	**Leveraging Generative AI for Business Innovation and the Future of GANs**	**09**
V	**Building and Deploying Generative Models: Practical Guide and Cloud-Based Solutions**	**09**
		45

R- Remember, U- Understand, A – Apply, AN- Analyze, EV- Evaluate, CR – Create

Unit /Module	Syllabus	Level of Knowledge Applicable as per Blooms Taxonomy
I	**Exploring the Evolution and Impact of Generative AI Across Industries** **A) Introduction to Generative AI:** Introduction, Defining generative AI and its evolution, Evolutionary trajectory, Breakthroughs in generative models, Applications in the real world, Challenges and advancements, Anticipated future trajectory, Conclusion. **B) Generative AI in Industries:** Introduction, Significance and impact of generative AI on various industries, Healthcare and drug discovery, Art and entertainment, Creative assistance in content generation, Manufacturing and design, Finance and risk management, Human resources and recruitment, Robotics and automation, Challenges and considerations, Future outlook, Conclusion.	e) U,R,A
II	**Fundamentals and Applications of Generative Models: Principles, Techniques, and Real-World Impact** **A) Fundamentals of Generative Models:** Introduction, Overview of generative models, Generative adversarial networks, Variational autoencoders, Autoencoders, CycleGAN, Bidirectional Encoder Representations from Transformers, Examples of Bidirectional Encoder Representations from Transformers implementations, DeepDream, Understanding the underlying principles, Underlying principles of generative models, Mathematical foundations, Generative adversarial networks, Variational autoencoders, Training mechanisms, Loss functions, Generative model evaluation, Ethical considerations, Comparison with discriminative models, Transfer learning in generative models, Case studies and real-world applications, Fundamental differences between generative and discriminative models.	a)U, R, AN, A b) U, R, AN, A
III	**Generative AI in Creative Industries: Applications, Ethics, and Future Trends** **A) Applications Across Industries:** Introduction, Exploring generative AI in healthcare, finance, entertainment, and more Generative AI in healthcare, Generative AI in the financial sector, Generative AI in the entertainment sector Generative art and design, Ethical considerations in AI-generated art, Case studies showcasing real-world applications, Future trends and potential disruptions, Conclusion. **B) Creative Expression with Generative AI:** Introduction,	a) R, U, A, AN b) U, R, AN, A

	Generative AI in art, music, and design, Generative adversarial networks in visual arts, Harmonies of code and melody, Aesthetic revolution in design Algorithmic , Collaborations between humans and AI, Ethical considerations in creative AI, Conclusion.	
IV	**<u>Leveraging Generative AI for Business Innovation and the Future of GANs</u>** **A) Generative AI in Business and Innovation:** Introduction, Enhancing product development and design, Innovations in manufacturing and supply chain, Siemens, Jet engines, Walmart, Amazon, Netflix, Spotify, Strategies for leveraging generative AI in business. **B) Deep Dive into GANs:** Introduction, Understanding the architecture and training process, Challenges and ongoing research in generative adversarial networks, Future of generative adversarial networks, Ethical guidelines Conclusion,	a) R, U, AN, A, CR
V	**<u>Building and Deploying Generative Models: Practical Guide and Cloud-Based Solutions</u>** **A) Building and Deploying Generative Models:** Introduction, Practical guide to developing generative models, Deploying generative models, Deploying a variational autoencoder on AWS AI platform, Deploying a generative adversarial network, Deploying a generative adversarial network on Microsoft Azure, AI services and tools, Google Cloud Platform: AI Platform (Unified), Conclusion.	a) R, U, A. AN b) R, U, AN, A, CR

List of Practical:		
Sr. No	**Syllabus**	**Level of Knowledge Applicable as per Blooms Taxonomy**
1.	Building a Simple Text Generator with GPT-3 or GPT-4: Create a chatbot, text completion tool, or a short story generator using GPT-3/4.	U, A, AN, CR
2.	Creating Images with Generative Adversarial Networks (GANs) : Train a GAN to generate simple images (e.g., faces, landscapes).	U, A, AN, CR

3.	Voice Synthesis and Text-to-Speech (TTS) with Deep Learning: Build a text-to-speech model or voice assistant using open-source libraries.	U, A, AN
4.	Music Generation with Neural Networks: Build a model that generates music in a specific style (e.g., classical, jazz).	U, A, AN, CR
5.	Deepfake Creation and Detection: Students create simple deepfake videos or images using deep learning models.	U, A, AN, CR
6.	Text-to-Image Generation with CLIP and VQ-VAE: Build a model that generates images from text descriptions.	U, A, AN, CR
7.	Style Transfer and Neural Art: Apply style transfer to images and videos (e.g., turn photos into artwork in the style of famous artists).	U, R, A, AN, CR
8.	Generative AI for Game Content Creation: Use AI models to generate characters, levels, or even stories for games.	U, R, A, AN, CR
9.	AI-Driven Video Editing and Automation: Create an AI that edits video, adds effects, or generates transitions.	U, A, AN, CR
10.	AI for Data Augmentation in Machine Learning: Use generative models to create additional data for training machine learning models (e.g., generating synthetic data to avoid class imbalance).	U, A, AN, CR

Learning Outcomes: After completion of Course, the learners will be able to:

1. Identify and describe the major advancements, applications, and challenges of generative AI in various industries such as healthcare, finance, and manufacturing.
2. Demonstrate understanding of generative models by explaining their architecture, training process, and use in various industries, while comparing them to discriminative models.

3. Create AI-generated art, music, or design while evaluating ethical implications and identifying future trends in creative industries.
4. Analyze case studies of companies leveraging generative AI and assess the potential of GANs for future innovations in business strategies.
5. Develop and deploy a generative adversarial network (GAN) or variational autoencoder (VAE) on cloud platforms, integrating AI services and tools for practical use cases.

Books and References:

1. Chollet, F. (2021). Deep learning with Python (2nd ed.). Manning Publications.
2. Valle, R. (2020). Hands-on generative adversarial networks with Keras. Packt Publishing.
3. Foster, D. (2020). Generative deep learning: Teaching machines to paint, write, compose, and play. O'Reilly Media.
4. Kalin, J. (2020). Generative adversarial networks cookbook. Packt Publishing.
5. Gibson, A., & Patterson, J. (2021). Deep learning: A practitioner's approach. O'Reilly Media.
6. Raschka, S., & Mirjalili, V. (2019). Python machine learning (3rd ed.). Packt Publishing.

Percentage of 6 categories of Blooms Taxonomy in question paper

	Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**	
% in Question Paper	20	20	20	15	10	15	100%

MCCSCTPRJ401 Project

Bachelor of Computer Applications		Semester – V	
Course Name: Project		**Course Code: MCCSCTPRJ401**	
Periods per week (1 Period is 50 minutes)		**2**	
Credits		**2**	
Vertical		**RP / OJT**	
		Hours	**Marks**
Evaluation System	**Practical and Viva**	**2**	**50**

The details are given in Project Policy document.

MCCOJTSCT302 On Job Training

Bachelor of Computer Applications	Semester – V		
Course Name: On Job Training	Course Code: MCCOJTSCT302		
Vertical:	RP / OJT		
Periods per week (1 Period is 60 minutes)	2		
Practical per week (1 Period is 60 minutes)	--		
Credits	2		
Evaluation System	Duration (in Hours)	Total Marks	Minimum Passing Marks
Continuous Internal Assessment	--	50	20

The details are given in OJT Policy document.