



**Hindi Vidya Prachar Samiti's  
Ramniranjan Jhunjhunwala College of Arts, Science & Commerce  
(Empowered Autonomous College)**

**Affiliated to  
UNIVERSITY OF MUMBAI**

**Syllabus for the T.Y.B.Sc. IT (under NEP)**

**Vertical under NEP: MAJOR**

**Program: B.Sc. Information Technology**

**Program Code: RJMAJIT**

**Semester V and VI**

**(REVISED 2025-2026 in alignment with the NEP 2020 facilitating the inter-and multidisciplinary learning and multiple entry and exit of the students)**

**Level 5.5**

**(CBCS 2025-2026)**

**B.Sc. IT Semester V and VI as per NEP 2020**  
Implemented from the academic year 2025-2026.  
**Major Subject: Information Technology**

Credit Structure for **B.Sc. IT Semester V and VI** as per **NEP 2020** Implemented from the academic year 2025-2026. **Major Subject: Information Technology**

**Semester: V**

**Level 5.5 Major Information Technology**

<b>Courses</b>	<b>Title</b>	<b>Credit</b>	<b>Total Credits</b>
<b>Major DSC (Discipline Specific Course)</b>			
RJDSCIT351	Full Stack Development with MERN Technologies	3	10
RJDSCIT352	Java Programming	3	
RJDSCITP351	MAJ: Major Practical (Full Stack development with MERN Technologies and Java Programming Practical)	2	
RJDSCITP352	Applied Software Project Management Practical	2	
<b>Major DSE (Discipline Specific Elective)</b>			
RJDSEIT351	System Administration with Linux	2	4
RJDSEITP351	System Administration with Linux Practical	2	
RJDSEIT352	Artificial Intelligence and Applications	2	
RJDSEITP352	Artificial Intelligence and Applications Practical	2	
<b>Minor</b>			
RJMINIT351	Design Principles of Internet of Things	2	4
RJMINITP351	Design Principles of Internet of Things Practical	2	
<b>Skill Enhancement Course</b>			
RJSECITP351	Mobile Programming Practical	2	2
<b>Field Project</b>			
RJFPIT351	Major Project	2	2
<b>Total:</b>			22

**\* As per University Grid**

**Semester: VI**  
**Level 5.5 Major Information Technology**

<b>Courses</b>	<b>Title</b>	<b>Credit</b>	<b>Total Credits</b>
<b>Major DSC (Discipline Specific Course)</b>			
RJDSCIT361	Advanced Web Development	3	10
RJDSCIT362	Principles of Information Security	3	
RJDSCITP361	MAJ: Major Practical (Advanced Web Development and Principles of Information Security Practical)	2	
RJDSCIT363	IT Services and Management	2	
<b>Major DSE (Discipline Specific Elective)</b>			
RJDSEIT361	Geographic Information System	2	4
RJDSEITP361	Geographic Information System Practical	2	
RJDSEIT362	Software Testing and Quality Assurance	2	
RJDSEITP362	Software Testing and Quality Assurance Practical	2	
<b>Minor</b>			
RJMINIT361	Business Analytics	2	4
RJMINITP361	Business Analytics Practical	2	
<b>Field Project</b>			
RJOJTIT361	On the Job Training	4	4
<b>Total:</b>			22

**\* As per University Grid**

## DISTRIBUTION OF TOPICS AND CREDITS

### T. Y. B.Sc. Information Technology SEMESTER V

Course	Nomenclature	Credits	Topics
RJDSCIT351	Full Stack development with MERN Technologies	03	Introduction, MERN overview, Hello World project setup, React Components, React State, Express and GraphQL, MongoDB basics, Architecture and ESLint, Modularization and Webpack, React Router, React Forms, React Bootstrap, Server Rendering, Authentication
RJDSCIT352	Java Programming	03	Introduction to Java, Classes, Inheritance, Interfaces, Multithreading, Packages, Servlet, Working with database, Cookies, Session, Java Server Pages, Java Server Faces
RJDSCITP351	MAJ: Major Practical (Full Stack development with MERN Technologies and Java Programming Practical)	02	<b>MERN</b> Introduction, React Components & State Management, Express.JS & GraphQL Basics, REST API, MongoDB CRUD Operations, Modularization & Webpack Configuration, React-Router & Navigation, route and query parameters, React Forms, API Integration, React-Bootstrap, UI Components, Server Rendering, Authentication & Deployment <b>Java:</b> OOPs Concept, Exception and Event Handling, Multithreading, Servlet, Cookies, Session, JDBC, JSP, JSF
RJDSCITP352	Applied Software Project Management Practical	02	Creating project Proposal, writing project abstract, project document - Introduction - requirements, rationale, project scope, limitations and advantages, survey of technologies, requirements and analysis - hardware and software design, product description, conceptual model, system design - Data design, UI design, Logical design, test case design, presentation and review of the software project.

**Semester: V**  
**Level 5.5 Major Information Technology**

<b>Semester V – Major DSC (Discipline Specific Course)</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Duration</b>
RJDSCIT351	Full Stack development with MERN Technologies	03	45 Hours
<b>Course Objectives:</b> <ul style="list-style-type: none"><li>➤ Understand the core concepts and architecture of the MERN stack and familiarize with full-stack development environments.</li><li>➤ Develop dynamic and responsive user interfaces using React with state management, routing, and form handling.</li><li>➤ Build and integrate backend services using Express.js and MongoDB, including API development, authentication, and deployment</li></ul>			

Unit	Details	Lectures
I	<p><b>Introduction:</b> MERN Overview, Components (React, Node.js, Express, MongoDB), Tools &amp; Libraries</p> <p><b>Hello World:</b> JSX, Project Setup, Node.js &amp; npm, Express Basics</p> <p><b>React Components:</b> Class &amp; Functional Components, Props &amp; Children, Dynamic Composition</p> <p><b>React State:</b> State Management, Event Handling, Lifting State Up, Stateless Components</p> <p><b>Express and GraphQL:</b> Express, Routing, Request Object, Response Object, Middleware, REST API, GraphQL Basics.</p>	15
II	<p><b>MongoDB:</b> MongoDB Basics (Documents, Collections, Databases, Query language, Installation.), The Mongo Shell, MongoDB CRUD Operations, MongoDB with Node.js, Schema Initialization</p> <p><b>Architecture and ESLint:</b> UI Server, Multiple Environments, Proxy-Based Architecture, ESLint (Stylistic Issues, Best Practices, Errors), ESLint for Front End</p> <p><b>Modularization and Webpack:</b> Back-end Modules, Front-End Modules &amp; Webpack, Transform &amp; Bundle, Libraries Bundle, Hot Module Replacement,</p> <p><b>React Router:</b> Simple Routing, Route Parameters, Query Parameters, Links, Programmatic Navigation, Nested Routes</p>	15
III	<p><b>React Forms:</b> Controlled Components, Filters, Form Handling, Specialized Input Components, API Operations (Update API, Delete API, updating an issue &amp; field, Deleting an issue)</p> <p><b>React Bootstrap:</b> Installation, UI Elements (Buttons, Navigation Bar, Panels, Tables, Forms, Grid System), Various Forms (Inline, Horizontal), Validations, Toasts</p> <p><b>Server Rendering:</b> Basic server Rendering, Webpack for the server, HMR for server, server router, hydrate, Data from API</p> <p><b>Authentication:</b> Sign-In UI, Google Sign-In, Verifying Google Token, JSON Web Tokens, Signing Out, Authorization, Authorization-Aware UI,</p>	15

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	<b>Pro MERN Stack</b> (Full Stack Web App Development with Mongo,	Vasan Subramanian	Apress	2nd	2019

	Express, React, and Node)				
2.	Full – Stack React Projects	Shama Hoque	Packt Publishing	2 <sup>nd</sup>	2018
3.	Beginning MERN Stack; Build and Deploy Full Stack React Apps	Greg Lim	Apress	1 <sup>st</sup>	2021

<b>Course Outcomes</b>	<b>Description (After this course, students will be able to--)</b>	<b>Bloom's Levels</b>	<b>PSO Addressed</b>
<b>CO 1</b>	Develop MERN-based applications with React components, Express routing, and MongoDB integration.	Level III- Apply	PSO 1, PSO 2
<b>CO 2</b>	Implement state management, React Router, and modular design using Webpack and ESLint in frontend development.	Level IV - Analyze	PSO 2
<b>CO 3</b>	Design secure and responsive web apps using React-Bootstrap with authentication via Google Sign-In and JWT-based authorization.	Level V- Evaluate	PSO 2, PSO 3

<b>Semester V –Major DSC (Discipline Specific Course)</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Duration</b>
RJDSCIT352	Java Programming	03	45 Hours
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>➤ Comprehensive understanding of Object-Oriented Programming concepts in Java.</li> <li>➤ Equip learners with the knowledge and skills to develop multithreaded applications, utilize Java packages and servlets for dynamic content, and work with databases using JDBC.</li> <li>➤ In-depth understanding of advanced Java concepts like cookies, session management, Java Server Pages (JSP) and Java Server Faces (JSF).</li> </ul>			

<b>Unit</b>	<b>Details</b>	<b>Lectures</b>
I	<b>Object Oriented Concepts with Java</b> <b>Introduction to Java:</b> Features of Java, Java Development Kit, Java Application Programming Interface, Java Virtual Machine, Java Program Structure. <b>Classes:</b> Types of Classes, this keyword, super keyword, Scope Rules, Access Modifier, constants, static members of a class, garbage collection. <b>Inheritance:</b> Derived Class Objects, Inheritance and Access Control. <b>Interfaces:</b> What Is an Interface? How Is an Interface Different from An Abstract Class? Multiple Inheritance. <b>Multithreading:</b> Thread Creations, Thread Life Cycle, Life Cycle Methods, Synchronization, wait() notify() notify all() methods.	15
II	<b>Core Java</b> <b>Packages:</b> Introduction to predefined packages, User Defined Packages, Java Built-in packages. <b>Servlets:</b> The Need for Dynamic Content, Java Servlet Technology, Why Servlets? What can Servlets do? Servlet API and Lifecycle, Using Annotations instead of Deployment Descriptor. <b>Working with Databases:</b> Introduction, JDBC Architecture, JDBC Drivers, java.sql package, Using Statement, PreparedStatement, CallableStatement, ResultSet.	15
III	<b>Advanced Java</b> <b>Cookies:</b> Kinds Of Cookies, Where Cookies Are Used? Creating Cookies Using Servlet <b>Sessions:</b> What Are Sessions? Lifecycle Of Http Session, Session Tracking with Servlet API <b>Java Server Pages:</b> Why use Java Server Pages? Disadvantages of JSP, JSP v/s Servlets, Life Cycle of a JSP Page, How does a JSP function? How does JSP execute?,JSP Elements.	15

	<b>Java Server Faces: Understanding JSF, Overview of the JavaServer Faces Lifecycle</b>	
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<b>Books and References:</b>					
<b>Sr. No.</b>	<b>Title</b>	<b>Author/s</b>	<b>Publisher</b>	<b>Edition</b>	<b>Year</b>
1.	Java EE 7 For Beginners	Sharanam Shah Vaishali Shah	SPD		2013
2.	Java Platform, Enterprise Edition: The Java EE Tutorial	Eric Jendrock, Ricardo Cervera-Navarro, Ian Evans, Kim Haase, William Markito	Oracle	7th	2014
3.	Introducing Java EE 7: A Look at What's New	Arun Gupta	O'Reilly Media, Inc		2013
4.	Core Java 8 for Beginners	Vaishali Shah, Sharnam Shah	SPD	1st	2015
5.	Java: The Complete Reference	Herbert Schildt	McGraw Hill	9th	2014

<b>Course Outcomes</b>	<b>Description (After this course, students will be able to--)</b>	<b>Bloom's Levels</b>	<b>PSO Addressed</b>
<b>CO 1</b>	Understand the key components of the Java development environment, such as Java Virtual Machine (JVM), and implement Java's object-oriented principles.	Level II, III - Understand, Apply	PSO1, PSO2
<b>CO 2</b>	Understand and utilize core java concepts to create an interactive web application with database functionality.	Level II, III - Understand, Apply	PSO1, PSO2
<b>CO 3</b>	Understand and develop dynamic web applications using JSP and JSF, and effectively manage the application's user sessions and cookies using servlets.	Level II, VI- Understand, Create	PSO3

<b>Semester V – Major DSC (Discipline Specific Course)</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Duration</b>
RJDSCITP351	MAJ: Major Practical (Full Stack development with MERN Technologies and Java Programming Practical)	02	60 Hours
<p><b>Course Objectives:</b></p> <ul style="list-style-type: none"> <li>➤ To understand and apply the core components of the MERN stack to build full-stack web applications.</li> <li>➤ To implement CRUD operations and modular architecture using MongoDB, Express, React, and Node.js</li> <li>➤ Develop responsive user interfaces with React, Webpack, and Bootstrap.</li> <li>➤ To Integrate authentication, server-side rendering, and performance optimization in MERN applications.</li> <li>➤ To learn how to implement OOPs concept in Java.</li> <li>➤ To develop GUI based applications using core java concepts and various Java frameworks.</li> <li>➤ To create a dynamic web application using servlets and database connectivity.</li> </ul>			

<b>Full Stack development with MERN Technologies Practical</b>	
<b>1.</b>	<b>Introduction to MERN &amp; Project Setup</b> <ol style="list-style-type: none"> <li>a. Create a Simple “Hello World” React application using JSX.</li> <li>b. Install and configure Node.js &amp; npm and create a basic Express server.</li> <li>c. Explore and list down the tools and libraries commonly used in MERN development.</li> </ol>
<b>2.</b>	<b>React Components &amp; State Management</b> <ol style="list-style-type: none"> <li>a. Create a simple React app demonstrating Class &amp; Form components with Props and Children.</li> <li>b. Implement event handling and state updates using the useState Hook.</li> </ol>
<b>3.</b>	<b>Express.JS &amp; GraphQL Basics</b> <ol style="list-style-type: none"> <li>a. Set up a simple Express server with routing and middleware.</li> <li>b. Create a REST API endpoint that returns a list of students.</li> </ol>
<b>4.</b>	<b>MongoDB Integration &amp; CRUD Operations</b> <ol style="list-style-type: none"> <li>a. Set up a MongoDB and perform CRUD operations using the MongoDB shell.</li> <li>b. Create a Node.js application that connects to MongoDB and performs CRUD operations.</li> </ol>
<b>5.</b>	<b>Modularization &amp; Webpack Configuration</b> <ol style="list-style-type: none"> <li>a. Organize a React application into modules and use Webpack for bundling.</li> <li>b. Implement Hot Module Replacement (HMR) in a React.</li> </ol>
<b>6.</b>	<b>React-Router &amp; Navigation</b>

	<ul style="list-style-type: none"> <li>a. Implement basic navigation using React Router with different route components.</li> <li>b. Use route parameters and query parameters to pass data between pages.</li> </ul>
<b>7.</b>	<b>React Forms &amp; API Integration</b> <ul style="list-style-type: none"> <li>a. Build a form using React-controlled components &amp; validate inputs.</li> <li>b. Integrate the form with an API to store form data in MongoDB.</li> </ul>
<b>8.</b>	<b>React-Bootstrap &amp; UI Components</b> <ul style="list-style-type: none"> <li>a. Create a UI layout using React-Bootstrap components like Navbar, Buttons, and Tables.</li> <li>b. Implement a responsive grid system with Bootstrap.</li> </ul>
<b>9.</b>	<b>Server Rendering &amp; Performance Optimization</b> <ul style="list-style-type: none"> <li>a. Implement server-side rendering (SSR) for a React app and compare performance with client-side rendering.</li> <li>b. Fetch API data on the server and hydrate the React app.</li> </ul>
<b>10.</b>	<b>Authentication &amp; Deployment</b> <ul style="list-style-type: none"> <li>a. Implement Google Sign-In and JWT-based authentication in a MERN app.</li> <li>b. Configure Role-Based Access Control (RBAC) using React Context API.</li> </ul>

<b>Java Programming Practical</b>	
<b>1.</b>	<b>OOPs concepts in Java – 1</b> <ul style="list-style-type: none"> <li>a. Write a program to create a class and implement a default, overloaded and copy constructor.</li> <li>b. Write a program to create a class and implement the concepts of Method Overloading.</li> <li>c. Write a program to create a class and implement the concepts of Static methods.</li> </ul>
<b>2.</b>	<b>OOPs concepts in Java – 2</b> <ul style="list-style-type: none"> <li>a. Write a program to implement the concepts of Inheritance and Method overriding.</li> <li>b. Write a program to implement the concepts of Abstract classes and methods.</li> <li>c. Write a program to implement the concept of interfaces.</li> </ul>
<b>3.</b>	<b>Exceptions</b> <ul style="list-style-type: none"> <li>a. Write a program to raise built-in exceptions and raise them as per the requirements.</li> <li>b. Write a program to define user defined exceptions and raise them as per the requirements.</li> </ul>
<b>4.</b>	<b>Multithreading</b> Write a java application to demonstrate 5 bouncing balls of different colors using threads.
<b>5.</b>	<b>Layouts and Event Handling using Java Framework</b> <ul style="list-style-type: none"> <li>a. Design an AWT program to perform various string operations like reverse string, string concatenation etc.</li> <li>b. Design a Swing application to demonstrate different layouts.</li> </ul>

	c. Write a java program to implement Java events like Text Events, Mouse Events, Windows Event and so on.
<b>6.</b>	<b>Servlet Programming</b> a. Create a simple calculator application using servlet. b. Create a servlet for a login page. If the username and password are correct then it says message “Hello <username>” else a message “login failed”.
<b>7.</b>	<b>Servlet with Cookies</b> Design a servlet with textboxes for accepting Cookie Name and Cookie Value. On click of a submit button, display the values on the same servlet in a table. Servlet with Session
<b>8.</b>	<b>Working with JDBC</b> a. Write a JDBC program that displays the data of a given table in a GUI Table. b. Write a servlet program to demonstrate simple database connectivity.
<b>9.</b>	<b>JSP</b> a. Write a simple JSP program. b. Request Dispatcher JSP - Design a jsp page to call servlet - welcome servlet and then hello servlet to display data accepted on jsp page. c. JSP using intrinsic objects - out, request, response, exception etc
<b>10.</b>	<b>JSF</b> Implement a simple JavaServer Faces Application.

<b>Course Outcomes</b>	<b>Description (After this course, students will be able to--)</b>	<b>Bloom's Levels</b>	<b>PSO Addressed</b>
<b>CO 1</b>	Build interactive and modular React applications using JSX, components, forms, routing, and state management techniques.	Level III - Apply	PSO1, PSO2
<b>CO 2</b>	Develop backend services with Express and Node.js, integrate them with MongoDB, and perform CRUD operations.	Level IV - Analyze	PSO1, PSO2
<b>CO 3</b>	Use tools like Webpack, React-Bootstrap, and ESLint to structure, optimize, and enhance the user interface and performance of full-stack applications.	Level III- Apply	PSO2, PSO3
<b>CO 4</b>	Implement fundamental concepts of OOPs, multithreading in java	Level III- Apply	PSO2

<b>CO 5</b>	Build interactive GUI applications using AWT and Swing	Level VI - Create	PSO3
<b>CO 6</b>	Develop dynamic web applications using JSP and JSF, and effectively manage the application's user sessions and cookies using servlets.	Level VI - Create	PSO3

<b>Semester V – Major DSC (Discipline Specific Course)</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Duration</b>
RJDSCITP352	MAJ: Applied Software Project Management Practical	02	60 Hours
<p><b>Course Objectives:</b></p> <ul style="list-style-type: none"> <li>➤ To equip students with the knowledge and skills to effectively plan, develop, execute, and manage software projects.</li> <li>➤ To facilitate students to understand different software development process models and implement different phases of SDLC</li> <li>➤ To encourage students to explore latest technologies and use in project development</li> <li>➤ To motivate students to explore areas of application requirement and build software solution.</li> </ul>			

<b>1.</b>	<p><b>Project Proposal:</b> Types of project proposals, stakeholders and users of the project, Rationale, Proposed technology, Feasibility to use the proposed technology, system flowchart / Context level DFD</p> <p><b>Task:</b> Select at least two different topics and write project proposals for the same.</p>
<b>2.</b>	<p><b>Project Abstract:</b> Introduction, Problem Statement - Scope, objective and outcomes of the project, operational feasibility, review of literature (Available publications, websites and mobile applications), methodology, estimation - resource, cost, man hours</p> <p><b>Task:</b> Write a project abstract for the selected and approved project topic. Format of the documentation is in Appendix I</p>
<b>Documentation</b>	
<b>3.</b>	<p><b>Introduction:</b> Background, Objectives, Purpose, Scope, and Applicability</p> <p><b>Survey of Technologies:</b> Available technologies for the selected project, selected technologies with justification. Advantages and limitation of the selected technology</p> <p><b>Task:</b></p>

	<p>Write the project documentation chapter 1 and chapter 2 for the selected and approved project topic. Format of the documentation is in Appendix I</p>
4.	<p><b>Requirements and Analysis:</b> Problem definition (problem and sub problem), requirement specification - problems in current system, Planning and scheduling: GANTT chart PERT (if applicable), software and hardware requirement, Preliminary Product Description: Identify the requirements and objectives of the new system. Define the functions and operation for selected and approved project topic. <b>Task:</b> Write problem statement, requirement specification, planning and scheduling with GANTT Chart, hardware and software requirement and preliminary product description for the selected and approved project topic Format of the documentation is in Appendix I</p>
5.	<p><b>System Design:</b> <b>Conceptual Models:</b> Conceptual models and data flow diagram – ER(Data base Design), Object Oriented UML diagrams -Class diagram, , Use case, Sequence Activity, State Machine, Component and Deployment Diagram for relevant projects Such as Gaming Apps, Mobile Apps, Website, IOT, Simulation etc (Diagrams may differ as per the guidance provided by project guides) <b>UI Design :</b> External and internal components and the architecture of user interface. Rough pictorial views of the user interface design and its components. <b>Task:</b> Write about the conceptual model applicable to the selected and approved project topic and Draw relevant flow diagrams for the same. Design UI (draw rough UI designs) for the selected and approved project topic. Format of the documentation is in Appendix I</p>
6.	<p><b>Testing and Security Issues :</b> Different testing methods that can be used, writing test cases, actual testing process. Real time considerations and security issues with respect to the project. Addressing the Security issues <b>Task :</b> Design test cases for the project. Write the test cases with possible outcomes for the selected and approved project List possible security issues, proposed solutions, security protocols to be applied relevant to selected and approved project topic. Format of documentation is in Appendix I</p>
<b>Presentation and Review</b>	
7.	<p><b>Presentation</b> Understand the project flow and working. <b>Task :</b> Demonstrate the working project and operational flow with visual aids to the project guide</p>
8.	<p><b>Review Task :</b> Final working project demonstration</p>

<b>Course Outcomes</b>	<b>Description (After this course, students will be able to--)</b>	<b>Bloom's Levels</b>	<b>PSO Addressed</b>
<b>CO 1</b>	Write software project proposals and abstract of the project	Level III - Apply	PSO1, PSO2
<b>CO 2</b>	Analyse the requirements and create a problem statement with problems and sub problems	Level IV - Analyze	PSO1, PSO2
<b>CO3</b>	Design a software solution for the analysed problem.	Level VI Design	PSO 3

## DISTRIBUTION OF TOPICS AND CREDITS

### T. Y. B.Sc. Information Technology SEMESTER V

<b>Major DSE (Discipline Specific Elective)</b>			
<b>Course</b>	<b>Nomenclature</b>	<b>Credits</b>	<b>Topics</b>
RJDSEIT351	System Administration with Linux	02	<p>Getting Started with Linux, Working with Users, Groups, and Permissions, Gaining Privileges, Console Access, Installing and Managing Software, Networking, Network Manager, Network Interfaces, Infrastructure Services, OpenSSH</p> <p>DHCP Servers, DNS, Mail, Web, File Servers, System Monitoring Tools, Viewing and Managing Log File, Automating System Task, Securing Server with iptables, Setting Up Cryptographic Services, Configuring booting with GRUB</p>
RJDSEITP351	System Administration with Linux Practical	02	<p>Installation of RHEL6.x, Working with Users, Groups, and Permissions, Working with Console, RPM, and Yum, Working with Storage, Network and Infrastructure services, Configuring DHCP Servers, DNS, Mail, Web, File Server, Configuring Firewall and Cryptographic services, Shell Scripting Programs</p>
RJDSEIT352	Artificial Intelligence and Applications	02	<p>Introduction to Artificial intelligence, Intelligent Agents, Problem Solving AI, Uninformed and Heuristic Search strategies, Knowledge Representation, Machine Learning and Generative AI and Agentic AI</p>
RJDSEITP352	Artificial Intelligence and Applications Practical	02	<p>Basics of searching algorithm, problem solving approach using AI, Implementing heuristics searching problem, Using prolog for problem solving. Agentic AI use cases</p>

Semester V – Major DSE (Discipline Specific Elective)			
Course Code	Course Title	Credits	Duration
RJDSEIT351	System Administration with Linux	02	30 Hours
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>➤ Gain insight into various Linux distributions.</li> <li>➤ Familiarize students to install, configure, and optimize for specific server roles.</li> <li>➤ Develop expertise in securing Linux servers from vulnerabilities</li> <li>➤ Acquire skills to monitor server performance, identify bottlenecks, and optimize resource utilization.</li> </ul>			

Unit	Details	Lectures
I	<p><b>Getting Started</b> Starting with Linux , Duties of the System Administrator, Installing Red Hat Enterprise Linux Server</p> <p><b>Working with Users, Groups, and Permissions:</b> 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, Managing Permissions, Role of Ownership, Basic Permissions: Read, Write, and Execute, Advanced Permissions, Working with Access Control Lists, Setting Default Permissions with umask, Working with Attributes.</p> <p><b>Gaining Privileges, Console Access, Installing and Managing Software</b></p> <p><b>YUM:</b> Checking for and updating Packages, Packages and Package Groups, Configuring Yum and Yum Repositories, Yum Plug-ins, Additional resources 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</p> <p><b>Networking, Network Manager:</b> The Network Manager Daemon, Interacting with Network Manager, Establishing Connections</p> <p><b>Network Interfaces:</b> Network Configuration Files, Interface Configuration files, Interface Control Scripts, Static routes and the default gateway, Configuring static routes in ifcfg files, Network function files, ETHTool.</p> <p><b>Infrastructure Services:</b> Services and Daemons- Configuring the default runlevel, Configuring the Services, Running Services, Additional Resources.</p> <p><b>OpenSSH-</b> The SSH Protocol, Configuring OpenSSH, Using OpenSSH certificate authentication</p>	15

II	<p><b>Servers:</b>  <b>DHCP Servers:</b> Why Use DHCP? Configuring DHCPv4 server, Configuring DHCPv4 Client.  <b>DNS Servers</b> – Introduction to DNS, BIND  <b>Web Servers</b> – The Apache HTTP server  <b>Mail Servers</b> – Email Protocols, Email Program Classification, Mail Transport Agents, Mail Delivery Agents, Mail User Agents, Additional Resources  <b>File Servers</b> – Samba, FTP  <b>System Monitoring Tools</b> – Viewing System Processes, Viewing Memory Usage, Viewing CPU Usage, Viewing Block Devices and File systems, Viewing Hardware Information, Monitoring Performance with NET-SNMP, Additional Resources  <b>Viewing and Managing Log Files</b> – Installing rsyslog, Locating Log files, Basic Configuration of rsyslog, working with queues in rsyslog, configuring rsyslog on a logging server, using rsyslog modules, debugging rsyslog, Managing Log files in graphical environment  <b>Automating System Tasks</b> – Cron and Anacron, At and Batch  <b>Securing Server with iptables:</b> 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:</b> 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  <b>Configuring booting with GRUB</b></p>	15
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<b>Books and References:</b>					
<b>Sr. No.</b>	<b>Title</b>	<b>Author/s</b>	<b>Publisher</b>	<b>Edition</b>	<b>Year</b>
1.	Red Hat Enterprise Linux 6 Deployment Guide	Red Hat	Red Hat Content Services	First	2021
2.	Red hat Linux Networking and System Administration	Terry Collings and Kurt Wall	Wiley	Third	2005
3.	Red Hat Enterprise Linux 6 Administration	Sander van Vugt	Sybex	First	2013
4.	Linux Administration: A Beginner's Guide	Wale Soyinka	McGraw-Hill Education	Seventh	2016

5.	Linux Bible	Christopher Negus	Wiley	Tenth	2020
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Course Outcomes	Description (After this course, students will be able to--)	Blooms Levels	PSO Addressed
CO 1	Understand and demonstrate system administration task of managing users, storage and network infrastructures	Level - II, III Understand, Demonstrate	PSO 1, PSO 2
CO 2	Develop expertise in configuring web servers, file and mail servers Demonstrate setups for monitoring system performance, automate system tasks, configuring firewall and SSL security	Level II, VI Develop, Demonstrate	PSO 2, PSO 3

Semester V – Major DSE (Discipline Specific Elective Practical)			
Course Code	Course Title	Credits	Duration
RJDSEITP351	System Administration with Linux Practical	02	60 Hours
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>➤ Develop expertise in installation of Red Hat Linux operating system</li> <li>➤ Acquire skills on setting boot loaders, partitioning storage and managing the process.</li> <li>➤ Acquire practical skills in configuring and maintaining servers and networks.</li> <li>➤ Gain proficiency in performing various administrative tasks using shell scripting</li> </ul>			

S.No	Practical List
0	Installation of RHEL6.x
1	<b>Working with Users, Groups, and Permissions</b> a. Creating and Managing Users b. Creating and Managing Groups c. Using Permissions and Advanced Permissions
2	<b>Working with Console, RPM, and Yum</b> a. Managing Console and Gaining Privileges b. Working with RPM

	c. Working with Yum
<b>3</b>	<b>Working with Storage, Network and Infrastructure services</b> a. Configuring and Managing Storage b. Connecting to the Network c. Configuring and enabling Infrastructure services d. Configuring OpenSSH
<b>4</b>	<b>Configuring Server for File Sharing</b> a. Configuring NFS Server and Client b. Configuring Samba c. Configuring FTP
<b>5</b>	<b>Configuring DHCP, DNS Servers</b> a. Configuring DHCP server b. Configuring DNS server
<b>6</b>	<b>Configuring Web and Mail Servers</b> c. Configuring Web server d. Configuring Mail server
<b>7</b>	<b>Configuring Monitoring and Automation tools</b> a. Configuring System Monitoring tools b. Configuring rsyslog c. Configuring cron, anacron, At and Batch Utility
<b>8</b>	<b>Firewall and Cryptographic services</b> a. Securing Server with iptables b. Setting Up Cryptographic Services
<b>9</b>	<b>Perform Daily System Administration tasks</b> a. Managing Processes b. Working with Storage Devices and Links c. Working with repository
<b>10</b>	<b>Write the program for the following:</b> a. Programs on Shell scripting b. Shell scripts to automate or monitor tasks/processor

<b>Course Outcomes</b>	<b>Description (After this course, students will be able to--)</b>	<b>Blooms Levels</b>	<b>PSO Adresse</b>
<b>CO 1</b>	Apply the knowledge to effectively administer Linux systems, including installation, configuration, user administration, file system management, and system monitoring	Level - III Apply	PSO2

<b>CO 2</b>	Demonstrate the configuration of web servers, file and mail servers Develop expertise in performing administrative task and automation using shell script	Level II, VI Develop, Demonstrate	PSO 2, PSO 3
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<b>Semester V – Major DSE (Discipline Specific Elective)</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Duration</b>
RJDSEIT352	Artificial Intelligence and Applications	02	30 Hours
<b>Course Objectives:</b>			
<ul style="list-style-type: none"> <li>➤ To understand the fundamental concepts and application of Artificial Intelligence</li> <li>➤ To acquire knowledge on intelligent agents and develop proficiency in problem-solving techniques using various search algorithms</li> <li>➤ To learn logical reasoning and inference methods to apply them to knowledge representation and problem-solving tasks</li> </ul>			

<b>Unit</b>	<b>Details</b>	<b>Lectures</b>
I	<p><b>Introduction:</b> What is Artificial Intelligence? Foundations of AI, History, AI application- speech recognition, computer vision.</p> <p><b>Intelligent Agents:</b> Objective, introduction, agent, agents and rationality, Task environment of Agents, The structure of Agents.</p> <p><b>Problem Solving AI:</b> Objective, General Problem-solving approach in AI, task domains of Artificial intelligence. Examples- Chess, Water Jug Problem, Production System, Tic- Tac toe, cryptarithmic problem, 8-puzzle problem.</p> <p><b>Uninformed Search Strategies:</b> Uniform Search Strategies (Blind Search), BFS, Uniform Cost Search, DFS</p>	15
II	<p><b>Heuristic Search strategies:</b> Best First Search, A* Search, Problem Reduction with AO*, Local Search Algorithm, Adversary Search.</p> <p><b>Knowledge Representation:</b> Types of knowledge, Logic/Symbolic logic, Normal Forms, First Order Predicate knowledge, Scope of occurrence of a quantifier, Resolution methods, forward and backward chaining.</p> <p><b>Machine Learning:</b> Objective, What is Machine Learning- Supervised learning, Unsupervised Learning, Reinforcement learning, Decision Tree.</p>	15

	<b>Generative AI and Agentic AI: What is Generative AI? Types of Generative AI, Building an AI Agent using Agentic AI.</b>	
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<b>Books and References:</b>					
<b>Sr. No.</b>	<b>Title</b>	<b>Author/s</b>	<b>Publisher</b>	<b>Edition</b>	<b>Year</b>
1.	Artificial Intelligence: A Modern Approach, 3rd Edition, Pearson, 2010.	Stuart Russell and Peter Norvig	Pearson	3rd Edition	2015
2.	Artificial Intelligence: A Rational Approach	Rahul Deva	Shroff Publisher	First	2018
3.	Artificial Intelligence & Generative AI for Beginners: The Complete Guide	David M. Patel	GD Publishing	First	2023
4.	A First Course in Artificial Intelligence	Deepak Khemani	TMH	First	2017
5.	Python Artificial Intelligence projects for Beginners	Joshua Eckroth	Packt Publishing	First	2018

<b>Course Outcomes</b>	<b>Description (After this course, students will be able to--)</b>	<b>Blooms Levels</b>	<b>PSO Adresse</b>
<b>CO 1</b>	Learn and understand the foundations, history, Intelligent agents and state of the art AI applications. Apply different problem-solving strategies using search techniques.	Level - I, II, III Understand, Apply	PSO1, PSO2
<b>CO 2</b>	Understand and Apply knowledge representation with reasoning methods to solve complex problems. Develop an understanding of machine learning techniques, and the basics of Generative AI.	Level II, III, Understand, Apply	PSO 2, PSO 3

**Semester V – Major DSE (Discipline Specific Elective)**

<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Duration</b>
RJDSEITP352	Artificial Intelligence and Applications Practical	2	60 Hours

**Course Objectives:**

- Gain practical experience in planning algorithms using Python
- Learn and implement predicate logic techniques using Prolog.
- Learn generative AI techniques and agentic AI use cases.

<b>1</b>	Write programs for the following: a. Implement depth first search algorithm. b. Implement breadth first search algorithm.
<b>2</b>	Write programs for the following: a. Simulate 4-Queen / N-Queen problem. b. Solve the Tower of Hanoi problem.
<b>3</b>	Write programs for the following: a. Solve the water jug problem. b. Simulate tic – tac – toe game
<b>4</b>	Write programs for the following: a. Solve constraint satisfaction problem b. Construct a Maze Problem Solver
<b>5</b>	Implementation of Heuristic(informed) search algorithms: a. Hill Climbing search b. A* Search
<b>6</b>	Prolog- - Installation - Data types and structures - Operations
<b>7</b>	Prolog- - Facts, Rules, Queries - Solving Queries using prolog
<b>8</b>	Prolog- - Problem Solving using Backtracking
<b>9</b>	<b>Agentic AI based Case study- (samples)</b>

	<ul style="list-style-type: none"> <li>- Smart Assistants (Personalized AI Bots)</li> <li>- AI in Fraud Detection</li> <li>- Robotic Process Automation (RPA) in Enterprises</li> <li>- AI in Human Resources (Automated Hiring and Talent Management)</li> </ul>
<b>10</b>	A mini-project in Python showcasing the capabilities of the AI

<b>Course Outcomes</b>	<b>Description (After this course, students will be able to--)</b>	<b>Blooms Levels</b>	<b>PSO Addressed</b>
<b>CO 1</b>	Understand the Use and application of python libraries for solving AI based problems like N-Queen, Maze problem, 8 tiles puzzle , tic tac toe etc.	Level III - Apply	PSO2, PSO3
<b>CO 2</b>	Problem Solving using Predicate logic in PROLOG	Level III - Apply	PSO2, PSO3
<b>CO 3</b>	Understand generative AI techniques and develop agentic AI use cases	Level III, VI - Apply, Analyze	PSO2, PSO3

## DISTRIBUTION OF TOPICS AND CREDITS

### T. Y. B.Sc. Information Technology SEMESTER V

<b>Minor</b>			
<b>Course</b>	<b>Nomenclature</b>	<b>Credits</b>	<b>Topics</b>
RJMINIT351	Design Principles of Internet of Things	2	Overview: Framework, architecture, technology behind IOT, sources, examples, Design Principles of connected devices: devices and data consolidation techniques, Internet Connectivity Principles: Addressing in IOT, MAC, Wireless sensor network, Data acquisition and control: analysis of data, Data Collection, Storage and Computing Using a Cloud Platform, IoT Privacy, Security and Vulnerabilities Solutions, business models and processes
RJMINITP351	Design Principles of Internet of Things Practical	2	Familiarization and installation of the relevant OS for RPi, RPi programming to communicate with different sensors and actuator devices, setting up wireless access point, installing windows 10 core, building a case study

<b>Semester V – Minor Course</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Duration</b>
RJMINIT351	Design Principles of Internet of Things	02	30 Hours
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>➤ To identify and analyze the technologies behind IoT systems and their applications.</li> <li>➤ To understand the principles and best practices for designing connected IoT devices.</li> <li>➤ To grasp the processes of data acquisition, storage, and organization in IoT systems.</li> <li>➤ To learn about business models and business model innovation in the IoT environment</li> </ul>			

<b>Unit</b>	<b>Details</b>	<b>Lectures</b>
<b>I</b>	<p><b>Internet of Things: An Overview</b>            Internet of Things, IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT, M2M Communication, Examples of IoT</p> <p><b>Design Principles for Connected Devices:</b> Introduction, IOT/M2M systems Layers and design standardization, Communication Technologies, Data Enrichment, Data consolidation and Device management at gateway, Ease of design and affordability</p> <p><b>Internet Connectivity Principles:</b> Introduction, Internet connectivity, Internet based communication, IP Addressing in IOT, Media access control, Application layer protocol</p> <p>Sensors, Participatory Sensing, RFIDs, and Wireless Sensor Networks</p>	<b>15</b>
<b>II</b>	<p><b>Data Acquiring, Organising, Processing and Analytics:</b>            Introduction, Data Acquiring and Storage, Organising the Data, Transactions, Business Processes, Integration and Enterprise Systems, Analytics Knowledge Acquiring, Managing and Storing Processes</p> <p><b>Data Collection, Storage and Computing Using a Cloud Platform:</b>            Introduction, Cloud Computing Paradigm for Data Collection, Storage and Computing, Everything as a Service and Cloud Service Models, IoT Cloud-Based Services Using the Xively, Nimbits and Other Platforms</p> <p><b>IoT Privacy, Security and Vulnerabilities Solutions:</b> Introduction, Vulnerabilities, Security Requirements and Threat Analysis, Use Cases and Misuse Cases, IoT Security Tomography and Layered Attacker Model, Identity Management and Establishment, Access Control and Secure Message Communication, Security Models, Profiles and Protocols for IoT</p>	<b>15</b>

	<b>Business Models and Processes Using IoT:</b> Introduction, Business Models and Business Model Innovation, Value Creation in the Internet of Things, Business Model Scenarios for Internet of Things	
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<b>Books and References:</b>					
<b>Sr. No.</b>	<b>Title</b>	<b>Author/s</b>	<b>Publisher</b>	<b>Edition</b>	<b>Year</b>
1.	Internet of Things: Architecture and Design Principles	Dr. Raj Kamal	McGraw Hill	1 <sup>st</sup>	2017
2.	Designing the Internet of Things	Adrian McEwen, Hakim Cassimally	WILEY	1 <sup>st</sup>	2014
3.	The Future of IoT: Leveraging the Shift to a Data Centric World	Don DeLoach, Emil Berthelsen and WaelElrifai	BookBaby	-	2017

<b>Course Outcomes</b>	<b>Description (After this course, students will be able to--)</b>	<b>Bloom's Levels</b>	<b>PSO Addressed</b>
<b>CO 1</b>	Evaluate and analyze real-world applications of IoT	Level IV,V - Analyze, Evaluate	PSO 1, PSO 2
<b>CO 2</b>	Identify and explain various business models in the IoT industry	Level II - Understand	PSO 1

<b>Semester V – Minor Course</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Duration</b>
RJMINITP351	Design Principles of Internet of Things Practical	02	60 Hours
<b>Practical No.</b>	<b>Details</b>		
0.	Starting Raspbian OS, Familiarizing with Raspberry Pi Components and interface, Connecting to ethernet, Monitor, USB.		
1.	Displaying different LED patterns with Raspberry Pi.		
2.	Displaying Time over 4-Digit 7-Segment Display using Raspberry Pi		
3.	Raspberry Pi Based Oscilloscope		
4.	Controlling Raspberry Pi with Telegram.		
5.	Setting up Wireless Access Point using Raspberry Pi		
6.	Fingerprint Sensor interfacing with Raspberry Pi		
7.	Visitor Monitoring with Raspberry Pi and Pi Camera		
8.	Interfacing Raspberry Pi with RFID.		
9.	Building Google Assistant with Raspberry Pi.		
10.	Installing Windows 10 IoT Core on Raspberry Pi (Demo Practical)		
11.	Case study		

<b>Books and References:</b>					
<b>Sr. No.</b>	<b>Title</b>	<b>Author/s</b>	<b>Publisher</b>	<b>Edition</b>	<b>Year</b>
1.	From Machine-to Machine to internet of things	Jan Holler, VlasiosTsiatsis and Catherine Mulligan	Academic Press	-	2014
2.	Getting Started with Raspberry Pi	Matt Richardson andShawn Wallace	SPD	3 <sup>rd</sup>	2016

<b>Course Outcomes</b>	<b>Description (After this course, students will be able to--)</b>	<b>Blooms Levels</b>	<b>PSO Addressed</b>
<b>CO 1</b>	Install Raspbian OS, display LED patterns, control Raspberry pi with telegram App, configure a Raspberry Pi as a Wireless Access Point	Level III, VI Apply, Create	PSO 1, PSO 2
<b>CO 2</b>	Build Google Assistant, visitor monitoring system Interface RFID with Raspberry Pi	Level -VI Create	PSO 1, PSO 2

## DISTRIBUTION OF TOPICS AND CREDITS

### T. Y. B.Sc. Information Technology SEMESTER V

<b>Skill Enhancement Course</b>			
<b>Course</b>	<b>Nomenclature</b>	<b>Credits</b>	<b>Topics</b>
RJSECITP351	Mobile Programming Practical	02	Introduction User Interface components, Activity and Intent, Working with Layout, Introduction to Widgets, resource folders, Menu option, Notifications, Android Speech, Database Programming with SQLite, Working with Map, Xamarin, UI Design & Navigation

<b>Semester V – Skill Enhancement Course</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Duration</b>
RJSECITP351	Mobile Programming Practical	02	60 Hours
<p><b>Course Objectives:</b></p> <ul style="list-style-type: none"> <li>➤ Understand mobile app development by learning UI components, layouts, activities, intents, and menus using Android Studio.</li> <li>➤ Explore cross-platform mobile development using Xamarin</li> <li>➤ Gaining knowledge on databases and advanced mobile features like SQLite, notifications, speech processing, and maps integration.</li> </ul>			

<b>Practical No:</b>	<b>Details</b>
<b>1</b>	<p><b>Introduction to Android studio and User Interface components</b></p> <ol style="list-style-type: none"> <li>1. Design an app to demonstrate use of different views (ButtonView, TextView etc)</li> <li>2. Design “Hello World” application. That will display “Hello World” in the middle of the screen in the red color with white background.</li> </ol>
<b>2</b>	<p><b>Introduction to Activity and Intent</b></p> <ol style="list-style-type: none"> <li>1. Create a sample application with a login module. (Check username and password) On successful login, go to the next screen and on failed login, alert the user using Toast. Also pass the username to the next screen.</li> </ol>

	<p>2. Create an application to pass numeric values from one screen to another.</p>
3	<p><b>Working with Layout</b></p> <ol style="list-style-type: none"> <li>1. Create a calculator app that performs addition, subtraction, division and multiplication operations on numbers using Linear Layout.</li> <li>2. Design an app for the Kilometer Converter using Absolute layout.</li> </ol>
4	<p><b>Introduction to Widgets</b></p> <ol style="list-style-type: none"> <li>1. Design a simple application with datepicker widget in android.</li> <li>2. Design a simple application with TimePicker widget in android.</li> </ol>
5	<p><b>Understand resource folders:</b></p> <p>Create a spinner application to use strings taken from the resource directory.</p>
6	<p><b>Understand Menu option.</b></p> <ol style="list-style-type: none"> <li>1. Create an application that will change the background image of the screen, based on selected options from the menu.</li> <li>2. Create an application using a menu with 5 options. The selected option should appear in the textbox.</li> </ol>
7	<p><b>Working with Notifications and Speech</b></p> <ol style="list-style-type: none"> <li>1. Create an application that will display toast (Message) on a specific interval of time</li> <li>2. Create an application that converts entered text into speech.</li> <li>3. Create an application that converts entered text into speech and shows a toast message every few seconds while the text is being spoken.</li> </ol>
8	<p><b>Database Programming with SQLite – Part I</b></p> <p>Create an application that will insert user name and email into a SQLite database and view all records in a ListView.</p>
9	<p><b>Database Programming with SQLite – Part II</b></p> <ol style="list-style-type: none"> <li>1. Extend the above application to update a user’s email by entering their name and the new email address.</li> <li>2. Delete a user record by entering their name.</li> </ol>
10	<p><b>Working with Map</b></p> <p>Design the mobile app working with Map.</p>
11	<p><b>Introduction to Xamarin &amp; First App</b></p> <ol style="list-style-type: none"> <li>1. <b>Introduction to Xamarin &amp; Cross-Platform Development</b>        Overview of Xamarin, Xamarin.Forms, Xamarin.Android, and Xamarin.iOS        Setting up the Xamarin development environment (Visual Studio, SDKs,</li> </ol>

	<p>Emulators)</p> <p><b>2. Creating Your First Xamarin App</b></p> <p>Understanding the structure of a Xamarin.Forms project</p> <p>Designing a simple UI using XAML</p> <p>Running the app on an Android emulator</p>
<b>12</b>	<p><b>UI Design &amp; Navigation</b></p> <p><b>1. Layouts and Controls in Xamarin.Forms</b></p> <p>StackLayout, Grid, AbsoluteLayout, FlexLayout</p> <p>Common controls: Button, Label, Entry, ListView</p> <p><b>2. Navigation and Data Passing</b></p> <p>NavigationPage and TabbedPage</p> <p>Passing data between pages</p>

<b>Books and References:</b>					
<b>Sr. No.</b>	<b>Title</b>	<b>Author/s</b>	<b>Publisher</b>	<b>Edition</b>	<b>Year</b>
1.	Head First Android Development: A Brain-Friendly Guide	David Griffiths	O'Reilly	Second	2017
2.	Android Programming for Beginners	John Horton	Packt Publishing	Second	2018
3.	Xamarin.Forms Essentials: First Steps Toward Cross-Platform Mobile Apps	Gerald Versluis	Apress	First	-

<b>Course Outcomes</b>	<b>Description (After this course, students will be able to--)</b>	<b>Blooms Levels</b>	<b>PSO Addressed</b>
<b>CO 1</b>	Develop Android applications using UI components, layouts, widgets, intents, and menus in Android Studio	Level III - Apply	PSO 1

<b>CO 2</b>	Build cross-platform mobile apps using Xamarin with XAML-based UI, navigation, and data passing.	Level VI - Create	PSO 2
<b>CO 3</b>	Implement databases and advanced mobile features like SQLite, notifications, speech processing, and maps.	Analyze (Level 4) & Apply (Level 3)	PSO 3
<b>CO 4</b>	Work with mobile development tools and frameworks to build interactive and efficient applications.	Apply (Level 3) & Create (Level 6)	PSO 1, PSO 2

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### T. Y. B.Sc. Information Technology SEMESTER V

<b>Field Project</b>			
<b>Course</b>	<b>Nomenclature</b>	<b>Credits</b>	<b>Topics</b>
RJFPIT351	Major Project	02	Software Project implementation based on the practical course “Applied Software Project Management” – Designing of UI, Programming and testing of the software designed.

<b>Semester V – Field Project</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Duration</b>
RJFPIT351	Major Project	02	60 Hours
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>➤ Implement a problem statement to simulate or to create a live project application from different areas of IT like software development, IOT, Networking, Security, Gaming etc.</li> <li>➤ Design effective interface and relevant code scripts for the interfaces</li> <li>➤ Explore and utilize new software tools and technologies.</li> <li>➤ Test the application created.</li> </ul>			
<b>Sr No</b>	<b>Details</b>		
<b>1.</b>	<b>System Design</b> Design and create database using selected technology <b>OR</b> Design and build basic gaming console platform for your application <b>OR</b> Design Network topology <b>OR</b> Design IOT system architecture with all components		
<b>2.</b>	<b>UI Design &amp; Coding</b> Design and Develop User Interface for software development project using relevant technology <b>OR</b> Design and Develop Gaming Interface using relevant technology. <b>OR</b>		

	Identify protocols to be implemented in the network project <b>OR</b> Design Hardware interface for IOT application and Develop code UI interface interaction
<b>3.</b>	<b>Unit Testing</b> Testing of individual project modules of respective project types.
<b>4.</b>	<b>Integration Testing</b> Testing of entire project for all stakeholders and all deliverable components.
<b>5.</b>	<b>Review and Corrections</b>

<b>Course Outcomes</b>	<b>Description (After this course, students will be able to--)</b>	<b>Blooms Levels</b>	<b>PSO Addressed</b>
<b>CO1</b>	Design, create and build a projects in one of the dedicated fields of Information Technology – ERP, Data analytics, IOT, Networking, Network Security, Gaming	Level VI Create, Design	PSO 3
<b>CO2</b>	Test the application, identify and analyze the shortcomings for improved solutions.	Level III Analyze Level VI Design	PSO 2 PSO 3

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### T. Y. B.Sc. Information Technology SEMESTER VI

#### Level 5.5 Major Information Technology

Course	Nomenclature	Credits	Topics
RJDSCIT361	Advanced Web Development	03	Introduction, The C# Language Advanced C# Programming, Web Form Fundamentals Styles, Themes and Master Pages, Understanding Structured Exception Handling, State Management, ASP.NET AJAX, ASP.NET core.
RJDSCIT362	Principles of Information Security	03	Computer Network Security Fundamentals, Security Threats ,Security Assessment, Network Vulnerabilities, Access Control and Authorization, Authentication, Cryptography, Firewalls, System Intrusion Detection and Prevention, Virus and Content Filtering, Security in Wireless Networks and Devices ,Cloud Security, Mobile Security Issues
RJDSCITP361	MAJ: Major Practical (Advanced Web Development and Principles of Information Security Practical)	02	Basic C# programming, Implementing web controls, navigation controls and master pages. Using Data controls and Gridview control. Implementing Cipher and cryptography techniques, Configure Routers, Extended ACLs, IP ACLs to Mitigate Attacks, Configuring a Zone-Based Policy Firewall and Layer 2 Security, Configure and Verify a Site-to-Site IPsec VPN Using CLI
RJDSCIT363	IT Services and Management	02	Introduction, Key concepts of service management, four dimensions of service management, ITIL service value system,ITIL management practices. Drive Stakeholder Value, Create, Delivery and Support (CDS), Value streams for user support, High-Velocity IT, Continual improvement

**Semester VI – Major DSC (Discipline Specific Course)**

Course Code	Course Title	Credits	Duration
RJDSCIT361	Advanced Web Development	3	45 Hours

**Course Objectives:**

- To develop a deep understanding of advanced web development techniques using modern technologies, frameworks, and tools.
- To learn techniques for improving web application performance, including efficient use of caching, and optimizing front-end and back-end interactions.
- To study the principles of web application architecture using MVC (Model-View-Controller).

Unit	Details	Lectures
I	<p><b>Introduction:</b> Introduction to .NET and .NET Core Framework, Characteristics of .NET and .NET Core, Understanding C# Programming language. Understanding Common type System, Understanding Common language Specification, Understanding Namespaces, Assemblies and types.</p> <p><b>The C# Language:</b> C# Language Basics, Variables and Data Types, Variable Operations, Object-Based Manipulation, Conditional Logic, Loops, Methods, about Classes and Objects, Understanding OOP Concepts With C#</p> <p><b>Advanced C# Programming:</b> Collections and Generics, Delegates and Events.</p>	15
II	<p><b>Web Form Fundamentals:</b> Using the Page Class, Using Application Events, Web Control Classes, Web Control Events and AutoPostBack, Using the Validation Controls, Rich controls. Website Navigation, The TreeView Control, The Menu Control.</p> <p><b>Styles, Themes, and Master Pages:</b> Styles, Themes, Master Page Basics, Advanced Master Pages.</p> <p><b>Understanding Structured Exception Handling :</b> System-Level Exceptions (System.SystemException), Application-Level Exceptions (System.ApplicationException) Throwing a General Exception.</p> <p><b>State Management:</b> Using View State, Transferring Information Between Pages, Using Cookies, Managing Session State, Configuring Session State, Using Application State, Comparing State Management Options</p>	15

III	<p><b>Security Fundamentals:</b> Understanding Security Requirements, Authentication and Authorization, Forms Authentication, Windows Authentication.</p> <p><b>ASP.NET AJAX:</b> Understanding Ajax, Using Partial Refreshes, Using Progress Notification, Implementing Timed Refreshes, Working with the ASP.NET AJAX Control Toolkit.</p> <p><b>ASP.NET core:</b> Understanding the application and utility framework, First ASP.NET core application, Creating ASP.NET core project, Adding core and content to the project, building and running projects, managing packages, debugging project</p>	15
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<b>Books and References:</b>					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Beginning ASP.NET 4.5 in C#	Matthew MacDonald	Apress	First Edition	2012
2.	Pro ASP.NET Core 6	Adam Freeman	Apress	Ninth Edition	2022
3.	Pro ASP.NET MVC 5	Adam Freeman	Apress	Fifth Edition	2014

Course Outcomes	Description (After this course, students will be able to--)	Blooms Levels	PSO Addressed
<b>CO 1</b>	Understand and develop applications using modern technologies.	Level II, III - Understand, Apply	PSO 1, PSO 3
<b>CO 2</b>	Integrating and optimizing web applications using front end and backend technologies.	Level III,IV - Apply, Evaluate	PSO 1, PSO 2, PSO 3
<b>CO 3</b>	Evaluate and analyse secure web application using AJAX toolkit and MVC framework	Level IV, V - Analyse, Evaluate	PSO 2, PSO 3

<b>Semester VI – Major DSC (Discipline Specific Course)</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Duration</b>
<b>RJDSCIT362</b>	<b>Principles of Information Security</b>	03	45 Hours
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>➤ Familiarize students with fundamental principles, models, and mechanisms of computer and network security.</li> <li>➤ Explore various cryptography techniques and key management methods for secure communication</li> <li>➤ Investigate network security measures by exploring intrusion detection, malicious software detection, and firewall design principles.</li> <li>➤ Explore security in IP Protocols, cloud technologies and wireless system</li> </ul>			

<b>Unit</b>	<b>Details</b>	<b>Lectures</b>
I	<p><b>Computer Network Security Fundamentals:</b> Introduction, Securing the Computer Network, Forms of Protection ,Security Standards</p> <p><b>Security Threats and Threat Motives to Computer Networks:</b> Sources of Security Threats, Security Threat Motives, Security Threat Management, Security Threat Correlation , Security Threat Awareness</p> <p><b>Security Assessment, Analysis, and Assurance:</b> System Security Policy, Building a Security Policy, Security Requirements Specification, Threat Identification, Threat Analysis, Vulnerability Identification and Assessment, Security Certification, Security Monitoring and Auditing</p> <p><b>Introduction to Computer Network Vulnerabilities:</b> Sources of Vulnerabilities, Vulnerability Assessment</p> <p><b>Scripting and Security in Computer Networks and Web Browsers:</b> Scripting, Scripting Languages, Computer Networks Scripts and Security</p>	15
II	<p><b>Access Control and Authorization:</b> Access Rights, Access Control Systems, Authorization, Types of Authorization Systems, Authorization Principles, Authorization Granularity</p> <p><b>Authentication:</b> Multiple Factors and Effectiveness of Authentication, Types of Authentication Methods</p>	15

	<p><b>Cryptography</b> : Symmetric Encryption, Public Key Encryption, Key Management: Generation, Transportation, and Distribution, Public Key Infrastructure (PKI), Hash Function, Digital Signatures</p> <p><b>Firewalls:</b> Types of Firewalls, Configuration and Implementation of a Firewall, The Demilitarized Zone (DMZ), Firewall Forensics, Firewall Services and Limitations</p> <p><b>System Intrusion Detection and Prevention:</b> Intrusion Detection Systems (IDSs), Types of Intrusion Detection, Response to System Intrusion, Challenges to Intrusion Detection Systems, Deploying IDS in Switched Environments, Implementing an Intrusion Detection System, Intrusion Prevention Systems (IPSs), Intrusion Detection Tools</p>	
III	<p><b>Virus and Content Filtering:</b> Virus Filtering, Content Filtering, Spam</p> <p><b>Computer Network Security Protocols:</b> Application-Level Security, Security in the Transport Layer, Security in the Network Layer , Security in the Physical Layer</p> <p><b>Security in Wireless Networks and Devices :</b>Types of Wireless Broadband Networks, Development of Cellular Technology, Other Features of Mobile Cellular Technology, Security Vulnerabilities in Cellular Wireless Networks</p> <p><b>Cloud Computing Technology and Security:</b> Cloud Computing Infrastructure Characteristics, Cloud Computing Service Models, Cloud Computing Deployment Models, Virtualization and Cloud Computing, Cloud Computing Security, Reliability, Availability, and Compliance Issues</p> <p><b>Mobile Systems and Corresponding Intractable Security Issues:</b> Current Major Mobile Operating Systems, Security in the Mobile, General Mobile Devices Attack Types, Mitigation of Mobile Devices Attacks, Users Role in Securing Mobile Devices</p>	15

<b>Books and References:</b>					
<b>Sr. No.</b>	<b>Title</b>	<b>Author/s</b>	<b>Publisher</b>	<b>Edition</b>	<b>Year</b>
1.	Guide to Computer Network Security	Joseph Migga Kizza	Springer	Fifth Edition	2020

2.	A Practical Introduction to Enterprise Network and Security Management	Bongsi k Shin	CRC Press		2017
3.	Cryptography and Network Security Principles and Practice	William Stallings	Pearson	Seventh Edition	2017
4.	Principles of Information Security	Michael E. Whitman and Herbert J. Mattord	Cengage Learning	Seventh Edition	2021
5.	Essential Cyber security Science	Josiah Dykstra	O'Reilly	5 <sup>th</sup>	2017

<b>Course Outcomes</b>	<b>Description (After this course, students will be able to--)</b>	<b>Blooms Levels</b>	<b>PSO Addressed</b>
<b>CO 1</b>	Analyze and evaluate security trends, attacks, and mechanisms Propose effective security solutions for network and web browser vulnerabilities	Level IV, V, VI - Analyze, Evaluate, Propose	PSO 2, PSO 3
<b>CO 2</b>	Evaluate and implement various security measures, such as security intrusion detection systems, and firewall configurations to mitigate threats.	Level IV, VI - Evaluate, implement	PSO 2, PSO 3
<b>CO 3</b>	Analyze and evaluate security threats in IP Protocols, cloud technologies and wireless system	Level IV, V - Analyze, evaluate	PSO 2

<b>Semester VI – Major DSC (Discipline Specific Course)</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Duration</b>
RJDSCITP361	MAJ: Major Practical (Advanced Web Development and Principles of Information Security Practical)	02	30 Hours
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>➤ Enable students to create responsive, and interactive web applications, focusing on integrating front-end and back-end components effectively.</li> <li>➤ Learn the practical steps involved in deploying web applications using .NET and .NET core framework.</li> <li>➤ Gain knowledge to recognize potential threats and implement security measures</li> <li>➤ Mitigate security risk by exploring intrusion detection, firewall design and VPN configuration</li> </ul>			

<b>Advanced Web Development Practical</b>	
1	Working with basic C# and ASP .NET <ol style="list-style-type: none"> <li>1. Create an application that obtains four int values from the user and displays the product.</li> <li>2. Create an application that receives the (Student Id, Student Name, Course Name, Date of Birth) information from a set of students. The application should also display the information of all the students once the data entered.</li> </ol>
2	Working with Object Oriented C# and ASP .NET <ol style="list-style-type: none"> <li>1. Create simple application to perform following operations               <ol style="list-style-type: none"> <li>i. Finding factorial Value</li> <li>ii. Money Conversion</li> <li>iii. Quadratic Equation</li> <li>iv. Temperature Conversion</li> </ol> </li> <li>2. Create simple application to demonstrate use of following concepts Exception handling</li> <li>3. Create simple application to demonstrate use of following concepts               <ol style="list-style-type: none"> <li>i. Function Overloading</li> <li>ii. Inheritance (all types)</li> </ol> </li> </ol>
3	Working with Web Forms and Controls <ol style="list-style-type: none"> <li>1. Create a simple web page with various server controls to demonstrate setting and use of their properties. (Example: AutoPostBack)</li> <li>2. Demonstrate the use of Calendar control to perform following operations.               <ol style="list-style-type: none"> <li>i. Display messages in a calendar control</li> </ol> </li> <li>3. ii. Display vacation in a calendar control               <ol style="list-style-type: none"> <li>ii. Selected day in a calendar control using style</li> <li>iii. Difference between two calendar dates</li> </ol> </li> <li>4. Demonstrate the use of Treeview control performs the following operations.</li> </ol>

	<ul style="list-style-type: none"> <li>i. Treeview control and datalist</li> <li>ii. Treeview operations</li> </ul>
4	<ul style="list-style-type: none"> <li>1. Create a Registration form to demonstrate use of various Validation controls.</li> <li>2. Create Web Form to demonstrate use of Adrotator Control.</li> <li>3. Create Web Form to demonstrate use of User Controls.</li> </ul>
5	<p>Working with Navigation, CSS and Master page.</p> <ul style="list-style-type: none"> <li>1. Create Web Form to demonstrate use of Website Navigation controls and Site Map.</li> <li>2. Create a web application to demonstrate use of Master Page with applying Styles and Themes for page beautification</li> </ul>
6	<p>Working with Database</p> <ul style="list-style-type: none"> <li>1. Create a web application bind data in a multiline textbox by querying in another textbox.</li> <li>2. Create a web application to display Data Binding using dropdown list control.</li> <li>3. Create a web application for inserting and deleting records from a database. (Using Execute-Non Query).</li> </ul>
7	<p>Working with AJAX : Create a web application to demonstrate use of various Ajax controls.</p>
8	<p>Working with GridView control</p> <ul style="list-style-type: none"> <li>1. Create a web application to demonstrate use of GridView button column and GridView events.</li> <li>2. Create a web application to demonstrate GridView paging and Create your own table format using GridView.</li> </ul>
9	<p>Create a simple ASP.NET core application with database functionality.</p>
10	<p>Develop an ASP.NET core application using MVC.</p>

<b>Principles of Information Security Practical</b>	
<b>1</b>	<p><b>Write program to implement the following Cipher Techniques:</b></p> <ul style="list-style-type: none"> <li>1. Caesar Cipher</li> <li>2. Monoalphabetic Cipher</li> <li>3. Vernam Cipher</li> </ul>
<b>2</b>	<p><b>Write program to implement the following Cipher Techniques:</b></p> <ul style="list-style-type: none"> <li>1. Playfair Cipher</li> <li>2. Rail Fence Cipher</li> <li>3. Vignere Cipher</li> </ul>

<b>3</b>	<b>Write program to implement the cryptography techniques:</b> <ol style="list-style-type: none"> <li>1. Write program to encrypt and decrypt strings using - DES Algorithm - AES Algorithm</li> <li>2. Write a program to implement an RSA algorithm to perform encryption / decryption of a given string.</li> <li>3. Write a program to implement the Diffie-Hellman Key Agreement algorithm to generate symmetric keys.</li> </ol>
<b>4</b>	<b>Configure Routers</b> <ol style="list-style-type: none"> <li>1. OSPF MD5 authentication</li> <li>2. NTP, To log messages to the syslog server</li> <li>3. To support SSH connections</li> </ol>
<b>5</b>	<b>Configure AAA Authentication</b> <ol style="list-style-type: none"> <li>1. Configure a local user account on Router and configure authenticate on the console and vty lines using local AAA</li> <li>2. Verify local AAA authentication from the Router console and the PC-A client</li> </ol>
<b>6</b>	<b>Configuring Extended ACLs</b> <ol style="list-style-type: none"> <li>1. Configure, Apply and Verify an Extended Numbered ACL</li> <li>2. Configure, Apply and Verify an Extended Named ACL</li> </ol>
<b>7</b>	<b>Configure IP ACLs to Mitigate Attacks</b>
<b>8</b>	<b>Configuring a Zone-Based Policy Firewall</b>
<b>9</b>	<b>Configure Layer 2 Security</b> <ol style="list-style-type: none"> <li>1. Assign the Central switch as the root bridge</li> <li>2. Secure spanning-tree parameters to prevent STP manipulation attacks</li> <li>3. Enable port security to prevent CAM table overflow attacks</li> </ol>
<b>10</b>	<b>Configure and Verify a Site-to-Site IPsec VPN Using CLI</b>
<b>11</b>	<b>Working with various NMap commands for network scanning and security</b>

<b>Course Outcomes</b>	<b>Description (After this course, students will be able to--)</b>	<b>Blooms Levels</b>	<b>PSO Addressed</b>
<b>CO 1</b>	Design a responsive website and applications applying C# concepts.	Level III, VI - Apply, Create	PSO 2, PSO 3

<b>CO 2</b>	Develop an application using Model View Controller Framework	Level III, VI - Apply, Create	PSO 2, PSO 3
<b>CO 3</b>	Understand and Configure routers for logging ,authenticating and ACLs to mitigate attacks	Level-II, VI Understand, Configure	PSO 1, PSO 3
<b>CO 4</b>	Understand and Configure basic ASA security, firewalls and VPN security settings	Level-II, VI Understand, Configure	PSO 1, PSO 3

<b>Semester VI – Major DSC (Discipline Specific Course)</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Duration</b>
<b>RJDSCIT363</b>	<b>IT Services and Management</b>	2	30 Hours
<p><b>Course Objectives:</b></p> <ul style="list-style-type: none"> <li>➤ Understand the fundamentals of IT service management and the ITIL 4 framework.</li> <li>➤ Explore the various management practices in ITIL, including general management, service management, and technical management.</li> <li>➤ Develop an understanding of driving stakeholder value and creating value for stakeholders.</li> <li>➤ Gain knowledge of creating, delivering, and supporting services within the ITIL service value system.</li> <li>➤ Explore the concept of High-Velocity IT and the importance of continual improvement.</li> </ul>			

<b>Unit</b>	<b>Details</b>	<b>Lectures</b>
<b>I</b>	<p><b>Introduction:</b> IT service management in the modern world, About ITIL 4, The structure and benefits of the ITIL 4 framework.</p> <p><b>Key concepts of service management :</b> Value and value co-creation, Organizations, service providers, service consumers, and other stakeholders, Products and services, Service relationships, Value: outcomes, costs, and risks.</p> <p><b>The four dimensions of service management:</b> Organizations and people, Information and technology, Partners and suppliers, Value streams and processes, External factors.</p> <p><b>The ITIL service value system :</b> Service value system overview, Opportunity, demand, and value, The ITIL guiding principles, Governance, Service value chain, Continual improvement</p>	<b>15</b>

	<b>ITIL management practices:</b> General management practices, Service management practices, Technical management practices	
<b>II</b>	<p><b>Drive Stakeholder Value:</b> Introduction, The customer journey, Step 1: Explore, Step 2: Engage, Step 3: Offer, Step 4: Agree, Step 5: Onboard, Step 6: Co-create, Step 7: Realize</p> <p><b>Create, Delivery and Support (CDS):</b> Service value system key concepts and challenges, Using a shift-left approach, Plan and manage resources in the service value system, The use and value of technology across the service value system. Value streams for new services: Reviewing service value chains and service value streams, ITIL practices and value streams for new services, Change enablement, Service design and software development and management, Service validation and testing, Release management and deployment management</p> <p><b>Value streams for user support:</b> ITIL practices and value streams for user support, Service desk, Incident management, Problem management, Knowledge management, Service level management and Monitoring and event management.</p> <p><b>How to create, deliver and support services</b></p> <p><b>High-Velocity IT :</b> Introduction, Key concepts, culture, techniques</p> <p><b>Continual improvement</b></p>	<b>15</b>
<p><b>Reference:</b></p> <ol style="list-style-type: none"> <li>1. ITIL Foundation 4 Edition Roman Jouravlev, Akashay Anand, et. al TSO, AXELOS, Second Edition ,2019</li> <li>2. ITIL 4 High-Velocity IT Akashay Anand, Dan Ashby, et. al TSO, AXELOS, First Edition , 2020</li> <li>3. ITIL Foundation Essentials ITIL 4 Edition by Claire Agutter (IT Governance publishing)</li> <li>4. ITIL 4 Drive Stakeholder Value Roman Jouravlev, Pavel Demin, et. al TSO, AXELOS, First edition ,2020</li> <li>5. ITIL 4 Direct, Plan and Improve Akashay Anand, Mauricio Corona, et. al TSO, AXELOS, First edition, 2020</li> </ol>		

<b>Books and References:</b>					
<b>Sr. No.</b>	<b>Title</b>	<b>Author/s</b>	<b>Publisher</b>	<b>Edition</b>	<b>Year</b>
1.	Guide to Computer Network Security	Joseph Migga Kizza	Springer	Fifth Edition	2020

2.	A Practical Introduction to Enterprise Network and Security Management	Bongsi k Shin	CRC Press		2017
3.	Cryptography and Network Security Principles and Practice	William Stallings	Pearson	Seventh Edition	2017
4.	Principles of Information Security	Michael E. Whitman and Herbert J. Mattord	Cengage Learning	Seventh Edition	2021
5.	Essential Cyber security Science	Josiah Dykstra	O'Reilly	5 <sup>th</sup>	2017

<b>Course Outcomes</b>	<b>Description (After this course, students will be able to--)</b>	<b>Blooms Levels</b>	<b>PSO Addressed</b>
<b>CO 1</b>	Design a responsive website and applications applying C# concepts.	Level III, VI - Apply, Create	PSO 2, PSO 3
<b>CO 2</b>	Develop an application using Model View Controller Framework	Level III, VI - Apply, Create	PSO 2, PSO 3
<b>CO 3</b>	Understand and Configure routers for logging ,authenticating and ACLs to mitigate attacks	Level-II, VI Understand, Configure	PSO 1, PSO 3
<b>CO 4</b>	Understand and Configure basic ASA security, firewalls and VPN security settings	Level-II, VI Understand, Configure	PSO 1, PSO 3

## DISTRIBUTION OF TOPICS AND CREDITS

### T. Y. B.Sc. Information Technology SEMESTER VI

#### Major DSE (Discipline Specific Elective)

Course	Nomenclature	Credits	Topics
RJDSEIT361	Geographic Information System	02	Introduction to GIS, Geographic information and Spatial data types, Data management and processing systems, Spatial Referencing and Positioning, Data Entry and Preparation, Spatial Data Analysis, Data Visualization
RJDSEITP361	Geographic Information System Practical	02	Familiarizing GIS, creating and managing vector and raster data, making a map, working with attribute and projection, georeferencing, Managing Data Tables and Spatial Datasets, advanced GIS operations
RJDSEIT362	Software Testing and Quality Assurance	02	Fundamentals of Testing, Testing Throughout the Software Life Cycle, Test Design Techniques, Test Management, Tool support for testing, Agile Testing.
RJDSEITP362	Software Testing and Quality Assurance Practical	02	Manual Testing, Automation Testing (Selenium Webdriver), JUnit Tool, JMeter Tool, Auto IT Tool

<b>Semester VI – Major DSE (Discipline Specific Elective)</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Duration</b>
RJDSEIT361	Geographic Information System	02	30 Hours
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>➤ To understand the principles of Geographical Information System</li> <li>➤ To learn Data Management and Processing Systems Hardware and Software Trends</li> <li>➤ To understand Spatial Referencing and Positioning</li> <li>➤ To understand the Classification of analytical GIS Capabilities</li> <li>➤ To understand Data visualization and its strategies</li> </ul>			

<b>Unit</b>	<b>Details</b>	<b>Lectures</b>
I	<p><b>Introduction to GIS:</b> The nature of GIS, The real world and representations of it.</p> <p><b>Geographic information and Spatial data types:</b> Models and representations of the real world, Geographic phenomena, Computer representations of geographic information, Organizing and managing spatial data, The temporal dimension.</p> <p><b>Data management and processing systems:</b> Hardware and Software Trends, Geographic Information Systems, Stages of Spatial Data handling, Database management Systems, GIS and Spatial Databases.</p>	15
II	<p><b>Spatial Referencing and Positioning:</b> Spatial Referencing; Satellite-based Positioning</p> <p><b>Data Entry and Preparation:</b> Spatial Data Input, Data quality, Data Preparation, Point Data Transformation</p> <p><b>Spatial Data Analysis:</b> Classification of analytical GIS Capabilities; Retrieval, classification and measurement; Overlay functions; Neighborhood functions; Network analysis GIS and application models; Error propagation in spatial data processing</p> <p><b>Data Visualization:</b> GIS and Maps, The Visualization Process Visualization Strategies: Present or explore? The cartographic toolbox, How to map?, Map Cosmetics, Map Dissemination</p>	15

<b>Books and References:</b>					
<b>Sr. No.</b>	<b>Title</b>	<b>Author/s</b>	<b>Publisher</b>	<b>Edition</b>	<b>Year</b>
1.	Principles of Geographic Information Systems: An introductory textbook	Otto Huisman and Rolf A. de By	The International Institute for Geo-Information Science and Earth Observation (ITC)	4th	2009
2.	Introduction to Geographic Information Systems	Chang Kang-tsung (Karl)	McGrawHill	4th	2008
3.	Principles of Geographic Information Systems	P.A Burrough and R.A.McDonnell	Oxford University Press	3rd	2015

<b>Course Outcomes</b>	<b>Description (After this course, students will be able to--)</b>	<b>Blooms Levels</b>	<b>PSO Addressed</b>
<b>CO 1</b>	Understanding and applying the importance of Geographical Information System to identify, locate, and acquire spatial data to projects.	Level II, III - Understand, Apply	PSO1, PSO2
<b>CO 2</b>	Understand and analyze GIS capabilities on the available datasets to analyse the spatial data.	Level II, IV - Understand, Analyse	PSO2

<b>Semester VI – Major DSE (Discipline Specific Elective)</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Duration</b>
RJDSEITP361	Geographic Information System Practical	02	60 Hours
<p>Course Objective:</p> <ul style="list-style-type: none"> <li>➤ Understand the conceptual foundation of GIS and basic analytical operations</li> <li>➤ Manage spatial information to create and analyze maps.</li> <li>➤ Implement advanced GIS operations to identify, locate, and acquire spatial data to projects.</li> </ul>			

<b>Geographic Information System Practical List</b>	
1.	Familiarizing GIS: Installation of QGIS, datasets for both Vector and Raster data, Maps.
2.	Creating and Managing Vector Data: Adding vector layers, setting properties, formatting, calculating line lengths and statistics
3.	Exploring and Managing Raster data: Adding raster layers, raster styling and analysis, raster mosaicking and clipping
4.	Making a Map, Working with Attributes, Importing Spreadsheets or CSV files Using Plugins, Searching and Downloading OpenStreetMap Data
5.	Working with attributes, terrain Data
6.	Working with Projections and WMS Data
7.	Georeferencing TopoSheets and Scanned Maps Georeferencing Aerial Imagery Digitizing Map Data
8.	Managing Data Tables and Spatial Datasets: Table joins, spatial joins, points in polygon analysis, performing spatial queries
9.	Advanced GIS Operations 1: Nearest Neighbor Analysis, Sampling Raster Data using Points or Polygons, Interpolating Point Data
10.	Advance GIS Operations 2: Batch Processing using Processing Framework Automating Complex Workflows using Processing Modeler Automating Map Creation with Print Composer Atlas Validating Map data

<b>Course Outcomes</b>	<b>Description (After this course, students will be able to--)</b>	<b>Blooms Levels</b>	<b>PSO Addressed</b>
<b>CO 1</b>	Apply formatting techniques to vector and raster data and implement georeferencing on a map.	Level III- Apply	PSO2
<b>CO 2</b>	Execute table joins to link non-spatial data with spatial datasets, develop workflow using advanced GIS operations	Level VI- Create	PSO3

<b>Semester VI – Major DSE (Discipline Specific Elective)</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Duration</b>
RJDSEIT362	Software Testing and Quality Assurance	02	30 Hours
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>➤ To gain knowledge of basic principles and concepts of S/W Testing and understand the relationship between s/w development activities and test activities.</li> <li>➤ To become familiar with testing and quality assurance techniques and processes.</li> <li>➤ To understand the challenges and solutions related to software test automation.</li> <li>➤ To understand agility in testing.</li> </ul>			

<b>Unit</b>	<b>Details</b>	<b>Lectures</b>
I	<p><b>Fundamentals of Testing:</b> Why is testing necessary? What is testing? Seven Testing principles, Test process, The psychology of testing.</p> <p><b>Testing Throughout the Software Life Cycle:</b> Software development lifecycle models - , Test levels, Test types: the targets of testing, Maintenance testing.</p> <p><b>Static Techniques:</b> Static testing and test process, Reviews and the test process, Review process, Static analysis by tools</p> <p><b>Test Design Techniques:</b> Identifying test conditions and designing test cases, Categories of test design techniques, Specification-based or black-box techniques, Structure-based or white-box techniques, Experience-based techniques, Choosing a test technique.</p>	15

II	<p><b>Test Management:</b> Test organization, Test planning and estimation, strategies, Test progress monitoring and control, Configuration management, Risk and testing, Incident management, Defect Management.</p> <p><b>Tool support for testing:</b> Types of test tool, Effective use of tools: Potential benefits and risks, Introducing a tool into an organization. Bug Reporting and Management</p> <p><b>Agile Testing:</b> Using Agile Methods to improve software testing, Building agility into testing process, The Seven - Step Process</p>	15
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<b>Books and References:</b>					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Foundation of Software Testing ISTQB Certification	Dorothy Graham, Rex Black, Erik van	Cengage	4th	2018
2.	Effective methods of S/W testing	William E. Perry	Wiley	Third	2014
3.	Agile Testing, A practical guide for Testers and Agile Teams	Lisa Crispin & Janet Gregory	Addison - Wesley		2009

Course Outcomes	Description (After this course, students will be able to--)	Bloom's Levels	PSO Addressed
CO 1	Understand the Fundamentals of Software Testing and analyze Testing Activities Across the Software Development Life Cycle Understand and apply methods for verifying and validating software to ensure it meets requirements and functions correctly.	Level- II, III, IV	PSO 2, PSO 3
CO 2	Identify the benefits and risks of test automation. Understand and apply the Agile testing process.	Level- II, III	PSO 2

<b>Semester VI – Major DSE (Discipline Specific Elective)</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Duration</b>
RJDSEITP362	Software Testing and Quality Assurance Practical	02	60 Hours
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>➤ To give insight to students about Manual testing Techniques</li> <li>➤ To get hands on various automation tools - Selenium webdriver, JUnit, JMeter, AutoIT</li> </ul>			

<b>S.No</b>	<b>Practical List</b>
	<b>Manual Testing</b>
1	Manual Testing 1 <ul style="list-style-type: none"> <li>- Boundary Value Analysis, Equivalence Partitioning</li> <li>- Decision table Testing</li> </ul>
2	Manual Testing 2 <ul style="list-style-type: none"> <li>- Path Testing</li> <li>- State Transition Testing</li> </ul>
	<b>Automation Testing (Selenium Webdriver)</b>
3	<ul style="list-style-type: none"> <li>- Introduction to Selenium - installation</li> <li>- Web Driver Manager - Write First TestCase in Selenium</li> <li>- Locators - Different Types of Locators</li> </ul>
4	<ul style="list-style-type: none"> <li>- WebElement Methods in Selenium</li> <li>- Perform wait operation in selenium</li> </ul>
5	<ul style="list-style-type: none"> <li>- Handle multiple windows in Selenium</li> <li>- Taking screenshot using Selenium WebDriver.</li> <li>- To capture browser console logs</li> </ul>
6	Perform Unit Testing with <b>JUnit Tool</b>
	<b>JMeter Tool</b>
7	Performance Testing using JMeter - HTTP

8	Performance Testing using JMeter - Other Samplers
	<b>Auto IT Tool</b>
9	<ul style="list-style-type: none"> <li>- Declaring Variables, Joining Variables and strings, Scope of the variables, Strings and Integers.</li> <li>- Implement Iterative and decision-making structures</li> </ul>
10.	Handling different windows application <ul style="list-style-type: none"> <li>- Calculator, MS Excel, MS Word, Notepad using AutoIt</li> </ul>

<b>Course Outcomes</b>	<b>Description (After this course, students will be able to--)</b>	<b>Bloom's Levels</b>	<b>PSO Addressed</b>
<b>CO 1</b>	Evaluate and Utilize Tools to Support Testing Activities	Level - III, V	PSO 2, PSO 3
<b>CO 2</b>	Design Effective Test Cases Using Appropriate Techniques.	Level -VI	PSO 3

## DISTRIBUTION OF TOPICS AND CREDITS

### T. Y. B.Sc. Information Technology SEMESTER IV

<b>Minor Course</b>			
<b>Course</b>	<b>Nomenclature</b>	<b>Credits</b>	<b>Topics</b>
RJMINIT361	Business Analytics	02	Introduction to Business Analytics, Data Wrangling, Probability, Descriptive Data Mining, Statistical Inference, Linear Regression, Time Series Analysis and Forecasting, Predictive Data Mining: Regression and Classification Tasks.
RJMINITP361	Business Analytics Practical	02	Data analysis using Excel, Data Wrangling and Visualization, Implementing Regression, Classification, Clustering algorithms, Hypothesis Testing, Performing Time Series Analysis and Forecasting and Working with Geospatial Data

<b>Semester VI – Minor Course</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Duration</b>
RJMINIT361	<b>Business Analytics</b>	02	30 Hours
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>➤ To demonstrate the ability to gather, clean, and interpret business data from multiple sources to provide actionable insights for decision-making.</li> <li>➤ To use advanced statistical methods and techniques (such as regression analysis, hypothesis testing, and probability distributions) to analyze business data and solve real-world problems.</li> </ul>			

<b>Unit</b>	<b>Details</b>	<b>Lectures</b>
I	<b>Introduction to Business Analytics:</b> Decision Making, Business Analytics Defined, A Categorization of Analytical Methods and Models, Big Data, the Cloud, and Artificial Intelligence, Business Analytics in Practice, Legal and Ethical Issues in the Use of Data and Analytics, Descriptive Statistics, Data Visualization <b>Data Wrangling - Data Management and Data Cleaning Techniques:</b> Discovery, Structuring, Cleaning, Enriching, Validating and Publishing. <b>Probability:</b> Events and Probabilities, Basic Relationships of Probability, Conditional Probability, Random Variables, Discrete Probability Distributions, Continuous Probability Distributions <b>Descriptive Data Mining :</b> Dimension Reduction, Cluster Analysis, Association Rules, Text Mining <b>Statistical Inference:</b> Selecting a Sample, Point Estimation, Sampling Distributions, Interval Estimation, Hypothesis Tests, Big Data, Statistical Inference	15
II	<b>Linear Regression:</b> Simple Linear Regression Model, Least Squares Method, Assessing the Fit of the Simple Linear Regression Model, The Multiple Linear Regression Model, Inference and Linear Regression, Categorical Independent Variables, Modeling Nonlinear Relationships, Model Fitting, Big Data and Linear Regression, Prediction with Linear Regression <b>Time Series Analysis and Forecasting:</b> Time Series Patterns, Forecast Accuracy, Moving Averages and Exponential Smoothing, Using Linear Regression Analysis for Forecasting, Determining the Best Forecasting Model to Use	15

	<p><b>Predictive Data Mining: Regression Tasks:</b> Regression Performance Measures, Data Sampling, Preparation, and Partitioning, k-Nearest Neighbors Regression, Regression Trees, Neural Network Regression, Feature Selection</p> <p><b>Predictive Data Mining: Classification Tasks:</b> Data Sampling, Preparation, and Partitioning, Performance Measures for Binary Classification, Classification with Logistic Regression, k-Nearest Neighbors Classification, Classification Trees, Neural Network Classification, Feature Selection</p>	
<p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Business Analytics: Principles, Concepts and Applications, by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Cengage Learning.</li> <li>2. Essentials of Business Analytics: Descriptive, Predictive and Prescriptive, By Jeffrey Camm, James Cochran, Jeffrey Ohlmann, David Anderson, Dennis Sweeney, Thomas Williams, Michael Fry, Cengage Learning, 2017.</li> <li>3. Business Analytics: The Science of Data - Driven Decision Making, By U. Dinesh Kumar, Second Edition, Wiley.</li> </ol>		

<b>Course Outcomes</b>	<b>Description (After this course, students will be able to--)</b>	<b>Bloom's Levels</b>	<b>PSO Addressed</b>
<b>CO 1</b>	To understand the process of Data Wrangling, Data Mining and analysis methodologies.	Level II, III - Understand, Apply	PSO 1, PSO 3
<b>CO 2</b>	To understand time series analysis, regression and classification and regression tasks.	Level III, V - Apply, Evaluate	PSO 1, PSO 2, PSO 3

<b>Semester VI – Minor Course</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Duration</b>
RJMINITP361	<b>Business Analytics Practicals</b>	2	60 Hours
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>➤ To proficiently use business analytics software and tools such as python and R to analyze and visualize business data effectively.</li> <li>➤ To apply predictive modeling techniques (e.g., machine learning, time series forecasting) to predict future business outcomes and trends.</li> </ul>			

<b>Practical No.</b>	<b>Practical List</b>
1	Basic and advanced data analysis using Excel
2	Data Wrangling and Visualization
3	Identifying and visualizing distribution of data.
4	Association Rules
5	Regression algorithms
6	Classification algorithms
7	Clustering Algorithms
8	Hypothesis Testing
9	Performing Time Series Analysis and Forecasting using python
10	Working with Geospatial Data

**References:**

1. Essentials of Business Analytics: Descriptive, Predictive and Prescriptive, By Jeffrey Camm, James Cochran, Jeffrey Ohlmann, David Anderson, Dennis Sweeney, Thomas Williams, Michael Fry, Cengage Learning, 2017.

<b>Course Outcomes</b>	<b>Description (After this course, students will be able to--)</b>	<b>Bloom's Levels</b>	<b>PSO Addressed</b>
<b>CO 1</b>	Importing legacy data from excel and performing analysis and visualization of the data.	Level III, VI - Apply, Create	PSO 2, PSO 3
<b>CO 2</b>	Perform data classification and clustering using relevant algorithms.	Level III, VI - Apply, Create	PSO 2, PSO 3
<b>CO 3</b>	Performing Time Series Analysis and Forecasting of data.	Level III, VI - Apply, Create	PSO 2, PSO 3

<b>Semester VI – OJT (Field Project)</b>			
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Duration</b>
RJOJTIT361	On the Job Training	4	120 Hours
<b>Course Objectives:</b> <ul style="list-style-type: none"> <li>➤ To enhance professional competency, familiarize students with professional principles, ethics, values, and integrity.</li> <li>➤ To provide exposure to emerging technologies/ automation and to gain insight in actual workflow mechanisms.</li> <li>➤ To enhance entrepreneurial capabilities in students</li> <li>➤ To enhance problem solving, decision-making and teamwork skills.</li> </ul>			

### **Introduction :**

Students are to complete individual internships with a registered Private, Commercial, Government or Non-government organization. The internship must be completed for 120 hours in the fields related to Information Technology. Some key areas are listed below -

### **Indicative areas**

- Trade and Agriculture
- Economy & Banking Financial Services and Insurance
- Logistics, Automotive & Capital Goods
- Fast Moving Consumer Goods & Retail

- Information Technology/Information Technology Enabled Services & electronics
- Handcraft, Art, Design & Music
- Healthcare & Life Science
- Sports, Wellness and Physical Education
- Tourism & Hospitality
- Digitization & Emerging Technologies (Internet of Things/Artificial Intelligence/Machine Learning/Deep Learning/Augmented Reality/Virtual Reality etc.)
- Humanitarian, Public Policy and Legal Services
- Communication
- Education
- Sustainable Development
- Commerce, Medium and Small-Scale Industries

**Note: This is only an indicative list and not an exhaustive one.**

### **Process of Implementation**

Appointment of OJT coordinators - teachers and students

Students are expected to fulfil this requirement full time during vacations or part time within the duration of semester VI

### **Pattern of Evaluation**

Evaluation during the OJT program involves two key components: External Evaluation (50%) and Internal Evaluation (50%). The following is a suggested two-fold pattern of evaluation.

1. Host Organization Evaluation (External) : The host organization will assess students based on criteria such as punctuality, completion of hours, and proficiency in required skill sets. They will also provide feedback on the student's overall performance.
2. Department Mentor Evaluation (Internal) : Students will be evaluated by their department mentor based on their weekly reporting, written report, and viva voce/presentations.

External (Organization)	Completion of Hours	Quality/ Performance	Punctuality/Regularity	Total
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Representative)	20	20	10	50
Internal (Department Mentor)	Weekly Reporting	Written Report	Viva-Voce /Presentation	
	15	20	15	50
<b>Total</b>				<b>100</b>

## **Documentation Format**

### **Cover Page**

- Title of the Report: On-the-Job Training Experience Report
- Name of the Student:
- Name of the organization:
- Department/Division Where Training took place
- Duration of Training: [Start Date to End Date of Training]
- Date of Submission: [Date of Submitting the Report]

### **Detailed Documentation Format**

#### **Certificate**

#### **Declaration of student**

- Introduction
- Company Overview
- Training Objectives
- Training Experience
- Skills Developed
- Achievements & Contributions
- Challenges Faced
- Lessons Learned
- Recommendations
- Conclusion
- Appendices
  - Appendix I - OJT Undertaking
  - Appendix II - Resume

- Appendix III - Confirmation letter from organization
- Appendix IV - Student Log
- Appendix V - Completion certificate
- References

### Appendix I : OJT Undertaking

1. Student Name:	
2. Current Address	
3. Residence Address	
4. Email ID	
5. Mobile No.	
6. Aadhar Number	
7. PAN Number	
8. Overall GPA	
9. Mode of Internship	
<p>I confirm that I agree with the terms, conditions, and requirements of the OJT Policy.</p> <p>Student Signature:</p>  <p>Date</p>	
<p>I confirm that the student has attended the OJT orientation, and he/she has met all paperwork and process requirements to participate in the OJT programme and has received approval from his/her mentor.</p>  <p>Sign of Head of the Department/ Department Coordinator/Mentor</p>  <p>Date_____</p>	

## Appendix II : Draft Resume Template

Name:

Contact Number and Email ID:

Education:

Higher Educational Institute(HEI) Name:

Degree / Specialization:

CGPA:

Internship / Work Experience:

Project:

- Emphasize accomplishments that are relevant to the field
- Be specific—omit unnecessary words and sentences
- Start your sentence with an action verb, not a passive one-Use past-tense verb to show what you have accomplished Quantify results as much as possible
- Use keywords that will catch a recruiter's eye
- Other Achievements and Personal Interests ( List other achievements also in reverse chronological order )
- Leadership positions held outside your formal work environment
- Personal interests and accomplishments that will distinguish you from other applicants
- Volunteer service/Social Work

Languages known (Mention the level of Proficiency):

Computer Proficiency (Mention the skills you possess):

**Appendix III : Format of Confirmation Letter from organization**  
**(to be printed on company letterhead.)**

To Whomsoever it may Concern

This is to certify that Mr/ Miss \_\_\_\_\_ from TYBSc IT class of R J College of Arts, Science and Commerce (Empowered Autonomous) is offered an internship opportunity in our organization. Duration of internship will be from \_\_\_\_\_ to \_\_\_\_\_.

Sign of authorized representative.

**Appendix IV: Student Log**

Day	Date	Task Assigned	Number of Hours
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**Appendix V : Supervisor Evaluation**

Name of the candidate:

Job Specification:

Total Duration:

Rate the candidate for the following in the range of 1 to 5 (put a check mark in relevant column)

Sr No	Particular	Excellent	Very Good	Good	Satisfactory	Poor
1	Punctual					
2	Regular					
3	Adaptable					
4	Ability to take					

	responsibility					
5	Ability to work in team					
6	Communication Skills					
7	Problem Solving					
8	Ability to complete task					
9	Grasp new Concept					
10	Quality of work done					

Comments:

Name and designation of Supervisor

Appendix VI : Completion certificate

Certificate of Completion

This is to certify that Mr / Miss \_\_\_\_\_ of R. J. College of Arts, Science and Commerce (Empowered Autonomous), Ghatkopar Mumbai has completed his / her internship with our organization. Duration of internship was \_\_\_\_\_ Hours starting from \_\_\_\_\_ to \_\_\_\_\_. During this period, he/she has satisfactorily completed given assignments.

Signature of authorized signatory.

**(to be printed on company letterhead.)**

**Distribution of Marks- Semester V**

Sr. No	Course Code	Course Title	Credit	Total Marks		
				Internal	External	Total
<b>Major DSC (Discipline Specific Course)</b>						
1.	RJDSCIT351	Full Stack Development with MERN Technologies	3	25	50	75
2.	RJDSCIT352	Java Programming	3	25	50	75
3.	RJDSCITP351	MAJ: Major Practical (Full Stack development with MERN Technologies and Java Programming Practical)	2	20	30	50
4.	RJDSCITP352	Applied Software Project Management_ Practical	2	20	30	30
<b>Major DSE (Discipline Specific Elective)</b>						
5.	RJDSEIT351	System Administration with Linux	2	20	30	50
6.	RJDSEITP351	System Administration with Linux Practical	2	20	30	50
7.	RJDSEIT352	Artificial Intelligence and Applications	2	20	30	50
8.	RJDSEITP352	Artificial Intelligence and Applications Practical	2	20	30	50
<b>Minor</b>						
9.	RJMINIT351	Design Principles of Internet of Things	2	20	30	50
10.	RJMINITP351	Design Principles of Internet of Things Practical	2	20	30	50
<b>Skill Enhancement Course</b>						
11.	RJSECITP351	Mobile Programming Practical	2	20	30	50
<b>Field Project</b>						
12.	RJFPIT351	Major Project	2	20	30	50
<b>Total:</b>			22			

### Distribution of Marks- Semester VI

Sr.No	Course Code	Course Title	Credits	Total Marks		
				Internal	External	Total
<b>Major DSC (Discipline Specific Course)</b>						
1.	RJDSCIT361	Advanced Web Development	3	25	50	75
2.	RJDSCIT362	Principles of Information Security	3	25	50	75
3.	RJDSCITP361	MAJ: Major Practical (Advanced Web Development and Principles of Information Security Practical)	2	20	30	50
4.	RJDSCIT363	IT Services and Management	2	20	30	50
<b>Major DSE (Discipline Specific Elective)</b>						
5.	RJDSEIT361	Geographic Information System	2	20	30	50
6.	RJDSEITP361	Geographic Information System Practical	2	20	30	50
7.	RJDSEIT362	Software Testing and Quality Assurance	2	20	30	50
8.	RJDSEITP362	Software Testing and Quality Assurance Practical	2	20	30	50
<b>Minor</b>						
9.	RJMINIT361	Business Analytics	2	20	30	50
10.	RJMINITP361	Business Analytics Practical	2	20	30	50
<b>Field Project</b>						
11.	RJOJTIT361	On the Job Training	4	40	60	100
<b>Total:</b>			22			

Evaluation and Assessment (Based on the centralized guidelines given by EC under NEP 2020)

Credit based Evaluation – 25 marks evaluation per credit.

**Major DSC theory courses** – 3 credit theory courses will be evaluated for 75 marks. 25 marks Internal assessment and 50 marks External evaluation (Semester End Examination)

**Major DSC practical course** – 2 credit practical courses will be evaluated for 50 marks. 20 marks continuous evaluation and 30 marks external evaluation (SEE practical examination)

**Minor and Major DSE Theory courses** for 2 credits will be evaluated for 50 marks – 20 marks Internal Assessment and 30 marks external evaluation. (Semester End Examination)

**Minor, Major DSE and SEC practical courses** - 2 credit practical courses will be evaluated for 50 marks. 20 marks continuous evaluation and 30 marks external evaluation (SEE practical examination)

### **Question Paper format**

Internal Assessment – based on Unit I for a 2-credit course and Unit I and half portion from Unit II for a 3-credit course.

(25 marks for Major DSC and 20 marks for Major DSE and Minor courses)

Q1. Attempt any four/five (each question will carry 5 marks)

- A. Knowledge / Understanding
- B. Application / Analysis
- C. Knowledge / Understanding
- D. Application / Analysis
- E. Knowledge / Understanding
- F. Application / Analysis
- G. Knowledge / Understanding
- H. Application / Analysis

Semester End Examination – For 50 Marks (Major DSC 3 credit)

Q1. Attempt any two (each question will carry 6 marks) – Unit I

- A. Knowledge / Understanding
- B. Application / Analysis
- C. Knowledge / Understanding
- D. Application / Analysis

Q2. Attempt any two (each question will carry 6 marks) – Unit II

- A. Knowledge / Understanding
- B. Application / Analysis
- C. Knowledge / Understanding

D. Application / Analysis

Q3. Attempt any two (each question will carry 6 marks) – Unit III

A. Knowledge / Understanding

B. Application / Analysis

C. Knowledge / Understanding

D. Application / Analysis

Q4. Attempt any two (each question will carry 7 marks) – All Unit

A. Knowledge / Understanding

B. Knowledge / Understanding

C. Application / Analysis

Semester End Examination – For 30 Marks (Major DSE, Minor 2 credit)

Q1. Attempt any three (each question will carry 5 marks)

A. Knowledge / Understanding (Unit I)

B. Application / Analysis (Unit I)

C. Knowledge / Understanding (Unit II)

D. Application / Analysis (Unit II)

Q2. Attempt any three (each question will carry 5 marks) – Unit II

A. Knowledge / Understanding

B. Application / Analysis

C. Knowledge / Understanding

D. Application / Analysis

Evaluation of FP (50 marks – 2 credits) and Major DSC- Software project Management practical (50 marks – 2 credits) will be conducted together in the form of Major Field project viva voce. 20 Marks internal Assessment for both courses will be done in continuous evaluation mode and 30 marks external evaluation will be done in the form of project viva voce by an external examiner.

**Mapping of the courses to employability / entrepreneurship / skill development**

**SEMESTER V**

<b>Course Code</b>	<b>Course Title</b>	<b>Unit No. And topics focusing on Employability / Entrepreneurship / Skill development</b>	<b>Employability /Entrepreneurship / Skill development</b>	<b>Specific Activity</b>
<b>MAJOR</b>				
RJDSCIT351	Full Stack Development with MERN Technologies	Skill Enhancement: Unit I: Node JS, React Class & Components, Props React State Management, Express, GraphQL Unit II: MongoDB, MongoShell, Architecture and ESLint, Modularization and Webpack, React Router Unit III: React Forms, React Bootstrap, Server Rendering, Authentication	Topics focuses on skill development to build robust web applications using modern tools like React, Express, GraphQL, and MongoDB	Programming and Database Assignments
RJDSCIT352	Java Programming	Skill Enhancement: Unit I: Classes, Inheritance, Interfaces, Multithreading Unit II: Packages, Servlet, Working with database, Cookies, Session Unit III: Java Server Pages, Java Server Faces	The topic focus on implementing the basic and advanced concepts of Java	Programming Assignments
RJDSCITP351	MAJ: Major Practical (Full Stack development with MERN Technologies	Skill Enhancement: Full Stack development with MERN Technologies Practical	The practical exercises are designed to help students develop full-stack	Hands on Practical

	and Java Programming Practical)	<p>Practical 01,02,3 - Implementing React Components, Express JS, GraphQL</p> <p>Practical 04- Performing MongoDB CRUD Operations</p> <p>Practical 05,06 - working with Modularization &amp; Webpack Configuration, React Router, Navigation</p> <p>Practical 07,08 - working with React Forms, React-Bootstrap &amp; UI Components</p> <p>Practical 09,10 - Implementing Server Rendering &amp; Performance Optimization</p> <p>Practical 10- Working with Authentication &amp; Deployment</p> <p><b>Java Programming practical:</b> Practical 1,2,3 - OPPs concept and multithreading, Practical 4,5,6,7 - Working with graphical interface, Session, cookies, Practical 8,9,10 - Working with database (JDBC) and framework (JSP, JSF)</p>	<p>development skills, with a focus on the MERN stack.</p> <p>The practical problems facilitate the students to apply core and advanced Java concepts through hands-on implementation</p>	
RJDSCITP352	Applied Software Project	<p>Skill Enhancement :</p> <p><b>Task 1 -</b> Writing project proposal</p>	<p>Tasks were assigned with a focus on implementing</p>	<p>Hands on project dissertation</p>

	<p>Management Practical</p>	<p><b>Task 2</b> – writing Project synopsis  <b>Task 3</b> – Write introduction to topic – background, objective, purpose, scope and survey of technology  <b>Task 4</b> - Write problem statement, requirement specification, planning and scheduling with GANT Chart, hardware and software requirement  <b>Task 5</b> - Write about the conceptual model  Draw relevant flow diagrams  <b>Task 6</b> - Design database schema with data integrity constraints, with relevant logic diagrams,  <b>Task 7</b> - List possible security issues, possible solutions, security protocols to be applied relevant to selected and approved project topic.  <b>Task 8</b> - Design test cases for the project. Write the test cases with possible outcomes for the selected and approved project.  <b>Task 9</b> - Demonstrate the working project and operational flow</p>	<p>key aspects of project development, including planning, programing, execution, monitoring, and delivery.</p>	
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		with visual aids to the project guide. <b>Task 10</b> - Final working project demonstration		
<b>Major DSE</b>				
RJDSEIT351	System Administration with Linux	Skill Enhancement: Unit I: Working with Users, Groups, and Permissions, Networking, Network Manager Unit II: Configuring Servers DHCP, DNS, Web, Mail and File Servers, Configuring Boot	The topics focus on basic understanding of Linux Administration techniques	Assignment
RJDSEITP351	System Administration with Linux Practical	Employability: Practical 1,2,3: Storage and Network Practical 4,5,6: Configuring servers Practical 9: System Administration tasks Practical 10: Shell Programming	The Practical problems facilitate the students to do linux administration task	Hands on Practical
RJDSEIT352	Artificial Intelligence and Applications	Skill Enhancement: Unit I: Intelligent Agents, General Problem-solving approach in AI, Uninformed Search Strategies Unit II: Heuristic Search strategies, Knowledge Representation using logics, Generative AI and Agentic AI	The topics focus on understanding of Application of AI in various fields, Intelligent Agents, various searching techniques, Knowledge representation in first order logic and Agentic AI concepts.	Assignment, Case study

RJDSEITP352	Artificial Intelligence and Applications Practical	Skill Enhancement Practical 1,2,3,4,5- Searching techniques and Problem-Solving using Python libraries Practical 6,7,8 - Knowledge representation and reasoning using ProLog. Practical 9,10- Agentic AI based Case study and mini project.	The Practical learning facilitate the students to use various python libraries in AI Problems solving.	Hands on practical's and case study.
<b>Minor</b>				
RJMINIT351	Design Principles of Internet of Things	Skill Enhancement: Unit I: Connected Devices, concepts related to M2M and system layers, IP addressing in IOT Unit II: Data acquiring, processing, data collection and storage, business models and process using IOT	Topics focus on understanding of various components of IOT and building a prototype and acquiring and analyzing real time data	
RJMINITP351	Design Principles of Internet of Things Practical	Skill Development, Entrepreneurship Building IOT applications with different sensors and actuators	Practical focus on interconnection of multiple devices and building an application using the devices.	
<b>SEC</b>				
RJSECITP351	Mobile Programming Practical	Skill Enhancement: Unit I: Unit II: Unit III: Unit IV:	Practicals focus on android Application Development for smartphones	Hands on practical with application development with User Interface

				Design
<b>Field Project</b>				
RJFPIT351	Major Project	Skill Enhancement: Gathering requirement and design of project Employability: code complete working Application.	Students get on Hands on experience of Designing fully functional Application	Project work

## Mapping of the courses to employability / entrepreneurship / Skill development

### SEMESTER VI

Course Code	Course Title	Unit No. And topics focusing on Employability / Entrepreneurship / Skill development	Employability/ Entrepreneurship/ Skill development	Specific Activity
<b>Major DSC (Discipline Specific Course)</b>				
RJDSCIT361	Advanced Web Development	Skill Enhancement: Unit I: Introduction to C# programming Language Unit II: Using Web forms and Master pages. Unit III : Understanding exception handling and state management Unit IV: Using AJAX and ASP. Net Core.	The topic focus on understanding and implementing the programming concepts on C# and ASP.NET core basic.	Assignment
RJDSCIT362	Principles of Information Security	Skill Enhancement: Unit I: Security Threats Assessment, Unit II: Access Control and Authorization, Authentication, Firewalls, System Intrusion Detection and Prevention Unit III: Security in Wireless Networks ,Cloud and Mobile Devices	The topics focuses on understanding the concept of Computer and Network Security	Assignment
RJDSCITP361	MAJ: Major Practical (Advanced Web Development and Principles of	Skill Development : Advanced Web Development: Practical 1,2,3,4: Basic C# programming,	The Practical focuses on using C# basic and using different web controls for designing website	Hands on practicals using C# and ASP.NET Core.  Practicals on

	Information Security Practical)	Implementing web controls Practical 5,6,7 : Using navigation controls and master pages. Practicals 8,9,10: Using Data controls and Gridview control.  Principles of Information Security Practical 1,2,3: Implementing cryptography techniques Practical 4,5,6,7,8 : ACLs, Firewall Practical 9,10 :VPN	and applications.  The Practical problems facilitate the students to configure Website Designing and security setting in network	Topology design to build secure LAN
RJDSCIT363	IT Services and Management	Skill Enhancement: Unit I: Service management Unit II: Drive Stakeholder Value, Create, Delivery and Support (CDS), Value streams for user support, Continual improvement	Topics covered to facilitates students to understand IT service management	Assignments, case study
<b>Major DSE (Discipline Specific Elective)</b>				
RJDSEIT361	Geographic Information System	Skill Enhancement: Unit I: Geographic information and Spatial data types Unit II: Spatial Data Analysis, Data Visualization	Topics designed to provide practical insights into GIS concepts	Assignment
RJDSEITP361	Geographic Information System Practical	Skill Enhancement: Practical 1,2,3 - creating and managing vector and raster data	Practical problems facilitate the students to comprehend the spatial data	Hands-on implementation

		Practical 4,5,6 - making a map, working with attribute and projection, Practical 7,8,9,10 - georeferencing, Managing Data Tables and Spatial Datasets, advanced GIS operations	fundamentals and techniques.	
RJDSEIT362	Software Testing and Quality Assurance	Skill Enhancement: Unit I: Fundamentals of Testing, Software testing throughout the SDLC, Software Design Testing Unit II: Tool support for testing, Tool support for testing	Topics covered to facilitate students to understand the Software testing process and Agile testing.	Assignments
RJDSEITP362	Software Testing and Quality Assurance Practical	Practical 1, 2 - Manual Testing Techniques Practical 3,4,5 - Using Selenium Web Driver tool Practical 6 - Unit testing using JUnit Practical 7,8 - Performance testing using JMeter Practical 9, 10- Using Autoit tool	Topics covered will help students to learn various testing tools and techniques which are used in the IT industry.	Hands-on implementation
<b>Minor</b>				
RJMINIT361	Business Analytics	Skill Enhancement: Unit I: Introduction to Business Analytics, Data Wrangling Unit II: Probability, Descriptive Data Mining, Statistical	Topics covered to facilitates students to understand different business analytic techniques for data wrangling and visualization.	Assignment

		Inference, Linear Regression Unit III: Time Series Analysis and Forecasting Unit IV: Predictive Data Mining Concepts Regression and Classification Tasks.		
RJMINITP361	Business Analytics Practical	Practical 1,2,3,4- Data analysis using excel, Data wrangling and visualization, Implementing regression and classification. Practical 5,6,7 Using Clustering Algorithm. Practical 8,8,10- Performing hypothesis testing, Performing Time Series Analysis and Forecasting	The topic focus on understanding and implementing regression techniques and time series analysis and forecasting.	Hands on Practical's
<b>Field Project</b>				
RJOJTIT361	On the Job Training	Skill Enhancement, Employability, Entrepreneurship: Developing a complete / partial project, working on different tools, developing small components	Industry Experience gained in the process of internship is enriching and students get prepared for real world tasks.	Industrial Internship

### Integration of Cross cutting Issues

Integration of Cross cutting Issues Class	Course Code	Cross Cutting Issues
TYBSc Information Technology Major	RJDSCIT351, <b>RJDSCIT352</b> RJDSCITP351, RJDSCITP352 RJDSEIT351, RJDSEIT352 RJDSEITP351, RJDSEITP352 RJMINIT351, RJMINITP351 RJSECITP351, RJFPIT351 RJDSCIT361, RJDSCIT362 RJDSCITP361, RJDSCIT363 RJDSEIT361, RJDSEIT362 RJDSEITP361, RJDSEITP362 RJMINIT361, RJMINITP361 RJOJTIT361	Quality Education, Industry, Innovation and Infrastructure, Reduced inequality, Decent work and economic growth UNSDG 4, 9,10

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