



**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

*** As per University Grid**

Courses	Title	Credit	Total Credits
Major DSC (Discipline Specific Course)			
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	
Major DSE (Discipline Specific Elective)			
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	
Minor			
RJMINIT351	Design Principles of Internet of Things	2	4
RJMINITP351	Design Principles of Internet of Things Practical	2	
Skill Enhancement Course			
RJSECITP351	Mobile Programming Practical	2	2
Field Project			
RJFPIT351	Major Project	2	2
Total:			22

Semester: VI
Level 5.5 Major Information Technology

Courses	Title	Credit	Total Credits
Major DSC (Discipline Specific Course)			
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	
Major DSE (Discipline Specific Elective)			
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	
Minor			
RJMINIT361	Business Analytics	2	4
RJMINITP361	Business Analytics Practical	2	
Field Project			
RJOJTIT361	On the Job Training	4	4
Total:			22

*** As per University Grid**

DISTRIBUTION OF TOPICS AND CREDITS

T. Y. B.Sc. Information Technology SEMESTER V – MAJOR COURSES

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	MERN 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 Java: 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

DISTRIBUTION OF TOPICS AND CREDITS

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

Major DSE (Discipline Specific Elective)			
Course	Nomenclature	Credits	Topics
RJDSEIT351	System Administration with Linux	02	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 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
RJDSEITP351	System Administration with Linux Practical	02	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
RJDSEIT352	Artificial Intelligence and Applications	02	Introduction to Artificial intelligence, Intelligent Agents, Problem Solving AI, Uninformed and Heuristic Search strategies, Knowledge Representation, Machine Learning and Generative AI and Agentic AI
RJDSEITP352	Artificial Intelligence and	02	Basics of searching algorithm, problem solving approach using AI,

	Applications Practical		Implementing heuristics searching problem, Using prolog for problem solving. Agentic AI use cases
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Semester V – Major DSE (Discipline Specific Elective)			
Course Code	Course Title	Credits	Duration
RJDSEIT351	System Administration with Linux	02	30 Hours
Course Objectives: <ul style="list-style-type: none"> <input type="checkbox"/> Gain insight into various Linux distributions. <input type="checkbox"/> Familiarize students to install, configure, and optimize for specific server roles. <input type="checkbox"/> Develop expertise in securing Linux servers from vulnerabilities <input type="checkbox"/> Acquire skills to monitor server performance, identify bottlenecks, and optimize resource utilization. 			

Unit	Details	Lectures
I	<p>Getting Started Starting with Linux , Duties of the System Administrator, Installing Red Hat Enterprise Linux Server</p> <p>Working with Users, Groups, and Permissions: Managing Users and Groups, Commands for User Management, Managing Passwords, Modifying and Deleting User Accounts, Configuration Files, Creating Groups, Using Graphical Tools for User, and Group Management, 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>Gaining Privileges, Console Access, Installing and Managing Software</p> <p>YUM: 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>Networking, Network Manager: The Network Manager Daemon, Interacting with Network Manager, Establishing Connections</p> <p>Network Interfaces: 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>Infrastructure Services: Services and Daemons- Configuring the default runlevel, Configuring the Services, Running Services, Additional Resources.</p> <p>OpenSSH- The SSH Protocol, Configuring OpenSSH, Using OpenSSH certificate authentication</p>	15

II	<p>Servers: DHCP Servers: Why Use DHCP? Configuring DHCPv4 server, Configuring DHCPv4 Client. DNS Servers – Introduction to DNS, BIND Web Servers – The Apache HTTP server Mail Servers – Email Protocols, Email Program Classification, Mail Transport Agents, Mail Delivery Agents, Mail User Agents, Additional Resources File Servers – Samba, FTP System Monitoring Tools – 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 Viewing and Managing Log Files – 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 Automating System Tasks – Cron and Anacron, At and Batch Securing Server with iptables: Understanding Firewalls, Setting Up a Firewall with system-config-firewall, Allowing Services, Trusted Interfaces, Masquerading, Configuration Files, Setting Up a Firewall with iptables, Tables, Chains, and Rules, Composition of Rule, Configuration Example, Advanced iptables Configuration, Configuring Logging, The Limit Module, Configuring NAT Setting Up Cryptographic Services: Introducing SSL, Proof of Authenticity: The Certificate Authority, Managing Certificates with OpenSSL, creating a Signing Request, Working with GNU Privacy Guard, Creating GPG Keys, Key Transfer, Managing GPG Keys, Encrypting Files with GPG, GPG Signing, Signing RPM Files Configuring booting with GRUB</p>	15
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Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
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

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
Course Objectives: <ul style="list-style-type: none"> <input type="checkbox"/> Develop expertise in installation of Red Hat Linux operating system <input type="checkbox"/> Acquire skills on setting boot loaders, partitioning storage and managing the process. <input type="checkbox"/> Acquire practical skills in configuring and maintaining servers and networks. <input type="checkbox"/> Gain proficiency in performing various administrative tasks using shell scripting 			

S.No	Practical List
0	Installation of RHEL6.x
1	Working with Users, Groups, and Permissions

	<ul style="list-style-type: none"> a. Creating and Managing Users b. Creating and Managing Groups c. Using Permissions and Advanced Permissions
2	<p>Working with Console, RPM, and Yum</p> <ul style="list-style-type: none"> a. Managing Console and Gaining Privileges b. Working with RPM c. Working with Yum
3	<p>Working with Storage, Network and Infrastructure services</p> <ul style="list-style-type: none"> a. Configuring and Managing Storage b. Connecting to the Network c. Configuring and enabling Infrastructure services d. Configuring OpenSSH
4	<p>Configuring Server for File Sharing</p> <ul style="list-style-type: none"> a. Configuring NFS Server and Client b. Configuring Samba c. Configuring FTP
5	<p>Configuring DHCP, DNS Servers</p> <ul style="list-style-type: none"> a. Configuring DHCP server b. Configuring DNS server
6	<p>Configuring Web and Mail Servers</p> <ul style="list-style-type: none"> c. Configuring Web server d. Configuring Mail server
7	<p>Configuring Monitoring and Automation tools</p> <ul style="list-style-type: none"> a. Configuring System Monitoring tools b. Configuring rsyslog c. Configuring cron, anacron, At and Batch Utility
8	<p>Firewall and Cryptographic services</p> <ul style="list-style-type: none"> a. Securing Server with iptables b. Setting Up Cryptographic Services
9	<p>Perform Daily System Administration tasks</p> <ul style="list-style-type: none"> a. Managing Processes b. Working with Storage Devices and Links c. Working with repository
10	<p>Write the program for the following:</p> <ul style="list-style-type: none"> a. Programs on Shell scripting b. Shell scripts to automate or monitor tasks/processor

Course Outcomes	Description (After this course, students will be able to--)	Blooms Levels	PSO Addressed
CO 1	Apply the knowledge to effectively administer Linux systems, including installation, configuration, user administration, file system management, and system monitoring	Level - III Apply	PSO2
CO 2	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

Semester V – Major DSE (Discipline Specific Elective)			
Course Code	Course Title	Credits	Duration
RJDSEIT352	Artificial Intelligence and Applications	02	30 Hours
Course Objectives: <ul style="list-style-type: none"> <input type="checkbox"/> To understand the fundamental concepts and application of Artificial Intelligence <input type="checkbox"/> To acquire knowledge on intelligent agents and develop proficiency in problem-solving techniques using various search algorithms <input type="checkbox"/> To learn logical reasoning and inference methods to apply them to knowledge representation and problem-solving tasks 			

Unit	Details	Lectures
I	<p>Introduction: What is Artificial Intelligence? Foundations of AI, History, AI application- speech recognition, computer vision.</p> <p>Intelligent Agents: Objective, introduction, agent, agents and rationality, Task environment of Agents, The structure of Agents.</p> <p>Problem Solving AI: 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>Uninformed Search Strategies: Uniform Search Strategies (Blind Search), BFS, Uniform Cost Search, DFS</p>	15

II	<p>Heuristic Search strategies: Best First Search, A* Search, Problem Reduction with AO*, Local Search Algorithm, Adversary Search.</p> <p>Knowledge Representation: 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>Machine Learning: Objective, What is Machine Learning-Supervised learning, Unsupervised Learning, Reinforcement learning, Decision Tree.</p> <p>Generative AI and Agentic AI: What is Generative AI? Types of Generative AI, Building an AI Agent using Agentic AI.</p>	15
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Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
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

	Description	Blooms	
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Course Outcomes	(After this course, students will be able to--)	Levels	PSO Addressed
CO 1	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
CO 2	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)			
Course Code	Course Title	Credits	Duration
RJDSEITP352	Artificial Intelligence and Applications Practical	2	60 Hours
Course Objectives: <ul style="list-style-type: none"> <input type="checkbox"/> Gain practical experience in planning algorithms using Python <input type="checkbox"/> Learn and implement predicate logic techniques using Prolog. <input type="checkbox"/> Learn generative AI techniques and agentic AI use cases. 			

1	Write programs for the following: <ul style="list-style-type: none"> a. Implement depth first search algorithm. b. Implement breadth first search algorithm.
2	Write programs for the following: <ul style="list-style-type: none"> a. Simulate 4-Queen / N-Queen problem. b. Solve the Tower of Hanoi problem.
3	Write programs for the following: <ul style="list-style-type: none"> a. Solve the water jug problem. b. Simulate tic – tac – toe game
4	Write programs for the following: <ul style="list-style-type: none"> a. Solve constraint satisfaction problem b. Construct a Maze Problem Solver
5	Implementation of Heuristic(informed) search algorithms: <ul style="list-style-type: none"> a. Hill Climbing search b. A* Search
6	Prolog- <ul style="list-style-type: none"> - Installation - Data types and structures - Operations
7	Prolog- <ul style="list-style-type: none"> - Facts, Rules, Queries - Solving Queries using prolog
8	Prolog- <ul style="list-style-type: none"> - Problem Solving using Backtracking
9	Agentic AI based Case study- (samples)

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

Course Outcomes	Description (After this course, students will be able to--)	Blooms Levels	PSO Addressed
CO 1	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
CO 2	Problem Solving using Predicate logic in PROLOG	Level III - Apply	PSO2, PSO3
CO 3	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 VI

Level 5.5 Major Information Technology

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

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

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

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
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-tsun g (Karl)	McGrawHill	4th	2008
3.	Principles of Geographic Information Systems	P.A Burrough and R.A.McDonnell	Oxford University Press	3rd	2015

Course Outcomes	Description (After this course, students will be able to--)	Blooms Levels	PSO Addressed
CO 1	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
CO 2	Understand and analyze GIS capabilities on the available datasets to analyse the spatial data.	Level II, IV - Understand, Analyse	PSO2

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

Geographic Information System Practical List	
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

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

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

Unit	Details	Lectures
I	<p>Fundamentals of Testing: Why is testing necessary? What is testing? Seven Testing principles, Test process, The psychology of testing.</p> <p>Testing Throughout the Software Life Cycle: Software development lifecycle models - , Test levels, Test types: the targets of testing, Maintenance testing.</p> <p>Static Techniques: Static testing and test process, Reviews and the test process, Review process, Static analysis by tools</p> <p>Test Design Techniques: 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>Test Management: Test organization, Test planning and estimation, strategies, Test progress monitoring and control, Configuration management, Risk and testing, Incident management, Defect Management.</p> <p>Tool support for testing: Types of test tool, Effective use of tools: Potential benefits and risks, Introducing a tool into an organization. Bug Reporting and Management</p> <p>Agile Testing: Using Agile Methods to improve software testing, Building agility into testing process, The Seven - Step Process</p>	15
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Books and References:					
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

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

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

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

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

Distribution of Marks- Semester V

Sr. No	Course Code	Course Title	Credit	Total Marks		
				Internal	External	Total
Major DSC (Discipline Specific Course)						
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
Major DSE (Discipline Specific Elective)						
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
Minor						
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
Skill Enhancement Course						
11.	RJSECITP351	Mobile Programming Practical	2	20	30	50
Field Project						
12.	RJFPIT351	Major Project	2	20	30	50
Total:			22			

Distribution of Marks- Semester VI

Sr. No	Course Code	Course Title	Credits	Total Marks		
				Internal	External	Total
Major DSC (Discipline Specific Course)						
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
Major DSE (Discipline Specific Elective)						
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
Minor						
9.	RJMINIT361	Business Analytics	2	20	30	50
10.	RJMINITP361	Business Analytics Practical	2	20	30	50
Field Project						
11.	RJOJTIT361	On the Job Training	4	40	60	100
Total:			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

Course Code	Course Title	Unit No. And topics focusing on Employability / Entrepreneurship / Skill development	Employability /Entrepreneurship / Skill development	Specific Activity
MAJOR				
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	Skill Enhancement: Full Stack development with MERN Technologies Practical	The practical exercises are designed to help students develop	Hands on Practical

	Technologies 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 & Webpack Configuration, React Router, Navigation</p> <p>Practical 07,08 - working with React Forms, React-Bootstrap & UI Components</p> <p>Practical 09,10 - Implementing Server Rendering & Performance Optimization</p> <p>Practical 10- Working with Authentication & Deployment</p> <p>Java Programming practical:</p> <p>Practical 1,2,3 - OPPs concept and multithreading,</p> <p>Practical 4,5,6,7 - Working with graphical interface, Session, cookies,</p> <p>Practical 8,9,10 - Working with database (JDBC) and framework (JSP, JSF)</p>	<p>full-stack 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	Skill Enhancement : Task 1 -	Tasks were assigned with a focus on	Hands on project dissertation

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

			concepts.	
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.

SEMESTER VI

Course Code	Course Title	Unit No. And topics focusing on Employability / Entrepreneurship / Skill development	Employability/ Entrepreneurship/ Skill development	Specific Activity
Major DSC (Discipline Specific Course)				
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,	The topics focuses on understanding the	Assignment

		<p>Unit II: Access Control and Authorization, Authentication, Firewalls, System Intrusion Detection and Prevention</p> <p>Unit III: Security in Wireless Networks ,Cloud and Mobile Devices</p>	concept of Computer and Network Security	
RJDSCITP361	MAJ: Major Practical (Advanced Web Development and Principles of Information Security Practical)	<p>Skill Development : Advanced Web Development: Practical 1,2,3,4: Basic C# programming, Implementing web controls</p> <p>Practical 5,6,7 : Using navigation controls and master pages.</p> <p>Practicals 8,9,10: Using Data controls and Gridview control.</p> <p>Principles of Information Security Practical 1,2,3: Implementing cryptography techniques</p> <p>Practical 4,5,6,7,8 : ACLs, Firewall</p> <p>Practical 9,10 :VPN</p>	<p>The Practical focuses on using C# basic and using different web controls for designing website and applications.</p> <p>The Practical problems facilitate the students to configure Website Designing and security setting in network</p>	<p>Hands on practicals using C# and ASP.NET Core.</p> <p>Practicals on Topology design to build secure LAN</p>
RJDSCIT363	IT Services and Management	<p>Skill Enhancement:</p> <p>Unit I: Service management</p> <p>Unit II: Drive Stakeholder Value, Create, Delivery and Support (CDS),</p>	Topics covered to facilitates students to understand IT service management	Assignments, case study

		Value streams for user support, Continual improvement		
Major DSE (Discipline Specific Elective)				
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 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	Practical problems facilitate the students to comprehend the spatial data fundamentals and techniques.	Hands-on implementation
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	Topics covered will help students to learn various testing tools and techniques which are used in the IT industry.	Hands-on implementation

		Practical 6 - Unit testing using JUnit Practical 7,8 - Performance testing using JMeter Practical 9, 10- Using Autoit tool		
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Integration of Cross cutting Issues

Integration of Cross cutting Issues Class	Course Code	Cross Cutting Issues
TYBSc Information Technology Major	RJDSCIT351, RJDSCIT352 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
