PROFESSIONAL ELECTIVES (PE)

VERTICAL 1:FULL STACK DEVELOPMENT

Sl. No	COURSE CODE	COURSE TITLE	T/P/I	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	JIT1020	APP Development	T	PE	3	3	0	0	3
2.	JIT1021	Cloud Services Management	T	PE	3	3	0	0	3
3.	JIT1022	UI and UX Design	T	PE	3	3	0	0	3
4.	JIT1023	Devops	T	PE	3	3	0	0	3
5.	JIT1024	Web Security and Privacy	T	PE	3	3	0	0	3
6.	JIT1025	MERN Stack development	T	PE	3	3	0	0	3
7.	JIT1026	Software Testing And Automation	T	PE	3	3	0	0	3
8.	JIT1027	No SQL Database	T	PE	3	3	0	0	3

VERTICAL 2 COGNITIVE ENGINEERING

Sl. No	COURSE CODE	COURSE TITLE	T/P/I	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	JIT1028	AI tools and Techniques.	T	PE	3	3	0	0	3
2.	JIT1029	Introduction to Machine Learning	T	PE	3	3	0	0	3
3.	JIT1030	Fundamentals Of Deep learning	T	PE	3	3	0	0	3
4.	JIT1031	Fog Computing	T	PE	3	3	0	0	3
5.	JIT1032	Expert System	T	PE	3	3	0	0	3
6.	JIT1033	Recommender Systems	T	PE	3	3	0	0	3
7.	JIT1034	Game Programming	T	PE	3	3	0	0	3
8.	JIT1035	Agent Based Intelligent Systems	T	PE	3	3	0	0	3

VERTICAL 3: AUTOMATION TOOLS

Sl. No	COURSE CODE	COURSE TITLE	T/P/I	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	JIT1002	Agile Methodology	T	PE	3	3	0	0	3
2.	JIT1023	Devops	T	PE	3	3	0	0	3
3.	JAD1020	Software Testing using Selenium	T	PE	3	3	0	0	3
4.	JAD1021	Pandas For Data Analysis	T	PE	3	3	0	0	3
5.	JAD1022	Data Visualization Using Tableau	T	PE	3	3	0	0	3
6.	JAD1023	Jenkins Automation for Server	T	PE	3	3	0	0	3
7.	JAD1024	Cloud Computing Tools	T	PE	3	3	0	0	3
8.	JAD1025	Infrastructure Build Tool Using Terraform	T	PE	3	3	0	0	3

VERTICAL 4: IOT

Sl. No	COURSE CODE	COURSE TITLE	T/P/I	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	JIT1036	Internet Of Things: Architecture Protocols And Applications	T	PE	3	3	0	0	3
2.	JIT1037	Programming For IOT Boards	T	PE	3	3	0	0	3
3.	JIT1038	Industrial IoT 4.0	T	PE	3	3	0	0	3
4.	JIT1039	IoT in HealthCare	T	PE	3	3	0	0	3
5.	JIT1040	Robotics in IOT	T	PE	3	3	0	0	3
6.	JIT1041	Mobile Application Development For IOT	T	PE	3	3	0	0	3
7.	JIT1042	Cognitive IOT	T	PE	3	3	0	0	3
8.	JIT1043	Privacy Security for IOT	T	PE	3	3	0	0	3

VERTICAL 5 CYBER SECURITY

Sl. No	COURSE CODE	COURSE TITLE	T/P/I	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	JCB1402	Foundation of Cyber Security	T	PE	3	3	0	0	3
2.	JCB1403	Cryptography and Cryptoanalysis	T	PE	3	3	0	0	3
3.	JCB1501	Cyber Forensics	T	PE	3	3	0	0	3
4.	JCB1502	Intrusion Detection Systems	T	PE	3	3	0	0	3
5.	JCB1503	Hardware Security	T	PE	3	3	0	0	3
6.	JCB1601	Cloud Security	T	PE	3	3	0	0	3
7.	JCB1603	Ethical Hacking	T	PE	3	3	0	0	3
8.	JCB1702	Web Application Security	T	PE	3	3	0	0	3

JIT1020	APP DEVELOPMENT	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

- To learn development of web applications with basic GUI Components
- To develop cross-platform applications with event handling
- To develop applications with location and data storage capabilities
- To develop web applications with database access
- To learn non-functional characteristics of app frameworks

UNIT-I   FUNDAMENTALS OF MOBILE AND WEB APPLICATION DEVELOPMENT   6

Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, What is Progressive Web App, Responsive Web design

UNIT-II APP DEVELOPMENT USING JAVA   6

Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Dev elopment Frameworks, Java & Kotlin for Android, Swift & Objective-C for iOS

UNIT-III HYBRID APP DEVELOPMENT   6

Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks

UNIT-IV   CROSS-PLATFORM APP DEVELOPMENT   6

What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross- platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native and Native Components

UNIT-V NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS   6

Comparison of different App frameworks, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Development, UI/UX, Reusability

TOTAL: 30 PERIODS

PRACTICAL EXERCISES:

1. Using react native, build a cross platform application for a BMI calculator.
2. Build a cross platform application for a simple expense manager which allows entering expenses and income on each day and displays category wise weekly income and expense.
3. Develop a cross platform application to convert units from imperial system to metric system (km to miles, kg to pounds etc.,)
4. Design and develop a cross platform application for day to day task (to-do) management.

5.Design an android application using Cordova for a user login screen with username, password, reset button and a submit button. Also, include header image and a label. Use layout managers.

6.Design and develop an android application using Apache Cordova to find and display the current location of the user.

7.Write programs using Java to create Android application having Databases

● For a simple library application.

● For displaying books available, books lend, book reservation. Assume that student information is available in a database which has been stored in a database server.

TOTAL: 60 PERIODS

COURSE OUTCOMES

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

- Develop Native applications with GUI Components.
- Develop hybrid applications with basic event handling.
- Implement cross-platform applications with location and data storage capabilities.
- Implement cross platform applications with basic GUI and event handling.
- Develop web applications with cloud database access.

TEXT BOOKS

1. Head First Android Development, Dawn Griffiths, O'Reilly, 1st edition, 2015
2. Apache Cordova in Action, Raymond K. Camden, Manning. 2015
3. Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, FullStack publishing

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1. Android Programming for Beginners, John Horton, Packt Publishing, 2nd Edition , 2018
2. Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach, International Edition , Matt Triff, Pawan Lingras, Rucha Lingras , CENGAGE Learning, 2016
3. React Native Cookbook, Daniel Ward, Packt Publishing, 2nd Edition

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- https://www.geeksforgeeks.org/web-development/
- https://www.startechup.com/blog/app-development-with-java/
- https://www.turing.com/resources/hybrid-mobile-app-development
- https://www.browserstack.com/guide/build-cross-platform-mobile-apps
- https://www.geeksforgeeks.org/non-functional-requirements-in-software-engineering/

Mapping of CO with PO

	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	3	3	1	1	1	-	-	-	2	1	3	2
CO-2	3	1	2	3	2	-	-	-	1	2	3	1
CO-3	1	1	3	1	3	-	-	-	3	3	1	1
CO-4	1	1	1	2	3	-	-	-	2	3	3	1
CO-5	1	3	3	2	2	-	-	-	1	3	1	2
Avg	1.8	1.8	2	1.8	2.2	-	-	-	1.8	2.4	2.2	1.4

JIT1021	CLOUD SERVICES MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce Cloud Service Management terminology, definition & concepts
- To compare and contrast cloud service management with traditional IT service management
- To identify strategies to reduce risk and eliminate issues associated with adoption of cloud services
- To Select appropriate structures for designing, deploying and running cloud-based services in a business environment
- To illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

UNIT-I   CLOUD SERVICE MANAGEMENT FUNDAMENTALS   9

Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models

UNIT-II CLOUD SERVICES STRATEGY   9

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture

UNIT-III CLOUD SERVICE MANAGEMENT   9

Cloud Service Reference Model, Cloud Service LifeCycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service

Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management

UNIT-IV CLOUD SERVICE ECONOMICS   9
Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models

UNIT-V CLOUD SERVICE GOVERNANCE & VALUE   9
IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon completion of the course, the students will be able to:
- Exhibit cloud-design skills to build and automate business solutions using cloud technologies.
- Possess Strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services
- Solve the real world problems using Cloud services and technologies
- Analyse the cloud service economics Cloud Cost Models
- Explain the various cloud service governance and its values

TEXT BOOKS

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by Enamul Haque, Enel Publications 2020
2. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, Zaigham Mohammad 2013
3. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour 2015

REFERENCES
1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing 2020
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi 2013

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- https://www.geeksforgeeks.org/economics-of-cloud-computing/
- https://www.isaca.org/resources/news-and-trends/newsletters/atisaca /2021/ volume-3/building-cloud-governance-from-the-basics

Mapping of CO with PO

	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO-1	3	3	1	1	1	-	-	-	2	1	3	2
CO-2	3	1	2	3	2	-	-	-	1	2	3	1
CO-3	1	1	3	1	3	-	-	-	3	3	1	1
CO-4	1	1	1	2	3	-	-	-	2	3	3	1
CO-5	1	3	3	2	2	-	-	-	1	3	1	2
Avg	1.8	1.8	2	1.8	2.2	-	-	-	1.8	2.4	2.2	1.4

		L	T	P	C
JIT1022	**UI AND UX DESIGN**	**2**	**0**	**2**	**3**

COURSE OBJECTIVES:

- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- To understand the various Research Methods used in Design
- To explore the various Tools used in UI & UX
- Creating a wireframe and prototype

UNIT I FOUNDATIONS OF DESIGN   6

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy

UNIT II FOUNDATIONS OF UI DESIGN   6

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides

UNIT III FOUNDATIONS OF UX DESIGN   6

Introduction to User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals

UNIT IV WIREFRAMING, PROTOTYPING AND TESTING   6

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Synthesizing Test Findings - Prototype Iteration

UNIT V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE
6

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture

TOTAL:30 PERIODS

LIST OF EXPERIMENTS

1. Designing a Responsive layout for an societal application
2. Exploring various UI Interaction Patterns
3. Developing an interface with proper UI Style Guides
4. Developing Wireflow diagram for application using open source software
5. Exploring various open source collaborative interface Platform
6. Hands on Design Thinking Process for a new product
7. Brainstorming feature for proposed product
8. Defining the Look and Feel of the new Project
9. Create a Sample Pattern Library for that product (Mood board, Fonts, Colors based on UI principles)
10. Identify a customer problem to solve

TOTAL: 60 PERIODS

COURSE OUTCOMES:
On completion of the course, the students will be able to:
- Build UI for user Applications
- Evaluate UX design of any product or application
- Demonstrate UX Skills in product development
- Implement Sketching principles
- Create Wireframe and Prototype

TEXT BOOKS
1. Joel Marsh, "UX for Beginners", O'Reilly , 2022
2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" O'Reilly 2021

REFERENCES
1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3 rd Edition , O'Reilly 2020
2. Steve Schoger, Adam Wathan "Refactoring UI", 2018
3. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", Third Edition, 2015

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- https://www.nngroup.com/articles/
- https://www.interaction-design.org/literature.

Mapping of CO with PO

	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	3	1	1	3	1	-	-	-	3	3	2	1
CO-2	2	3	1	3	2	-	-	-	1	2	2	2
CO-3	1	3	3	2	2	-	-	-	2	3	1	2
CO-4	1	2	3	3	1	-	-	-	3	2	1	3
CO-5	1	2	3	2	1	-	-	-	2	1	1	1
Avg	1.6	2.2	2.2	2.6	1.4	-	-	-	2.2	2.2	1.4	1.8

JIT1023	DEVOPS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

- To introduce DevOps terminology, definition & concepts.
- To understand the different Version control tools.
- To understand the concepts of Continuous Integration and Testing.
- To understand Configuration management using Ansible.
- Illustrate the benefits and drive the adoption of cloud-based Dev ops tools to solve real world problems

UNIT I   INTRODUCTION TO DEVOPS   6

Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.

UNIT II   COMPILE AND BUILD USING MAVEN & GRADLE   6

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases (compile build, test, package) Maven Profiles, Maven repositories (local, central, global), Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle

UNIT III   CONTINUOUS INTEGRATION USING JENKINS   6

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a

Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT IV   CONFIGURATION MANAGEMENT USING ANSIBLE   6

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

UNIT V   BUILDING DEVOPS PIPELINES USING AZURE   6

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file

COURSE OUTCOMES:
- Understand different actions performed through Version control tools like Git.
- Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.
- Ability to Perform Automated Continuous Deployment
- Ability to do configuration management using Ansible
- Understand to leverage Cloud-based DevOps tools using Azure DevOps

TOTAL: 45 PERIODS

TEXT BOOKS
1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014

REFERENCES
1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni
2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.
3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.
4. Mariot Tsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019.
5. https://www.jenkins.io/user-handbook.pdf
6. https://maven.apache.org/guides/getting-started/

	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO-1	**3**	**1**	**1**	**3**	**1**	**-**	**-**	**-**	**3**	**3**	**2**	**1**
CO-2	**2**	**3**	**1**	**3**	**2**	**-**	**-**	**-**	**1**	**2**	**2**	**2**
CO-3	**1**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**2**	**3**	**1**	**2**
CO-4	**1**	**2**	**3**	**3**	**1**	**-**	**-**	**-**	**3**	**2**	**1**	**3**
CO-5	**1**	**2**	**3**	**2**	**1**	**-**	**-**	**-**	**2**	**1**	**1**	**1**
Avg	**1.6**	**2.2**	**2.2**	**2.6**	**1.4**	**-**	**-**	**-**	**2.2**	**2.2**	**1.4**	**1.8**

		L	**T**	**P**	**C**
JIT1024	**WEB SECURITY AND PRIVACY**	**3**	**0**	**0**	**3**

COURSE OBJECTIVE
- To familiarize the fundamentals of web application security
- To help students understand the wide aspects of secure development and deployment of web applications
- To explain how to build secure APIs
- To make understand the basics of vulnerability assessment and penetration testing
- To explain about Hacking techniques and Tools

UNIT I   FUNDAMENTALS OF WEB APPLICATION SECURITY   9

The history of Software Security-Recognizing Web Application Security Threats,Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, SessionManagement-Input Validation.

UNIT II SECURE DEVELOPMENT AND DEPLOYMENT   9
Web Applications Security - Security Testing, Security Incident Response Planning,the Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)

UNIT III   SECURE API DEVELOPMENT   9
API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys, OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

UNIT IV VULNERABILITY ASSESSMENT AND PENETRATION TESTING   9

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database- based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

UNIT V HACKING TECHNIQUES AND TOOLS   9

Social Engineering, Injection, Cross-Site Scripting(XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite, etc.

TOTAL : 45 PERIODS

Course Outcome:

At the end of the course, the students will be able to

- Discuss the basic concepts of web application security and the need for it
- Explain the process for secure development and deployment of web applications
- Make use of the skill to design and develop Secure Web Applications that use Secure APIs
- Analyze the problem and carry out vulnerability assessment and penetration testing
- Acquire the skill to think like a hacker and to use hackers tool sets for ethical hacking.

TEXT BOOKS:

1. Andrew Hoffman, "Web Application Security: Exploitation and Counter measures for Modern Web Applications", First Edition, O'Reilly Media, Inc. 2020,
2. Bryan Sullivan, Vincent Liu, "Web Application Security: A Beginners Guide",   The McGraw-Hill Companies ,2012,.

REFERENCES:

1. Ravi Das and Greg Johnson, " Testing and Securing Web Applications", Taylor & Francis Group, LLC, 2021,
2. Prabath Siriwardena, "Advanced API Security", Apress Media LLC, USA, 2020.
3. Malcom McDonald, "Web Security for Developers", No Starch Press, Inc.2020,
4. Neil Madden, "API Security in Action", Manning Publications Co., NY, USA,2020.

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1. https://www.rapid7.com/fundamentals/web-application-security/
2. https://owasp.org/www-community/api_security_tools
3. https://owasp.org/
4. https://www.veracode.com/security/vulnerability-assessment-and-penetration-testing
5. https://www.guru99.com/learn-everything-about-ethical-hacking-tools-and-skills.html

Mapping of PO with CO

	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO-1	3	3	3	3	2	-	-	-	2	2	-	3
CO-2	3	3	3	3	2	-	-	-	2	2	-	3
CO-3	3	2	3	3	2	-	-	-	2	2	-	3
CO-4	3	3	3	3	2	-	-	-	2	2	-	3
CO-5	3	1	3	3	3	1	-	2	2	2	-	3
Avg	3	2.4	3	3	2.2	-	-	2	2	2	-	3

		L	T	P	C
JIT1025	**MERN STACK DEVELOPMENT**	**3**	**0**	**0**	**3**

COURSE OBJECTIVE
- To introduce the basics of JavaScript and importance of MERN stack.
- To identify the role of React in designing front-end components.
- To familiarize the design issues in the development of backend components using Node.js and Express.
- To illustrate the significance of using MongoDB as a database system.
- To make understand the advanced features of full stack development.

UNIT I   JAVASCRIPT AND BASICS OF MERN STACK   9

JavaScript Fundamentals -Modules -DOM tree -Node properties -browser events -Events - Forms, controls -Document and resource loading -Mutation observer -Event loop -MERN Components.

UNIT II   REACT   9

React ES6 -React Render HTML -React JSX -Components -React Classes -Composing Components -Passing Data -Dynamic Composition -React state -setting State -Async State Initialization - Event Handling -Stateless Components -Designing components-React Forms - React CSS -React SaaS.

UNIT III   NODE.JS AND EXPRESS   **9**

Node.js basics -Node Package Manager -Node.js web server -Node.js File system -Node Inspector -Node.js Event Emitter -Frameworks for Node.js -Express.js Web App -Node.js Data Access - Express REST APIs -REST -Resource Based -HTTP Methods as Actions -JSON-Express - Routing -Handler Function -Middleware -List and Create API -Automatic Server Restart -Error Handling -Template Engine.

UNIT IV   MONGODB   **9**

 MongoDB -MongoDB Basics -Documents -Collections -Query Language -Installation- The mongo Shell -MongoDB Node.js Driver -Reading from MongoDB -Writing to MongoDB - CRUD operations -projections -Indexing -Aggregaton -Replication -Sharding -Creating backup – Deployment.

UNIT V   ADVANCED FEATURES   **9**

Modularization and Webpack -Routing with React Router -Forms -More Filters in the List API - UI Components -React-Bootstrap -Table and Panel -Forms -Alerts -Modals -Server Rendering - Basic Server Rendering -Handling State -MongoDB Aggregate -Pagination -Higher Order Components -Search Bar -Google Sign-In -Session Handling.

TOTAL : 45 PERIODS

COURSE OUTCOME:

At the end of the course, the students will be able to

- Discuss the basic concepts of javascript and MERN
- Build programs and applications using REACT
- Create applications using Node.Js and Express
- Apply MongoDB for database access.
- Explain what future enhancements are available for MERN stack.

TEXT BOOKS

1. Vasan Subramanian , "Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node" , APress Publisher, 2019.
2. Eric Bush, "Node.Js, Mongodb, React, React Native Full-Stack Fundamentals and Beyond", Blue Sky Productions Incorporated, 2018.

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1. Manu Sharma , "Full Stack Development with MongoDB", BPB publication, 2022.
2. Greg Lim , "Beginning MERN Stack: Build and Deploy a Full Stack MongoDB, Express, React, Node.js App" , Independent publication, 2021.

3. Chris Northwood , "The Full Stack Developer Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer", APress Publisher 2018

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1. https://www.tutorialsteacher.com/javascript
2. https://reactjs.org/
3. https://nodejs.org
4. www.Expressjs.com
5. www.mongodb.com

Mapping of PO with CO

	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO-1	3	1	3	3	3	-	-	-	2	2	-	3
CO-2	3	2	3	3	3	-	-	-	2	2	-	3
CO-3	3	3	3	3	3	-	-	-	2	2	-	3
CO-4	3	2	3	3	3	-	-	-	2	2	-	3
CO-5	3	2	3	3	3	-	-	-	2	2	-	3
Avg	3	2	3	3	3	-	-	-	2	2	-	3

JIT1026	SOFTWARE TESTING AND AUTOMATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES
- To understand the basics of software testing
- To learn how to do the testing and planning effectively
- To build test cases and execute them
- To focus on wide aspects of testing and understanding multiple facets of testing
- To get an insight about test automation and the tools used for test automation

UNIT I   FOUNDATIONS OF SOFTWARE TESTING   6

Why do we test Software?, Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing

UNIT II   TEST PLANNING   6

The Goal of Test Planning, High Level Expectations,Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.

UNIT III   TEST DESIGN AND EXECUTION   6

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.

UNIT IV   ADVANCED TESTING CONCEPTS   6

Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, Testing in the Agile Environment, Testing Web and Mobile Applications.

UNIT V   TEST AUTOMATION AND TOOLS   6

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.

TOTAL : 45 PERIODS

PRACTICAL EXERCISES:

1. Develop the test plan for testing an e-commerce web/mobile application .
2. Design the test cases for testing the e-commerce application
3. Test the e-commerce application and report the defects in it.
4. Develop the test plan and design the test cases for an inventory control system.
5. Execute the test cases against a client server or desktop application and identify the defects.
6. Test the performance of the e-commerce application.
7. Automate the testing of e-commerce applications using Selenium.
8. Integrate TestNG with the above test automation.
9. Mini Project:

10. Build a data-driven framework using Selenium and TestNG

11. Build Page object Model using Selenium and TestNG

12. Build BDD framework with Selenium, TestNG and Cucumber

TOTAL:60 PERIODS

COURSE OUTCOMES

- Understand the basic concepts of software testing and the need for software testing
- Design Test planning and different activities involved in test planning
- Design effective test cases that can uncover critical defects in the application
- Carry out advanced types of testing
- Automate the software testing using Selenium and TestNG

TEXTBOOKS

1. Yogesh Singh, "Software Testing", Cambridge University Press, 2012
2. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" - Second Edition 2018

REFERENCES

1. Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition, 2012, John Wiley & Sons, Inc.
2. Ron Patton, Software testing, 2nd Edition, 2006, Sams Publishing
3. Paul C. Jorgensen, Software Testing: A Craftsman's Approach, Fourth Edition, 2014, Taylor & Francis Group.
4. Carl Cocchiaro, Selenium Framework Design in Data-Driven Testing, 2018, Packt Publishing.
5. Elfriede Dustin, Thom Garrett, Bernie Gaurf, Implementing Automated Software Testing, 2009, Pearson Education, Inc.
6. Satya Avasarala, Selenium WebDriver Practical Guide, 2014, Packt Publishing.
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MAPPING OF PO WITH CO

	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	3	3	2	1	2	-	-	-	1	1	3	2
CO-2	2	3	1	1	1	-	-	-	2	2	1	2
CO-3	2	2	1	3	1	-	-	-	1	3	1	2
CO-4	2	1	3	2	1	-	-	-	1	1	1	2
CO-5	2	2	1	3	1	-	-	-	1	3	2	1
Avg	2.2	2.2	1.6	2	1.2	-	-	-	1.2	2	1.6	1.8

JIT1027	NO SQL DATABASE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE

- To describe the basics of NoSQL
- To make understand the features of RDBMS and NoSQL
- To familiarize the concept of Document oriented NoSQL Database.
- To help the students understand how store and access data column oriented databases
- To explain the usage of key value pair NoSQL database.

UNIT I   BASICS OF NOSQL   9

Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points.

UNIT II   RDBMS AND NOSQL   9

Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases. Replication and sharding,

UNIT III   DOCUMENT ORIENTED NOSQL DB   9

NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented Database Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.

UNIT IV COLUMN ORIENTED NOSQL DB   9

Column- oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.

UNIT V KEY VALUE PAIR NOSQL DB   9

NoSQL Key/Value databases using Riak, Key-Value Databases,Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Query by Data, Operations by Sets. Graph NoSQL databases usingNeo4, NoSQL database development tools and programming languages, Graph Database. Features, Suitable Use Cases.

TOTAL : 45 PERIODS

COURSE OUTCOME:

At the end of the course, the students will be able to

- Discuss basic concepts of NoSQL databases.
- Explain the similarities and contrasts of RDBMS with different NoSQL databases.

- Explain the detailed architecture and performance tune of Document-oriented NoSQL databases.
- Analyze problems and use column oriented databases when necessary.
- Build efficient Key-Value Pair NoSQL databases.

TEXT BOOKS
1. Martin Fowler , Pramod Sadalage, " NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications",1st Edition ,2014.
2. Dan Sullivan Sullivan , "NoSQL for Mere Mortals", Wesley Publication ,1st Edition, 2015

REFERENCES
1. Adam Fowler, "NoSQL For Dummies" , For dummies publication , 2015.
2. Shashank Tiwari , "Professional NoSQL", Wiley publication 2011.
3. Gaurav Vaish, "Getting Started with NoSQL" , Packet publishing Limited, 2013.
4. Olivier Pivert , "NoSQL Data Models: Trends and Challenges" , Wiley publication, 2018
5. Dan McCreary, Ann Kelly, "Making Sense of NoSQL: A guide for managers and the rest of us", Manning Publications, 2013.

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2. https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp
3. https://www.geeksforgeeks.org/introduction-to-nosql/
4. https://www.javatpoint.com/nosql-database
5. https://www.couchbase.com/resources/why-nosql/

Mapping of PO with CO

	Program Outcomes											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO-1	3	1	1	1	2	-	-	-	2	2	-	3
CO-2	3	1	3	1	2	-	-	-	2	2	-	3
CO-3	3	1	3	1	2	-	-	-	2	2	-	3
CO-4	3	1	3	1	2	-	-	-	2	2	-	3
CO-5	3	1	3	1	2	-	-	-	2	2	-	3
Avg	3	1	2.6	1	2	-	-	-	2	2	-	3

COGNITIVE ENGINEERING

		L	T	P	C
JIT1028	**AI TOOLS AND TECHNIQUES**	3	0	0	3

COURSE OBJECTIVES:
- To demonstrate various AI applications, languages and Intelligent Agents.
- To solve problems using search strategies and understand the basic process of Machine Learning.
- To apply classification and regression algorithms on real world data.
- To develop an expert system.
- To comprehend the structure of an artificial neural network

Prerequisite: Mathematics, Python Programming

UNIT-I : ARTIFICIAL INTELLIGENCE   9
Introduction, Definition of AI, Goals of AI, Turing Test, Applications of AI, AI Programming Languages; Introduction, Intelligent Systems, the Concept of rationality, types of Agents, Environments and its properties, PEAS.

UNIT-II: UNIFORMED SEARCH STRATEGIES   9
Breadth-first search, Uniform cost search, Depth-first search, Iterative deepening Depth-first search, Bidirectional search -Search Strategies: Greedy best-first search, A* search, Heuristic Functions-Beyond Classical Search: Hill-climbing search, Simulated annealing search

UNIT-III : REGRESSION AND CLASSIFICATION   9
Simple Regression, Multiple Regression, Model Assessment-Training Error, Generalized Error, Testing Error, Bias-Variance Tradeof -Linear classification, Logistic Regression, Decision Trees

UNIT-IV : CLUSTERING AND EXPERT SYSTEMS   9
K-Means Clustering- Introduction, Need and Justification of ES, Knowledge Representation, Knowledge Acquisition and Variation, Utilisation and Functionality, Basics of Prolog.

UNIT-V : ARTIFICIAL & CONVOLUTION NEURAL NETWORK   9

Biological Neuron, Types of ANN, Optimization Techniques, Vanishing Gradient Problem, Exploding Gradient Problem, Weight Initialization. Introduction, Components of CNN –Architecture Convolution Layer(with example), Pooling/Downsampling Layer, Flattening Layer, Fully Connected Layer; Rectified Linear Unit Layer, Exponential Linear Unit,Unique Properties of CNN, Architectures of CNNs, Applications of CNN

TOTAL: 45 HOURS

COURSE OUTCOMES:
At end of the course students will be able to:

   CO1 : Understand to classify various AI Applications and the List of AI Languages

   CO2 : Learn to apply informed search techniques to problems

   CO3 : Understand to solve real world data using classification techniques

   CO4 : Understand the concept of clustering over classification

   CO5 : Understand the principles of data simulation and modeling

TEXT BOOKS:

1. Dr.Nilakshi Jain, "Artificial Intelligence:Making a System Intelligent", WileyPublications, 1st Edition,2019

2. Vijayvargia, Abhishek, "Machine Learning with Python: An Approach to Applied Machine Learning", BPB Publications; 1st edition,2018.

REFERENCES:

1. Dr.S.Lovelyn Rose, Dr. L.Ashok Kumar, Dr.D.Karthika Renuka, "Deep Learning using Python",Wiley India Pvt. Ltd 2019..

2. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Publications, 4th Edition, 2020.

3. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011.

4. Stuart Russell and Peter Norvig , "Artificial Intelligence A Modern Approach", Third Edition- Pearson Education

5. Ela Kumar , "Artificial Intelligence" –-IK International

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   2. **https://ai.google/**
   3. **https://www.coursera.org/learn/neural-networks-deep-learning#syllabus**
   4. **https://swayam.gov.in/nd1_noc19_me71/preview**
   5. **https://www.javatpoint.com/ai-tools**

CO-PO AND CO-PSO MAPPING:

CO1 : Understand to classify various AI Applications and the List of AI Languages
CO2 : Learn to apply informed search techniques to problems
CO3 : Understand to solve real world data using classification techniques
CO4 : Understand the concept of clustering over classification
CO5 : Understand the principles of data simulation and modeling

CO/ PO,PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3			3						3	
CO2	3	3	3		3					3	3	
CO3	3	3	3		3				3	3	2	
CO4	3	3			3						2	
CO5	3	3	3		3				3		3	
AVG	3	3	3		3				3	3	2.6	

		L	T	P	C
JIT1029	**Introduction to Machine Learning**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

- To understand the basic concepts of machine learning.
- To understand and build supervised learning models
- To understand and build unsupervised learning models
- To understand the concept of Neural Networks
- To evaluate the algorithms based on corresponding metrics identified

Prerequisite: Mathematics, Statistics and Probability, Python Programming

UNIT-I : INTRODUCTION TO MACHINE LEARNING   9
Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik-Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning.

UNIT-II : SUPERVISED LEARNING   9
Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Perceptron algorithm, Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree.

UNIT-III : UNSUPERVISED LEARNING   9

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.

UNIT-IV:NEURAL NETWORKS   9

Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error back propagation, from shallow networks to deep networks – Unit saturation – ReLU, hyper parameter tuning, batch normalization, regularization, dropout.

UNIT-V:DESIGN AND ANALYSIS OF MACHINE LEARNING   9

Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms – t test, McNemar's test, K-fold CV paired t test

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon completion of the course, the students will be able to:
- Learn the basic concepts of machine learning
- Construct supervised learning models.
- Construct unsupervised learning algorithms.
- Learn the concept of neural networks
- Understand to evaluate and compare different models

TEXT BOOKS:
1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRC Press, 2014.

REFERENCES:
1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997.
3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, 2018.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016
5. Sebastain Raschka, Vahid Mirjalili , "Python Machine Learning", Packt publishing, 3rd Edition, 2019.

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2. **https://ai.google/**
3. **https://www.coursera.org/learn/neural-networks-deep-learning#syllabus**
4. **https://swayam.gov.in/nd1_noc19_me71/preview**
5. **https://www.javatpoint.com/ai-tools**

Mapping of CO with PO/PSO

	Program Outcomes												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	3	3	3	-	2	-	-	-	2	2	3		
CO-2	3	3	3	3	-	2	-	-	-	2	2	3		
CO-3	3	3	3	3	-	2	-	-	-	2	2	3		
CO-4	3	3	3	3	-	2	-	-	-	2	2	3		
CO-5	3	3	3	3	-	2	-	-	-	2	2	3		

JIT1030	FUNDAMENTALS OF DEEP LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- **To understand the basic concepts of Deep Learning**
- **To understand the methods and terminologies involved in deep neural network.**
- **To impart knowledge on CNN.**
- **To introduce RNN and Deep Generative model**
- **To solve real world computer vision applications using Deep learning.**

Prerequisite: Mathematics, Statistics and Probability, Python Programming

UNIT-I BASICS OF DEEP LEARNING   9
Deep Feed-Forward Neural Networks – Gradient Descent – Back-Propagation - Vanishing Gradient Problem – Mitigation – Rectified Linear Unit (ReLU) – Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training – Nestors Accelerated Gradient Descent – Regularization for Deep Learning – Dropout – Adversarial Training – Optimization for Training Deep Models

UNIT-II VISUALIZATION AND UNDERSTANDING CNN   9
Convolutional Neural Networks (CNNs): Introduction to CNNs; Evolution of CNN Architectures:AlexNet, ZFNet, VGG.Visualization of Kernels; Backprop-to-image/ Deconvolution Methods; Deep Dream, Hallucination,Neural Style Transfer; CAM, Grad-CAM**.**

UNIT-III CNN FOR IMAGE AND VIDEO PROCESSING   9

CNNs for Recognition, Verification, Detection, Segmentation: CNNs for Recognition and Verification (Siamese Networks, Triplet Loss, Contrastive Loss, Ranking Loss); CNNs for Detection: Background of Object Detection, R-CNN, Fast R-CNN. CNNs for Segmentation: FCN, SegNet

UNIT-IV RNN FOR IMAGE AND VIDEO PROCESSING   9
Recurrent Neural Networks - Feed-Forward Neural Networks vs Recurrent Neural Networks -Review of RNNs; CNN + RNN Models for Video Understanding: Spatio-temporal Models,Action /Activity Recognition

UNIT-V DEEP GENERATIVE MODELS   9
Deep Generative Models: Review of (Popular) Deep Generative Models: GANs, VAEs Variants and Applications of Generative Models in Vision: Applications: Image Editing, Inpainting,Superresolution, 3D Object Generation, Security

TOTAL: 45 HOURS

COURSE OUTCOMES:
At end of the course students will be able to:
    CO1 : Implement basic Image processing operations
    CO2 :Understand the basic concept of deep learning
    CO3 :Design and implement CNN and RNN and Deep generative model
    CO4 :Understand the role of deep learning in computer vision applications
    CO5 : Design and implement Deep generative model

TEXT BOOKS:

1. Ian Goodfellow Yoshua Bengio Aaron Courville, "Deep Learning", MIT Press, 2017
2. Ragav Venkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRC Press, 2018

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1. Adrian Rosebrock ,"Deep Learning for Computer Vision" -pyimagesearch

2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville,"Deep Learning"- MIT Press

 3. Pieter Abbeel and John Schulman,"Deep Reinforcement Learning"- Grokking

4. Christopher M. Bishop ,"Pattern Recognition and Machine Learning",paperback-23 August 2016.

5. Andrew W. Trask,"Grokking Deep Learning"

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2. **https://www.geeksforgeeks.org/introduction-deep-learning/**
3. **h**ttps://www.techtarget.com/searchenterpriseai/definition/deep-learning-deep-neural-network
4. **https://www.simplilearn.com/tutorials/deep-learning-tutorial/what-is-deep-learning**
5. **https://www.coursera.org/specializations/deep-learning**

CO-PO AND CO-PSO MAPPING:

CO/PO,PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3					3						3		
CO2	3	3						3	3			3		
CO3			3					3	3		3	3		
CO4	3	3						3	3					
CO5	3	2	3	3								3		
AVG	3	2.6	3	3		3		3	3		3	3		

JIT1031	FOG COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- To understand the basic concepts of Fog Computing and Edge computing
- To understand the Architecture and working procedure of systems.
- To gain knowledge about the protocols.
- To impart knowledge in management of Data and Security.
- To solve real world computer applications using Fog Computing.

Prerequisite: Cloud Computing, Networks and IoT

UNIT-I : BASICS OF FOG COMPUTING 9
Fog Computing-Definition-Characteristics-Application Scenarios - Issues –Fog. Computing and Internet of Things-Pros and Cons-Myths of Fog Computing -Need and Reasons for Fog Computing Fog Computing and Edge Computing-IoT, FOG, Cloud Benefits.

UNIT-II: SYSTEM ARCHITECTURE 9
Working Procedure -Performance Evaluation Components- Software Systems – Architecture-Modeling and Simulation –Challenges

UNIT-III : FOG PROTOCOLS 9

Fog Protocol-Fog Kit- Proximity Detection Protocols- DDS/RTPS computing Protocols

UNIT-IV : MANAGEMENT OF DATA AND SECURITY ANALYSIS   9

Smart Management of Big Data-Smart Data-Structure of Smart Data- Smart Data Life. Cycle-System Architecture-Multi-dimensional Payment Plan- -Security and Privacy. Issues-Multimedia Fog Computing-Architecture Deduplication-Hybrid Secure. Deduplication- Security Challenges-Security Requirements.

UNIT-V :CASE STUDY   9

CASE STUDY: Wind Farm - Smart Traffic Light System, Wearable Sensing. Devices,Wearable Event Device, Wearable System, Demonstrations, Post. Application Example. EventApplications Example

TOTAL: 45 HOURS

COURSE OUTCOMES:
At end of the course students will be able to:
    CO1 : Descriptive Knowledge about the basic concepts of Fog Computing and Edge computing
    CO2 : Understand the Architecture and working principles of the system.
    CO3 : Understand and analysis the different protocol mechanism
    CO4 : Understand how to do Data Security analysis
    CO5 : Learn the various industry based application of fog computing.

TEXT BOOKS:

1. Assad Abbas, Samee U. Khan "Fog Computing: Theory and Practice " wiley India May2020
2. Stojan Kitanov (Mother Teresa University, Macedonia)"Introduction to Fog Computing" IGI Global Publication

REFERENCES:

1 . Mukherjee ,"Fog Computing: Concepts, Frameworks and Technologies"

2. Buyya,Rajkumar,Srirama & Satish Narayana "Edge and Fog Computing: Principles and Paradigms"

3. Jantsch, Axel , Liljeberg , Pasi , Preden , Jürgo-Sören , Rahmani & Amir M Ray ,"Fog Computing in the Internet of Things: Intelligence at the Edge" -Springer

4. Zaigham Mahmood ,"Fog Computing-Concepts,Frameworks and Technologies"-Springer

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3. **https://www.heavy.ai/technical-glossary/fog-computing**
4. https://link.springer.com/chapter/10.1007/978-3-030-34957-
8.**https://www.tutorialspoint.com/what-is-fog-computing**

CO-PO AND CO-PSO MAPPING:

CO/ PO,PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3													
CO2	3													
CO3	3	3										3		
CO4	3	3		3									3	
CO5	3								3	3			3	
AVG	3	3		3					3	3		3	3	

		L	T	P	C
JIT1032	**EXPERT SYSTEM**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

- Understand the principles and components of expert systems.
- Develop and implement rule-based reasoning systems using forward and backward chaining.
- Apply certainty factors and uncertainty handling techniques in rule-based inference engines.
- Apply knowledge acquisition techniques to capture expert knowledge effectively.
- Analyze case studies and real-world applications of expert systems in engineering domains.

Prerequisite: Artificial Intelligence and Python Programming

UNIT-I Introduction to Expert Systems   9

Components of an expert system: knowledge base, inference engine, user interface, and explanation module. Expert system architectures: rule-based systems, case-based systems, and hybrid systems, Benefits and limitations of expert systems in engineering domains, Examples of successful expert system applications in engineering fields, Comparison between expert systems and conventional programming approaches, Introduction to knowledge engineering

and knowledge acquisition for expert systems, Challenges in developing and deploying expert systems, Ethical and legal considerations in the use of expert system.

UNIT-II Knowledge Representation 9

Knowledge types: declarative, procedural, and heuristic knowledge, Rule-based knowledge representation: IF-THEN rules and production rules, Rule-based reasoning: forward chaining and backward chaining, Rule-based inference engines: Rete algorithm and conflict resolution strategies
Case-based reasoning: case representation, retrieval, and adaptation, Semantic networks and ontologies for knowledge representation, Knowledge engineering tools and methodologies for capturing and organizing expert knowledge, Knowledge validation and verification techniques, Knowledge representation using frames and scripts and Integration of domain-specific knowledge with expert systems

UNIT-III Inference Engines 9

Inference mechanisms in expert systems, Forward chaining algorithms: data-driven and goal-driven strategies, Backward chaining algorithms: goal-directed and sub goal-directed strategies, Conflict resolution strategies: specificity, salience, and certainty factors, Rule-based reasoning systems: matching and firing rules, chaining and agenda control, Rule-based inference engines: forward chaining and backward chaining engines. Certainty factors and handling uncertainty in expert systems, Inference with numerical and probabilistic information, Explanation and justification mechanisms in expert systems, Temporal and dynamic reasoning in expert systems

UNIT-IV   Knowledge Acquisition and Engineering 9

Knowledge acquisition techniques: interviewing, observation, and documentation, Knowledge elicitation methods: structured interviews, protocol analysis, and knowledge workshops, Knowledge representation using frames and semantic networks, Knowledge engineering methodologies: knowledge acquisition, representation, and validation, Knowledge acquisition tools and expert system shells, Knowledge refinement and iterative development process, Knowledge reuse and maintenance in expert systems, Knowledge acquisition from domain experts and existing data sources, Natural language processing and machine learning techniques for knowledge acquisition, Ontologies and knowledge engineering in the Semantic Web context.

UNIT-V   Advanced Topics and Applications 9

Uncertainty handling in expert systems: fuzzy logic, probability theory, and certainty factors, Hybrid expert systems: integrating rule-based and case-based reasoning, Explanation and justification mechanisms in expert systems, Knowledge-based systems for fault diagnosis and troubleshooting, Expert systems for decision support and optimization, Expert systems in robotics and automation, Challenges and future directions in expert systems research and development.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon completion of the course, the students will be able to:
- Understand the fundamental concepts and principles of expert systems
- Apply knowledge engineering techniques to capture and represent expert knowledge.
- Utilize appropriate inference engines for effective decision-making in engineering domains.
- Understand knowledge acquisition techniques to capture expert knowledge effectively.
- Analyze and evaluate real-world engineering problems for potential applications of expert systems.

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" Authors, 4th Edition Edition, Pearson Publisher 2020.
2. Joseph C. Giarratano and Gary D. Riley Edition ,"Expert Systems: Principles and Programming" 4th Edition ,Cengage Learning,2018.

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1. Cornelius T. Leondes ,"Expert Systems and Artificial Intelligence: An Information Manager's Guide" 1st Edition, 2019 ,Academic Press.
2. Bruce G. Buchanan and Edward H. Shortliffe ,"Rule-Based Expert Systems: The MYCIN Experiments of the Stanford Heuristic Programming Project" 1st Edition , Addison-Wesley ,1984.
3. John Durkin ,"Expert Systems: Design and Development" , 1st Edition ,Prentice Hal,1994
4. Cornelius T. Leondes, "Fuzzy Logic and Expert Systems Applications" –Pearson Publications 2020

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2. http://aima.cs.berkeley.edu/
3. https://www.sciencedirect.com/journal/expert-systems-with-applications
4. **https://www.journals.elsevier.com/expert-systems-with-applications**
5. https://dl.acm.org/doi/abs/10.1016/j.eswa.2022.119049

CO-PO AND CO-PSO MAPPING:

| | Program Outcomes | | | | | | | | | | | | PSO | |
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	3	3	-	-	-	-	-	-	-	-	3		
CO-2	3	3	3	-	-	-	-	-	-	-	-	3		
CO-3	3	3	3	-	-	-	-	-	-	-	-	3		
CO-4	3	3	3	-	-	-	-	-	-	-	-	3		
CO-5	3	3	3	-	-	-	-	-	-	-	-	3		

		L	T	P	C
JIT1033	**RECOMMENDER SYSTEMS**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

- To understand the foundations of the recommender system.
- To learn the content-based recommendation systems
- To learn about collaborative filtering
- To make students to learn about attack-resistant recommender systems.
- To learn Evaluating Recommender Systems

Prerequisite: Probability and Statistics, Machine Learning , Python Programming

UNIT-I INTRODUCTION   9

Introduction and basic taxonomy of recommender systems - Traditional and non-personalized Recommender Systems - Overview of data mining methods for recommender systems- similarity measures- Dimensionality reduction – Singular Value Decomposition (SVD), Applications of recommendation systems and Issues with recommender system

UNIT-II CONTENT-BASED RECOMMENDATION SYSTEMS   9

High-level architecture of content-based systems, advantages and drawbacks of content based filtering - Item profiles, Discovering features of documents, Obtaining item features from tags, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

UNIT-III COLLABORATIVE FILTERING   9

A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF, components of neighborhood methods (rating normalization, similarity weight computation, neighborhood selection and Attacks on collaborative recommender systems

UNIT-IV ATTACK-RESISTANT RECOMMENDER SYSTEMS   9

Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack – Group attack – Strategies for robust recommender design - Robust recommendation algorithms.

UNIT-V EVALUATING RECOMMENDER SYSTEMS   9

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – Design Issues – Accuracy metrics – Limitations of Evaluation measures - Evaluation on historical datasets, Error metrics, Decision-Support metrics, User-Centred metrics.

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon completion of the course, the students will be able to:

CO1: To understand basic techniques and problems in the field of recommender systems
CO2: To understand the concepts of content based recommender system
CO3:To understand the concepts of collaborative filtering
CO4: To understand the concepts of attack-resistant recommender systems
CO5: To understand the concepts of evaluating recommender systems

TEXT BOOKS:
1 Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press(2011), 1st ed.
2. Fatih Gedikli , "Recommender Systems and the Social Web: Leveraging Tagging Data for Recommender Systems"- Springer

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1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich , Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
3. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Sytems Handbook, 1st ed, Springer (2011),
4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Press, 2020.r.

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1. https://freevideolectures.com/course/4694/nptel-e-business/54
2. https://www.cse.iitk.ac.in/users/nsrivast/HCC/Recommender_systems_handbook.pdf
3. https://recommender-systems.com/study-learn/online-courses/
4. https://www.pdfdrive.com/recommender-systems
5. https://www.nvidia.com/en-us/glossary/data-science/recommendationsystem.

Mapping of CO with PO/PSO

	Program Outcomes												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	3	3	-	-	-	-	-	-	-	-	3	3	3

CO-2	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO-3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO-4	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO-5	3	3	3	-	-	-	-	-	-	-	-	3	3	3

		L	T	P	C
JIT1034	**GAME PROGRAMMING**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

- Understand the concepts of Game design and development.
- Learn the processes, mechanics and issues in Game Design.
- Be exposed to the Core architectures of Game Programming
- Know about Game programming platforms, frame works and engines to develop games.
- To learn Evaluating Recommender Systems

Prerequisite: Data Structures and Algorithms, Python Programming

UNIT-I 3D GRAPHICS FOR GAME PROGRAMMING   9

3D Transformations, Quaternions, 3D Modeling and Rendering, Ray Tracing, Shader Models, Lighting, Color, Texturing, Camera and Projections, Culling and Clipping, Character Animation,Physics-based Simulation, Scene Graphs.

UNIT-II GAME ENGINE DESIGN   9

Game engine architecture, Engine support systems, Resources and File systems, Game loop and real-time simulation, Human Interface devices, Collision and rigid body dynamics, Game profiling

UNIT-III GAME PROGRAMMING   9

Application layer, Game logic, Game views, managing memory, controlling the main loop, loading and caching game data, User Interface management, Game event management.

UNIT-IV   GAMING PLATFORMS AND FRAMEWORKS   9

2D and 3D Game development using Flash, DirectX, Java, Python, Game engines - Unity. DX Studio, Unity.

UNIT-V   GAME DEVELOPMENT   9

Developing 2D and 3D interactive games using DirectX or Python – Isometric and Tile Based
Games, Puzzle games, Single Player games, Multi-Player games.

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon completion of the course, the students will be able to:

CO1: Discuss the concepts of Game design and development.
CO2:Design the processes, and use mechanics for game development.
CO3: Explain the Core architectures of Game Programming.
CO4: Use Game programming platforms, frame works and engines.
CO5: Create interactive Games.

TEXT BOOKS:
1. Mike Mc Shaffrfy and David Graham, "Game Coding Complete", Fourth
Edition, Cengage Learning, PTR, 2012.
2. Jason Gregory, "Game Engine Architecture", CRC Press / A K Peters, 2009.

REFERENCES:
1. David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach to
Real-Time Computer Graphics" 2 nd Editions, Morgan Kaufmann, 2006.
2. Ernest Adams and Andrew Rollings, "Fundamentals of Game Design", 2 nd Edition
Prentice Hall / New Riders, 2009.
3. Eric Lengyel, "Mathematics for 3D Game Programming and Computer Graphics", 3
rd Edition, Course Technology PTR, 2011.
4. Jesse Schell, The Art of Game Design: A book of lenses, 1 st Edition, CRC Press,
2008.

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2. https://www.freecodecamp.org/news/the-ultimate-beginners-guide-to-game-
development-in-unity-f9bfe972c2b5/
3. https://www.udemy.com/course/unitycourse2/
4. https://www.developer.com/languages/game-programming-fundamentals/
5. https://www.gamedesigning.org/career/programming-languages/

Mapping of CO with PO/PSO

	Program Outcomes												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO-1	3	-	3	-	-	-	-	-	-	-	-	3	3	3
CO-2	3	-	3	-	2	-	-	-	-	-	-	3	3	3
CO-3	3	1	3	-	2	-	-	-	1	-	-	3	3	3
CO-4	3	1	3	-	3	-	-	-	1	-	-	3	3	3
CO-5	3	1	3	-	3	-	-	-	1	-	-	3	3	3

JIT1035	AGENT BASED INTELLIGENT SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- To Study the fundamentals concepts of agent based systems
- To learn the mechanism through knowledge representation
- Understand the Planning Problem-State Space Search
- To understand Agents and security
- To gain Knowledge in Agent Applications

Prerequisite: Artificial Intelligence , Python Programming

UNIT-I : BASICS FUNDAMENTALS OF AGENTS 9
Definitions - Foundations - History - Intelligent Agents-Problem Solving-Searching -Heuristics -Constraint Satisfaction Problems - Game playing.

UNIT-II: KNOWLEDGE REPRESENTATION AND REASONING 9
Logical Agents-First order logic-First Order Inference-Unification-Chaining-Resolution Strategies-Knowledge Representation-Objects-Actions-Events

UNIT-III : PLANNING AGENTS 9
Planning Problem-State Space Search-Partial Order Planning-Graphs-Nondeterministic Domains-Conditional Planning-Continuous Planning-MultiAgent Planning.

UNIT-IV : AGENTS AND UNCERTAINTY 9
Acting under uncertainty – Probability Notation-Bayes Rule and use –Bayesian Networks-Other Approaches-Time and Uncertainty-Temporal Models- Utility Theory - Decision Network – Complex Decisions

UNIT-V : HIGHER LEVEL AGENTS 9

Knowledge in Learning-Relevance Information-Statistical Learning Methods-Reinforcement Learning-Communication-Formal Grammar-Augmented Grammars-Future of AI

TOTAL: 45 HOURS

COURSE OUTCOMES:
At end of the course students will be able to:
   CO1 : Understand the development of software agents
   CO2 : Understand the mechanism through knowledge representation.
   CO3 : Gain Knowledge in Multi agent and Intelligent agents.
   CO4 : Understand Agents and security
   CO5 : Gain knowledge on applications of agents

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence - A Modern Approach",2nd Edition, Prentice Hall, 2002
2. Michael Wooldridge, "An Introduction to Multi Agent System", John Wiley, 2002

REFERENCES:
   1 . Patrick Henry Winston, Artificial Intelligence, 3rd Edition, AW, 1999.
   2. Nils.J.Nilsson, Principles of Artificial Intelligence, Narosa Publishing House, 1992.
   3. Gerhard Weiss, Multi Agent Systems – A Modern Approach to Distributed Artificial Intelligence, MIT Press , 2016
   4. Mohammad Essaaidi, Maria Ganzha, and Marcin Paprzycki, Software Agents, Agent Systems and Their Applications, IOS Press , 2012 .
   5. Patrick Henry Winston, Artificial Intelligence,3rd Edition,AW1999.

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   2. **https://www.javatpoint.com/agents-in-ai**
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   4. **https://www.simplilearn.com/what-is-intelligent-agent-in-ai-types-function-article**
   5. **https://www.techtarget.com/searchenterpriseai/definition/agent-intelligent-agent**

CO-PO AND CO-PSO MAPPING:

CO/ PO,PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2				3	3	3	2		2	3		
CO2	3	3		3	2	3			3		2	3		
CO3	3	3				3						3		

CO4	3	3			2	3		2	3		3	3		
CO5	3		3			3		3			3	3		
AVG	3	2.6	3	3	2	3	3	2.6	2.6		2.5	3		

JIT1002	AGILE METHODOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- To understand the basic concepts of Agile Software Process.
- To comprehend various Agile Methodologies.
- To develop Agile Software Process.
- To apply principles of Agile Testing.
- To understand metrics used in Agile.

Prerequisite: Software Engineering, Object Oriented Analysis and Design

UNIT-I   :   INTRODUCTION   9

      Software is new product development- Iterative and Evolutionary Methods- Agile Development – Case Study: Perform a comparative Study between Traditional / Heavy weight Methodologies with Agile Methodology.

UNIT-II   :   AGILE AND ITS SIGNIFICANCE   9

      Agile Story: Evolutionary delivery -Scrum Demo- Planning game, -Sprint back log- adaptive planning - Agile Motivation – Problems with The Waterfall - Research Evidence Scrum: Method Overview -Life cycle phases and Work product roles.

UNIT-III   : AGILE METHODOLOGY   9

      Extreme Programming: Method Overview -Life cycle phases and Work product roles - Unified process: Method Overview -Life cycle phases and Work product roles- EVO: Method Overview -Life cycle phases and Work product roles -Case Study: Student group must collaborate and report together along with assigned batch members. Collect the requirements from the client and adopt the suitable agile practice method.

UNIT-IV   :   AGILE PRACTICES   9

      Agile Project management - Agile Environment -. Agile Requirements - Case Study – Practices: At the end of each sprint of automated and acceptance tests

UNIT-V   :   AGILITY AND QUALITY ASSURANCE   9

      Agile product development – Agile Metrics – Feature Driven Development (FDD)- Agile approach to Quality Assurance -Test Driven Development – Agile approach in Global Software Development

TOTAL: 45 HOURS

COURSE OUTCOMES:
At end of the course students will be able to:
    CO1 : Differentiate agile methodologies and Non –agile methodologies
·   **CO2 :** Describe the various practices followed in Agile Software Process

    CO3 : Select suitable agile approach for the projects.

    CO4 : Understand Agile Environment.

    CO5 : Apply agile metrics to projects.

TEXT BOOKS:

1. Craig Larman, "Agile and Iterative Development – A Manager's Guide", Pearson Education, 2006.

2. Elisabeth Hendrickson Quality Tree Software Inc, "Agile Testing", 2008.

REFERENCES:
1. Chetankumar Patel, MuthuRamachandran, Story Card Maturity Model (SMM): A Process Improvement Framework for Agile Requirements Engineering Practices, Journal of Software, Academy Publishers, Vol 4, No 5 (2009), 422-435, Jul 2009.E. Capriolo, D Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.

2. David J. Anderson; Eli Schragenheim, Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.

3. Hazza and Dubinsky, "Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009.

4. Kevin C. Desouza, "Agile Information Systems: Conceptualization, Construction, and Management, Butterworth-Heinemann, 2007.

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    2. https://www.udemy.com/course/introduction-to-agile/
    3.https://www.infoworld.com/article/3237508/what-is-agile-methodology-modern-software-development-explained.html
    4.https://www.javatpoint.com/agile
    5. https://www.nimblework.com/agile/agile-methodology/

CO-PO AND CO-PSO MAPPING:

CO/ PO,PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	2	-	-	-	1	1	3	2	3	2
CO2	2	3	1	1	1	-	-	-	2	2	1	2	1	2
CO3	2	2	1	3	1	-	-	-	1	3	1	2	2	3
CO4	2	1	3	2	1	-	-	-	1	1	1	2	3	1
CO5	2	2	1	3	1	-	-	-	1	3	2	1	2	1
AVG	2.2	2.2	1.6	2	1.2	-	-	-	1.2	2	1.6	1.8	2.2	1.8

		L	T	P	C
JIT1023	**DEVOPS**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To introduce DevOps terminology, definition & concepts.
- To understand the different Version control tools.
- To understand the concepts of Continuous Integration and Testing.
- To understand Configuration management using Ansible.
- To illustrate the benefits and drive the adoption of cloud-based Dev ops tools to solve real world problems

Prerequisite: C Programming, Java Programming

UNIT-I : INTRODUCTION TO DEVOPS 9
Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.

UNIT-II : COMPILE AND BUILD USING MAVEN & GRADLE 9

 Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases (compile build, test, package) Maven Profiles, Maven repositories (local, central, global), Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle

UNIT-III : CONTINUOUS INTEGRATION USING JENKINS 9
        Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT-IV : CONFIGURATION MANAGEMENT USING ANSIBLE 9

   Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

UNIT-V : BUILDING DEVOPS PIPELINES USING AZURE 9

   Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file

TOTAL: 45 HOURS
COURSE OUTCOMES:
At end of the course students will be able to:
   CO1 : Understand different actions performed through Version control tools like Git.
   CO2 : Perform Continuous Integration and Continuous Testing and Continuous
   Deployment using Jenkins by building and automating test cases using Maven & Gradle.
   CO3 : Ability to Perform Automated Continuous Deployment
   CO4 : Ability to do configuration management using Ansible
   CO5 : Understand to leverage Cloud-based DevOps tools using Azure DevOps

TEXT BOOKS:
   1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.
   2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014

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1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni
2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.
3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.
4. Mariot Tsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019.

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2. https://maven.apache.org/guides/getting-started/
3. https://www.atlassian.com/devops
4. https://en.wikipedia.org/wiki/DevOps
5. https://www.techtarget.com/searchitoperations/definition/DevOps

CO-PO AND CO-PSO MAPPING:

CO/ PO,PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	3	1	-	-	-	3	3	2	1		
CO2	2	3	1	3	2	-	-	-	1	2	2	2		
CO3	1	3	3	2	2	-	-	-	2	3	1	2		
CO4	1	2	3	3	1	-	-	-	3	2	1	3		
CO5	1	2	3	2	1	-	-	-	2	1	1	1		
AVG	1.6	2.2	2.2	2.6	1.4	-	-	-	2.2	2.2	1.4	1.8		

JAD1020	SOFTWARE TESTING USING SELENIUM	L	T	P	C

				3	0	0	3

COURSE OBJECTIVES:
- To study the basics of software testing.
- To study selenium web driver.
- To study the test frameworks and test design.
- To study test reporting and logging.
- To study dynamic web elements and automation for web services.

Prerequisite: Software Engineering, Software Testing.

UNIT-I   : INTRODUCTION TO SOFTWARE TESTING & SELENIUM   9

Fundamentals of software testing - Testing lifecycle and methodologies - Role of automation in software testing Introduction to Selenium: Overview of Selenium and its features - Selenium WebDriver architecture - Setting up the Selenium environment

UNIT-II   : SELENIUM WEBDRIVER   9

Selenium WebDriver Basics: Locating web elements using different techniques (e.g., ID, XPath, CSS selectors) - Interacting with web elements (e.g., clicking, typing, selecting) - Handling different types of web elements (e.g., text fields, checkboxes, dropdowns)

UNIT-III   :   TEST FRAMEWORKS AND TEST DESIGN   9

Introduction to test frameworks (e.g., TestNG, JUnit) - Creating test cases and test suites - Organizing tests and test data - Test design techniques (e.g., boundary value analysis, equivalence partitioning)Test Automation

UNIT-IV   : TEST REPORTING AND LOGGING   9

Generating test reports and logs - Analyzing test results and debugging failures - Integration with Continuous Integration (CI) tools (e.g., Jenkins)Selenium Grid and Cross-Browser Testing: Introduction to Selenium Grid - Parallel test execution for improved efficiency

UNIT-V   : ADVANCED TOPICS IN SELENIUM   9

Introduction to Test Automation for Web Services: Overview of testing web services - Introduction to tools/frameworks for web service testing (e.g., REST Assured) - Testing API endpoints and response validation.

TOTAL: 45 HOURS

COURSE OUTCOMES:
At end of the course students will be able to:

CO1 : Understand the basics of software testing
CO2 : Learn the selenium web driver
CO3 : Understand Test frameworks and framework design.
CO4 : Learn test reporting and logging techniques.
CO5 : Learn dynamic web elements and automation for web services.

TEXT BOOKS:
1. Paul C , "Software. Testing. A Craftsman's Approach", CRC press, Fourth Edition, 2013.
2. Satya Avasarala, 'Selenium WebDriver Practical Guide", 2014.

REFERENCES:
1. Unmesh Gundecha, **"**Selenium Testing Tools Cookbook", 2nd Edition, 2015.
2. Zhimin Zhan, "Selenium WebDriver Recipes in C#", Apress publisher,2015.
3. Dima Kovalenko, "Selenium Design Patterns and Best Practices", Packt Publishing, 2018.
4. S BASU, "Selenium with Python Simplified For Beginners", Independently published 2020.

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3. https://www.javatpoint.com/selenium-webdriver
4. https://www.tutorialspoint.com/selenium/selenium_webdriver.htm
5. https://support.smartbear.com/testcomplete/videos/testcomplete-basics-logging-and-reporting/

CO-PO AND CO-PSO MAPPING:

CO/ PO,PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	-	-	-	-	-	-	-	-	-		
CO2	3	2	1	-	-	-	-	-	-	-	-	-		
CO3	2	2	2	-	-	-	-	-	-	-	-	-		
CO4	2	3	3	-	-	-	-	-	-	-	-	-		
CO5	2	3	2	-	-	-	-	-	-	-	-	-		
AVG	2.2	2.6	2	-	-	-	-	-	-	-	-	-		

JAD1021	PANDAS FOR DATA ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- To understand the fundamentals of data analysis and its importance in various fields
- To utilize the pandas plotting subpackage for data visualization.

- To understand the process of building a Python package for data analysis.
- To learn techniques for preprocessing data before applying machine learning algorithms.
- To understand the process of hyperparameter tuning using grid search.

Prerequisite: Statistics and Probability, Database management systems.

UNIT-I : FUNDAMENTALS OF DATA ANALYSIS   9
Fundamentals of data analysis-Statistical foundations-Setting up a virtual environment-Pandas data structures-Bringing data into a Pandas DataFrames-Inspecting a DataFrame object-Grabbing subsets of the data-Adding and removing data

UNIT-II :USING PANDAS FOR DATA ANALYSIS   9
Data Wrangling with Pandas:Data Wrangling-Collecting temperature data-Cleaning up the data-Restructuring the data-Handling duplicate, missing,or invalid data-Database-style operations on DataFrames- DataFrame operations-Aggregations with pandas and numpy-Time Series-plotting with pandas-the pandas.plotting subpackage

UNIT-III   APPLICATIONS AND PLOTTING   9
Seaborn utility-Formatting-Customizing Visulaizations-Building a python package-Data extraction with pandas-Exploratory data analysis-Modeling performance-Simulating login attempts-Rule based anomaly detection.

UNIT-IV MACHINE LEARNING WITH SCIKIT   9
Exploratory data analysis-prepocessing data-clustering –Regression-Classification

UNIT-V METHODS TO OPTIMIZE DATA   9
Hyperparameter tuning with grid search-Ensemble methods-Inspecting classification prediction confidence-Addressing class imbalance-Regularization-Unsupervised methods-Supervised methods-Online Learning

TOTAL: 45 HOURS

COURSE OUTCOMES:
At end of the course students will be able to:
    CO1 : Understand the fundamentals of data analysis.
    CO2 : Able to perform various operations and aggregations using Pandas and NumPy.
    CO3 : Able to perform exploratory data analysis on different datasets.
    CO4 : Have a good understanding of classification techniques and algorithms.
    CO5 : Have a good understanding of ensemble methods and their application.

TEXT BOOKS:
1. Stefanie Molin, "Hands-On Data Analysis with Pandas", Packt Publishing Ltd, 2019.
2. Ashish Kumar, "A Complete Guide to Pandas, from Installation to Advanced Data Analysis Techniques", 2nd Edition, 2019.

REFERENCES:

1. Alvaro Fuentes, "Become a Python Data Analyst", Packt Publishing, 2018
2. Jacqueline Kazil, Katharine Jarmul, "Data Wrangling with Python", O'Reilly Media, 2016.
3. Hannah Stepanek, "Thinking in Pandas" , Apress, 2020.

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1. https://www.google.co.in/books/edition/Thinking_in_Pandas/pZnpDwAAQBAJ?hl=en&gbpv=0
2. https://www.google.co.in/books/edition/Hands_On_Data_Analysis_with_Pandas/buGlDwAAQBAJ?hl=en&gbpv=1&printsec=frontcover
3. https://www.packtpub.com/product/hands-on-data-analysis-with-pandas-second-edition/9781800563452
4. https://www.goodreads.com/book/show/45861407-hands-on-data-analysis-with-pandas
5. https://searchworks.stanford.edu/view/13489419

CO-PO AND CO-PSO MAPPING:

CO/ PO,PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	2	-	-	-	1	1	3	2	3	2
CO2	2	3	1	1	1	-	-	-	2	2	1	2	1	2
CO3	2	2	1	3	1	-	-	-	1	3	1	2	2	3
CO4	2	1	3	2	1	-	-	-	1	1	1	2	3	1
CO5	2	2	1	3	1	-	-	-	1	3	2	1	2	1
AVG	2.2	2.2	1.6	2	1.2	-	-	-	1.2	2	1.6	1.8	2.2	1.8

JAD1022	DATA VISUALIZATION USING TABLEAU	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To perceive in-depth knowledge on how to represent data with visual analytics as suits the target audience, task and data.

- To equip the students with knowledge of visual encoding design choices for arranging and representing data in an interactive and spatial form.

- To gain an insight into Data Visualization techniques and tools.

- To explore business insights and achieve business goals in the right direction

- To provide insight and training on designing visualization dashboard that would support decision making on large scale data

Prerequisite: Database Management Systems, Data Mining and Warehousing.

UNIT-I : INTRODUCTION 9

Purpose of visualization, Data Abstraction: Data Types, Dataset types, Attribute types, Semantics, Preparing your Data, Survey Data, Compute descriptive Statistics, Explore the data visually, Design Standards: Chart Format, Color, Text and Labels Readability, Scales, data Integrity, chart Junk, data density, data richness, Attribution and Design Standard Checklist. Task Abstraction: Actions, Targets, Analyzing & Deriving – Example, Four levels for Validation, Marks and Channels, Analysis – Four levels of Validation.

UNIT-II:Data Manipulation with Pandas 9

Introduction, Data Indexing and selection, operating on data, handling missing data, Hierarchical Indexing, combining dataset, Aggregation and Grouping, Pivot tables, String operation Visualization with Matplotlib: Line plots, Scatter Plots, Visualizing Errors, Density and Contour plots, Histogram, Customizing Plot legends, Color bars, Test and Annotation, Three dimensional Plotting, Geographic data with base map, visualization with sea born

UNIT-III : VISUALIZATION TECHNIQUES 9

Arrange tables, Arrange Network and Trees, Map Color and other Channels, Manipulate Views, Facet, Reduce Items and Attributes: Filter, Aggregate, Time-Series Data visualization, Text data Visualization, Multivariate data visualization.

UNIT-IV :DATA VISUALIZATION USING TABLEAU 9

Exploratory Data Analysis using Tableau Visualizations, Creating basic visualizations- Bar Chart, Geographic map, Crosstab Report, Scatter plot, Line Chart, Connecting to Data, Live Connection, Extract Data, Combine data sources, Join tables, Blend data sources, cross-database join, filtering and sorting data, creating groups and hierarchies - Publishing to Tableau Server - Mapping

UNIT-V : Case Study 9

Geographic Maps, Filled Maps, Mapping options Heat Map, Choropleth map and highlight table, Histograms, Dashboard Development -design Principles and Interactivity

TOTAL: 45 HOURS

COURSE OUTCOMES:
At end of the course students will be able to:

CO1 : Understand the need for data abstraction and task abstraction and would be able to relate with the various data, datasets associated with different applications.
CO2 : Apply the various visual analytics techniques available for arranging the different types of data.
CO3 : Identify and apply appropriate data visualization techniques, given particular requirements imposed by the data.
CO4 : Employ best practices in data visualization to develop charts, maps, tables and other visual representations of data and would be able to identify the need for reducing and aggregating item-sets.
CO5 : Apply the different exploratory data analysis techniques on the datasets using Tableau.

TEXT BOOKS:
1. Sosulski K (2018), "Data Visualization made simple: Insights into Becoming Visual, New York: Routledge.
2. Jake VanderPlas "Python Data Science Handbook", November 2017.

REFERENCES:
1. TamaraMunzner, "Visualization Analysis and Design", December 2014.
2. Few, Stephen, "Show me the numbers: Designing Tables and Graphs to Enlighten" 2nd Edition. Analytics Press Publishers June 2012.
3. Mathew Ward, Georges Grinstein and Daniel Keim, "Interactive Data Visualization Foundations, Techniques, Applications" , 2010.
4. Stephen Few, "Information Dashboard Design: Displaying Data for At-a-glance Monitoring", Analytics Press, 2nd Edition, 2013.

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2. https://app.rawgraphs.io/
3. https://www.datawrapper.de/
4. https://www.tableau.com/
5. https://www.tableau.com/learn/articles/data-visualization

CO-PO AND CO-PSO MAPPING:

CO/ PO,PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3				3				3					
CO2	3	2	3		3						3			
CO3	3		3		3	2					3	3		
CO4	3		3									3		
CO5	3	3	3		3						3			
AVG	3	2.6	3		3	2			3		3	3		

JAD1023	JENKINS AUTOMATION FOR SERVER	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Understand the automation tools and their application

- To Learn about Jenkins interface and its role in

- To Understand Version Control Integration for Jenkins

- To Learn about Continuous Delivery and Deployment with Jenkins

- To Learn about advanced server automation concepts.

Prerequisite: Operating Systems, Computer Network

UNIT-I : INTRODUCTION TO SERVER AUTOMATION TOOLS 9

Introduction-Overview of server automation- benefits-Introduction to popular server automation tools-Understanding infrastructure as code (IaC) principles,Ansible Automation-Introduction-architecture- components and terminology-Chef Automation-Introduction to Chef: architecture, components, and terminology- Puppet Automation-Introduction to Puppet: architecture, components, and terminology-SaltStack Automation-Introduction to SaltStack: architecture, components, and terminology- Comparison and Selection of Automation Tools

UNIT-II : INTRODUCTION 9

Introduction to Jenkins-Overview of Jenkins and its role in software development and automation-Installation and setup of Jenkins on a local machine or server-Familiarization with the Jenkins user interface and basic configuration options-Introduction to Jenkins jobs and their types (e.g., Freestyle, Pipeline)-Creating and configuring jobs using the Jenkins web interface -Parameterized builds and job triggering options

UNIT-III : VERSION CONTROL INTEGRATION 9

Version Control Integration- Integrating Jenkins with popular version control systems-Setting up build triggers on version control events-Configuring webhooks for automatic job triggering-Continuous Integration with Jenkins- principles of continuous integration (CI)-Configuring Jenkins for automated build and unit testing-Running tests and generating test reports with Jenkins

UNIT-IV : CONTINUOUS DELIVERY AND DEPLOYMENT WITH JENKINS 9

Introduction to continuous delivery and deployment -Creating deployment pipelines in Jenkins-Integrating Jenkins with deployment tools -Jenkins Pipeline Fundamentals-Understanding Jenkins pipelines and their advantages -Implementing Jenkins pipelines using the declarative syntax-Writing Jenkins files for defining and managing pipelines

UNIT-V : ADVANCED TOPICS IN SERVER AUTOMATION 9

Configuration management with multiple environments -Integration of server automation tools with version control systems- Implementing advanced features like idempotence, conditional execution, and error handling-Advanced Jenkins Pipeline Concepts -Using Jenkins pipeline stages and steps- Scripted pipeline syntax and advanced scripting techniques -Error handling, parallel execution, and agent configuration in Jenkins pipelines- Jenkins Plugin Ecosystem.

TOTAL: 45 HOURS

COURSE OUTCOMES:
At end of the course students will be able to:
　　CO1:Apply the automation techniques
　　CO2:Apply server automation tools for server validation
　　CO3:Apply version control integration of various projects
　　CO4:Learn about Continuous delivery
　　CO5:Learn about advanced server automation tools

TEXT BOOKS:

1. "Intelligent Automation: Welcome to the world of Hyper automation", Pascal Bornet , World Scientific Publishing Co Pvt Ltd.,2020.

2. Arnon Axelrod," Complete Guide to Test Automation",Apress publications,2020

REFERENCES:

1. Walter de Gruyter ,"Robotic Process Automation Management, Technology, Applications", de Gruyter Publication,2021.

2. Bernd Ruecker ,"Practical Process Automation",OReilly media Publication,2021.

3. Mitesh Soni, "Hands-on Pipeline as YAML with Jenkins", BPB Publications, 2021.

4. Brent Laster, "Jenkins 2: Up and Running", O'Reilly Media, 2018.

WEBSITE REFERENCES :
　　1. https://www.jenkins.io/
　　2. https://www.tutorialspoint.com/jenkins/jenkins_automated_testing.htm
　　3. https://www.testim.io/blog/jenkins-test-automation/
　　4. https://www.youtube.com/watch?v=PAKWqRE0aTk
　　5. https://www.youtube.com/watch?v=f4idgaq2VqA

CO-PO AND CO-PSO MAPPING:

CO/	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

PO,PSO														
CO1	2	-	2	-	-	-	-	-	2	2	2	3	3	3
CO2	3	-	2	-	-	-	-	-	-	-	2	-	3	3
CO3	1	-	2	-	-	-	-	-	-	1	2	-	3	3
CO4	3	-	2	-	-	-	-	-	-	1	2	-	3	3
CO5	2	-	2	-	-	-	-	-	-	1	2	-	3	3
AVG	3	-	2	-	-	-	-	-	-	-	2	-	3	3

JAD1024	CLOUD COMPUTING TOOLS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- To understand the principles of cloud architecture, models and infrastructure.
- To understand the concepts of virtualization and virtual machines.
- To gain knowledge about virtualization Infrastructure.
- To explore and experiment with various Cloud deployment environments.
- To learn about the security issues in the cloud environment

Prerequisite: Computer Networks, Cloud computing

UNIT-I : Cloud Computing Overview 9

Origins of Cloud computing – Cloud components - Essential characteristics – On-demand self-service, Broad network access, Location independent resource pooling, Rapid elasticity , Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing.

UNIT-II : Cloud Insights 9
Architectural influences – High-performance computing, Utility and Enterprise grid computing, Cloud scenarios – Benefits: scalability, simplicity, vendors, security, Limitations – Sensitive

information - Application development- security level of third party - security benefits, Regularity issues: Government policies.

UNIT-III   :   Cloud Architecture- Layers and Models   9

Layers in cloud architecture, Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service (PaaS), features of PaaS and benefits, Infrastructure as a Service (IaaS), features of IaaS and benefits, Service providers, challenges and risks in cloud adoption. Cloud deployment model: Public clouds – Private clouds – Community clouds - Hybrid clouds - Advantages of Cloud computing.

UNIT-IV   :   Cloud Simulators- CloudSim and GreenCloud   9

Introduction to Simulator, understanding CloudSim simulator, CloudSim Architecture(User code, CloudSim, GridSim, SimJava) Understanding Working platform for CloudSim, Introduction to GreenCloud

UNIT-V   :   Introduction to VMWare Simulator   9

Basics of VMWare, advantages of VMware virtualization, using Vmware workstation, creating virtual machines-understanding virtual machines, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.

TOTAL: 45 HOURS

COURSE OUTCOMES:
At end of the course students will be able to:
   CO1 : Understand the design challenges in the cloud.
   CO2 : Apply the concept of virtualization and its types.
   CO3 : Experiment with virtualization of hardware resources and Docker.
   CO4 : Develop and deploy services on the cloud and set up a cloud environment.
   CO5 : Explain security challenges in the cloud environment.

TEXT BOOKS:
   1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010

   2. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008

   3. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

   4. James Turnbull, "The Docker Book", O'Reilly Publishers, 2014

REFERENCES:

1. Cloud computing for dummies- Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, Wiley Publishing, Inc, 2010
2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011

3. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.

4. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", O'Reilly Media, Inc., 2009.

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2. https://www.ibm.com/cloud/free?utm_content=SRCWW&p1=Search&p4=4370007 5080984306&p5=p&gclid=Cj0KCQjw7aqkBhDPARIsAKGa0oJ5hTJCgy9JVMAb DqxKyh0KbBCmHrqfm80UeIe4YAojIAJiw2ifDKEaAvkZEALw_wcB&gclsrc=aw .ds
3. https://www.knowledgehut.com/blog/cloud-computing/cloud-computing-tools
4. https://mindmajix.com/cloud-computing-tools
5. https://www.analyticssteps.com/blogs/top-cloud-computing-tools-market

CO-PO AND CO-PSO MAPPING:

CO/ PO,PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	3	-	-	-	-	2	3	3	3	2	2
CO2	2	2	2	1	1	-	-	-	3	2	3	1	3	1
CO3	2	1	2	1	1	-	-	-	-	1	2	1	3	1
CO4	2	2	2	1	-	-	-	-	1	2	1	3	1	3
CO5	3	1	1	2	1	-	-	-	3	2	1	2	2	2
AVG	3	2	2	2	1				3	2	2	2	2	2

JAD1025	INFRASTRUCTURE BUILD TOOL USING TERRAFORM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- To understand the principles and benefits of Infrastructure as Code.
- To gain proficiency in using Terraform as an infrastructure build tool.

- To learn to install and configure Terraform for various cloud providers.
- To develop the skills to write Terraform configurations to provision infrastructure resources.
- To acquire knowledge of advanced Terraform concepts like managing multiple environments and using plugins.

Prerequisite: Computer Networks, Cloud Computing

UNIT-I : INTRODUCTION TO INFRASTRUCTURE AS CODE AND TERRAFORM   9
Overview of Infrastructure as Code concepts - Introduction to Terraform and its benefits - Terraform ecosystem and components.

UNIT-II : TERRAFORM INSTALLATION AND CONFIGURATION   9
Installing Terraform on different platforms - Setting up the development environment - Configuring Terraform for various cloud providers.

UNIT-III : TERRAFORM BASICS   9
Understanding Terraform configuration files - Declaring and managing infrastructure resources - Working with variables and data types - Resource dependencies and ordering.

UNIT-IV : PROVISIONING INFRASTRUCTURE WITH TERRAFORM   9
Creating and managing AWS infrastructure with Terraform - Provisioning virtual machines, storage, and networking components - Leveraging Terraform modules for reusable infrastructure code - Handling Terraform state and remote backends.

UNIT-V : TERRAFORM ADVANCED CONCEPTS   9
Managing infrastructure across multiple environments: dev, staging, production - Using conditionals and loops in Terraform configurations - Terraform workspace and environment management - Terraform providers and plugins.

TOTAL: 45 HOURS

COURSE OUTCOMES:
At end of the course students will be able to:
    CO1 : Explain the concept of Infrastructure as Code and its significance.
    CO2 : Install and configure Terraform for infrastructure provisioning.
    CO3 : Write Terraform configurations to define and manage infrastructure resources.
    CO4 : Provision and manage infrastructure using Terraform across different cloud providers.
    CO5 : Apply advanced Terraform techniques such as managing multiple environments and utilizing plugins.

TEXT BOOKS:
1. Yevgeniy Brikman, "Terraform: Up & Running", O'Reilly Media, 2017.
2. Kief Morris, "Infrastructure as Code: Managing Servers in the Cloud", O'Reilly Media, 2016.

REFERENCES:

1. Stephane Jourdan, Thomas Peham, Eberhard Wolff, and Sergey Prysmak, "Infrastructure as Code Cookbook ", Packt Publishing, 2020.
2. Scott Winkler and Martin Atkins "Terraform in Action", Manning publications.
3. Mikael Krief , "Terraform Cookbook: Efficiently define, launch, and manage Infrastructure as Code across various cloud platforms", Packt Publishing, 2020.
4. vgeniy Brikman , "Terraform: Up & Running: Writing Infrastructure as Code", O'Reilly Media, 2nd Edition, 2019.

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2. https://developer.hashicorp.com/terraform/tutorials/aws-get-started/infrastructure-as-code
3. https://developer.hashicorp.com/terraform/intro
4. https://www.youtube.com/watch?v=3J3wSzKVJ2A
5. https://www.azuredevopslabs.com/labs/vstsextend/terraform/

CO-PO AND CO-PSO MAPPING:

CO/ PO,PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	2	1	3	2	2	1				2	3		
CO2	3	2	2	2	2	1	1				1	2		
CO3	2	2	2	3	3	1					2	2		
CO4	2	2	3	3	2	2	1				2	2		
CO5	2	2	3	3	2	2					2	2		
AVG	2.4	2	2.2	2.8	2.2	1.6	0.6	0	0	0	1.8	2.2		

IoT:Internet Of Things

PREREQUISTE: Python Programming, Computer Networks,Mobile Computing,Internet Of Things

JIT1036	INTERNET OF THINGS: ARCHITECTURE PROTOCOLS AND APPLICATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Understand the Architectural Overview of IoT

- To Understand the IoT Reference Architecture and Real World Design Constraints

- To Understand the various IoT Protocols.

- To Understand various IoT transport & session layer protocols.

- To Understand various IoT service layer protocols and security

UNIT-I : OVERVIEW 9

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management

UNIT-II: REFERENCE ARCHITECTURE 9

IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

UNIT-III : IOT DATA LINK LAYER & NETWORK LAYER PROTOCOLS 9

PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN,6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP.

UNIT-IV : TRANSPORT & SESSION LAYER PROTOCOLS 9

Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session   Layer HTTP,CoAP, XMPP, AMQP, MQTT

UNIT-V : SERVICE LAYER PROTOCOLS & SECURITY 9

Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4 ,6LoWPAN, RPL, Application Layer

TOTAL: 45 HOURS

COURSE OUTCOMES:
At end of the course students will be able to:
  CO1 : Describe the basic concept and architecture of IOT systems
  CO2 : Understand key skills employed in the IIoT & IoRT space building applications**.**
  CO3 : Analyze various IoT Comprehend IOT protocols
  CO4 : Analyze various IoT Comprehend IOT protocols
  CO5 : Analyze various IoT service layer protocols and security

TEXT BOOKS:
  1.JanHoller, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos,David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a NewAge of Intelligence", 1st Edition, Academic Press, 2014.

  2.Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI

  3.Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer

REFERENCES:
  1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications

  2. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on Approach)",1stEdition, VPT, 2014

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  2.https://www.hindawi.com/journals/jece/2017/9324035
  3. https://www.sciencedirect.com/science/article/pii/B9780128205815000134

CO-PO AND CO-PSO MAPPING:

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CO1	3	3	3	3		1	1							
CO2	3	2	3	3		1	1							
CO3	3	3	2	3		2	2							
CO4	3	3	3	2		2	2							
CO5	3	2	2	2		2	2							
AVG	3	3	3	3		2	2							

		L	T	P	C
JIT1037	**PROGRAMMING FOR IOT BOARDS**	3	0	0	3

COURSE OBJECTIVES:

- To introduce Internet of Things (IoT) environment and its technologies for designing smart systems
- To explore open-source computer hardware/software platform, development and debugging environment, programming constructs and necessary libraries
- To learn embedded programming constructs and real time systems
- To understand various options in programming languages
- To test, debug, and deploy and to solve real world problems.

UNIT-I : INTRODUCTION TO IOT BOARDS 9

IoT- Introduction and Characteristics, Things, Architecture, Enabling Technologies, Challenges,

Levels - Environment -board, IDE, shields; Programming - syntax, variables, types, operators,

constructs and functions; sketch - skeleton, compile and upload, accessing pins; debugging -

UART communicationprotocol and serial library

UNIT-II : INTERFACING WITH IOT BOARDS 9

Circuits - design, wiring, passive components; sensors and actuators, interfacing, read and write;

software libraries to handle complicated hardware; shields, interfacing and libraries

UNIT-III : Single Board Computers and Python Interfacing 9

Board schematic, setup, configure and use, OS implications; linux - basics, file system and processes, shell CLI, GUI; python - basics, API's RPi.GPIO, PWM library to access pins, Tkinter Networking - Internet Connectivity, Standard Internet Protocols, MQTT, CoAP, Networking Socket Interface; Cloud - Public APIs and SDK's for accessing cloud services, Twitter API using Twython package; Interfacing - sensors and actuators, Pi Camera, Servo, A/D, D/A

UNIT-IV :Embedded Programming and RTOS 9

MCU - GPIO, WDT, timers/counters, IO, A/D, D/A, PWM, Interrupts, Memory, serial communicationUART, I2C, SPI, Peripheral Interfacing OS - basics, types, tasks, process, threads

(POSIX Threads),thread preemption, Preemptive Task Scheduling Policies, Priority Inversion, Task communication, Task Synchronization issues - racing and deadlock, binary and counting semaphores(Mutexexample),choosingRTOS

UNIT-V :Real World Projects   9

IoT Integrated Primary Health Care, Large Scale Face Detection by AI Powered Street Lights, Cloud IoT Systems for Smart Agriculture, Smart Home Gadgets, Autonomous Car Features – speed and horn intensity control.

TOTAL: 45 HOURS

COURSE OUTCOMES:
At end of the course students will be able to:

CO1 : Understand basic circuits, sensors and interfacing, data conversion process and shield libraries to interface with the real world

CO2 : Program SBC for practical IoT devices using Python

CO3 : Explore protocols, data conversion process, Api and expansion boards for real world interaction

CO4 : Learn embedded programming constructs and constraints real time systems

CO5 : Illustrate IoT prototyping for real world socio-economic problems

TEXT BOOKS:
1. Yamanoor, Sai, and Srihari Yamanoor. Python Programming with Raspberry Pi, 1st edition, Packt Publishing Ltd, 2017.
2. Donald Norris, The Internet of Things: Do-It-Yourself Projects with Arduino, Raspberry Pi, and BeagleBone Black, 1st edition,McGraw Hill Education, 2015

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2.Schwartz, Marco. Internet of things with arduino cookbook, 1st edition, Packt Publishing Ltd,2016.

3. Kooijman, Matthijs. Building Wireless Sensor Networks Using Arduino, 1st edition, Packt Publishing Ltd, 2015.

WEBSITE REFERENCES :

1. https://elearn.nptel.ac.in/shop/iit-workshops/completed/lab-workshop-on-internet-of-things-iot/
2. https://ict.iitk.ac.in/courses/learn-iot-through-arduino-and-raspberry-pi/
3. https://onlinecourses.swayam2.ac.in/arp20_ap03/preview

CO-PO AND CO-PSO MAPPING:

CO/ PO,PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2				3									
CO2	3													
CO3	3		3	3										
CO4	3													
CO5		3												
AVG	3	3	3	3	3									

JIT1038	INDUSTRIAL IoT 4.0	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- To develop knowledge in Industrial Internet of Things (IIoT) fundamentals.

- To understand the architecture, IOT and its protocols

- To Understand the various data analytics techniques

- To Understand the CPS for Industry 4.0

- To provide students with a good depth of knowledge of Designing Industrial IOT Systems for various applications

UNIT-I :   Industrial IOT Introduction   9

Introduction to IOT, IOT Vs. IIOT, History of IIOT, Components of IIOT - Sensors and Actuators for Industrial Processes, Role of IIOT in Manufacturing Processes. Challenges & Benefits in implementing IIOT**.**

UNIT-II: IIoT Architecture   9

Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models, Industrial IoT-Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking

UNIT-III : IIOT ANALYTICS   9

Big Data Analytics and Software Defined Networks, Machine Learning and Data Science, Julia Programming, Data Management with Hadoop.

UNIT-IV : Industrial IoT: CYBER PHYSICAL SYSTEM   9

Introduction to Cyber Physical Systems (CPS), Architecture of CPS- Components, Data science and technology for CPS, Emerging applications in CPS in different fields. Case study: Application of CPS in health care domain.

UNIT-V : Industrial IoT- Application Domains   9

Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.

TOTAL: 45 HOURS

COURSE OUTCOMES:
At end of the course students will be able to:
   CO1 : To understand the basics of industrial IoT (IIoT).
   CO2 : To develop various applications using IIOT architectures
   CO3 : Recognize the uses of cloud computing and data analytics
   CO4 : Analyze privacy and security measures for industry standard solutions
   CO5 : Design and implement IOT applications that manage various technology

TEXT BOOKS:
   1. Veneri, Giacomo, and Antonio Capasso- Hands-on Industrial Internet of Things: Create a Powerful Industrial IoT Infrastructure Using Industry 4.0, 1stEd., Packt Publishing Ltd,2018
   2. Alasdair Gilchrist- Industry 4.0: The Industrial Internet of Things, 1st Ed., Apress, 2017

REFERENCES:
   1. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, 1st Edition, Apress, 2017
   2. Aboul Ella Hassanien, Nilanjan Dey and Sureaka Boara, Medical Big Data and Internet of Medical Things: Advances, Challenges and Applications, 1st edition, CRC Press, 2019.

WEBSITE REFERENCES :
   1.   **https://onlinecourses.nptel.ac.in/noc22_cs52/preview**
   2.   **https://www.coursera.org/specializations/developing-industrial-iot#courses**
   3.   **https://www.coursera.org/learn/industrial-internet-of-things.**
   4.   **https://www.coursera.org/learn/internet-of-things-sensing-actuation**

CO-PO AND CO-PSO MAPPING:

CO/ PO,PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2													
CO2	3													
CO3	3		3											
CO4	3													
CO5		3												
AVG	3	3	3											

JIT1039	IoT in HealthCare	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- To design products related to IoT based Health care applications
- To Understand and design multidisciplinary approach for design, development,
- To simulate, and implement IoT health care systems.
- To Apply the monitored health parameter sensor output data for further computing, analyzation and visualization.
- To Identify and summarize remote health monitoring and Tele-health.

UNIT-I   :   INTRODUCTION TO IOT BASED HEALTH CARE   9

Introduction to IoT applications in smart healthcare& their distinctive advantages - Patient Health Monitoring System (PHMS), Tele-Health, TeleMedicine, Tele-Monitoring, Mobile Health Things (m-health).

UNIT-II: IOT SMART SENSING HEATH CARE AND POWER CHALLENGE   9

Concept of Generic Biomedical sensors, Smart Sensors: Monitor health parameters, Wearable ECG sensors, IoT Data Acquisition System, Energy harvesting, Battery based systems, Power management.

UNIT-III   : INTERNET OF MEDICAL THINGS   9

Data Confidentially, Data Integrity, Data Protection, Security awareness, Emergent threats: Autonomous, IoT heterogeneity and ubiquity, Physical environment.

UNIT-IV   SECURITY AND PRIVACY   9

Security, Privacy and Ethical Issues Smart Health and well-being Applications Risk Analysis Cyber-Physical-Social Systems, Machine Ethics, Physical Safety Software Quality, IT Security, Privacy, Risk of Technology Misuse

UNIT-V :   WEARABLE TECHNOLOGIES – CASE STUDIES   9

Soft Skin simulation for Wearable Haptic Rendering, Design Challenges for real wearable computers, Collaboration with wearable computers. IoT Based Contactless Body Temperature Monitor.

TOTAL: 45 HOURS

COURSE OUTCOMES:

At end of the course students will be able to:

CO1 : Understand and design multidisciplinary approach for design, development, simulation, and implementation of IoT health care systems.

CO2 : Apply the monitored health parameter sensor output data for further computing,analyzation and visualization.

CO3 : Identify and summarize remote health monitoring and Tele-health

CO4 : Elaborate security, privacy and ethical issues in smart sensor health and well-being application

CO5 : Learn about the requirement's to design Frameworks for Wearable Computing

TEXT BOOKS:
1. Dac-Nhuong Le," Emerging Technologies for Health and Medicine: Virtual Reality, Augmented Reality, Artificial Intelligence, Internet of Things,Robotics, Industry 4.0," Wiley, 2019
2. S. Misra, A. Mukherjee, and A. Roy "Introduction to IoT". CambridgeUniversity Press, 2017

REFERENCES:
1. Qusay F. Hassan " Internet of Things A to Z Technologies and Applications,
2. Intelligent Data Sensing and Processing for Health and Well-being Applications, Miguel Antonio Wister Ovando, Pablo Pancardo Garcia,Francisco Diego Acosta Escalante, Jose Adan Hernandez Nolasco
3. Vankamamidi S. Naresh1,Suryateja S. Pericherla,Pilla Sita Rama Murty,SivaranjaniReddi, "Internet of Things in Healthcare: Architecture, Applications, Challenges, and Solutions",International Journal of Computer Systems Science &Engineering,vol 35 no 6 November 2020

WEBSITE REFERENCES :

1. **https://www.udemy.com/course/iot-based-emergency-health-care-system**
2. **https://skill-lync.com/medical-technology-courses/iot-healthcare**

CO-PO AND CO-PSO MAPPING:

CO/ PO,PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2													
CO2	3													
CO3	3		3											
CO4	3													
CO5		3												
AVG	3	3	3											

JIT1040	Robotics in IOT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:
- To learn basics of Internet of Things (IoT), and its execution using multiple robotic sensors
- To understand Internet of Robotic Things (IoRT) and its various implementations in industry and automation
- To implement IoT and Robotics application in autonomous driving and health care
- To Learn the design and analysis of Industry 4.0 systems for Energy and smart vehicular applications.
- To understand the Cloud Robotics and Industrial Automation

UNIT-I : Introduction to IoT and Vision systems   **9**

History and evolution of IoT, AI, ML, Machine Vision, optoelectronic sensors, 3D & 2D machine vision technologies, robot navigation, control schemes, motion controllers, intelligent algorithms and vision systems.

UNIT-II: Robotic Sensors   **9**

Optical sensors and actuators; Mechanical sensors and actuators; Acoustic sensors and actuators; Performance characteristics of sensors and actuators.

UNIT-III   : Internet of Robotic Things   **9**

Communication architecture for IoRT; Decentralized and automated IoT infrastructure using Blockchain; IoRT Platforms Architecture, IoRT applications

UNIT-IV   **:Autonomous Vehicle Systems**   **9**

Introduction to Autonomous Driving; Perception in Autonomous Driving; Robot Operating System (ROS) Overview - Client Systems for Autonomous Driving - Decision planning and control in autonomous vehicle systems - Cloud Platform for Autonomous Driving.

UNIT-V   **: Cloud Robotics and Industrial Automation**   **9**

IoMT and Robotics in Healthcare IoMT Driven connected healthcare, Efficient design for IoMT based healthcare design, Robotics in healthcare, Components of Cloud Robotics; Limitations and challenges of Cloud Robotics; Applications:Autonomous mobile robots, Cloud medical robots, Industrial robots.

                                                           TOTAL: 45 HOURS

COURSE OUTCOMES:
At end of the course students will be able to:

    CO1 : Understand IoT ecosystem in robotic paradigm

    CO2 : Analyze IoT infrastructure and develop IoRT applications

    CO3 : Apply IoT in robotics over different platforms

    CO4 : Implement Cloud robotics in automations

    CO5 : Implement automated applications using multiple robotic sensors

TEXT BOOKS:

1. Vermesan, Ovidiu, and Joël Bacquet, eds.,Cognitive Hyperconnected Digital Transformation: Internet of Things Intelligence Evolution, 1st edition, River Publishers, 2017.
2. A.K.Gupta, S.K.Arora, and J.Riescher, Industrial Automation and Robotics, 1st edition

,   Mercury Learning and Information LLC,2017

REFERENCES:

    1. A.K Dubey, A.Kumar, and S.R Kumar., AI and IoT-based Intelligent Automation in

Robotics, 1st edition. Wiley, 2020

    2. . A.E.Hassanien, N.Dey, and S.Borra, Medical Big Data and Internet of Medical Things:

Advances, Challenges and Applications, 1st edition ,Taylor & Francis Group,2019

    3. S.Liu, L.Li and J.Tang, Creating Autonomous Vehicle Systems, Synthesis Lectures on

Computer Science, 1st edition ,Morgan & Claypool,2018

    4. Nathan Ida, Sensors, Actuators, and Their Interfaces: A multidisciplinary introduction, 2nd

edition The Institution of Engineering and Technology, 2017

WEBSITE REFERENCES :

1. https://www.udemy.com/course/iot-robotics-hacking-nodemcu/

CO-PO AND CO-PSO MAPPING:

CO/ PO,PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3		2	2	2						
CO2	3	3	3	3										
CO3	3	3	3	3		1	1	1						
CO4	3	3	3	3		1	1	1						
CO5	3	3	3	3										
AVG	3	3	3	3		2	2	2						

JIT1041	MOBILE APPLICATION DEVELOPMENT FOR IOT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the mobile application development for Internet of Things (IoT) devices
- To deploy various components of mobile devices and essential sensors for various application
- To understand   architectures and models used in Mobile
- To understand   analytics and security aspects of mobile applications in IoT platforms
- To apply the technologies for low power wireless devices.

UNIT-I : INTRODUCTION TO IOT ECOSYSTEM   9

IoT ecosystem; Industry 4.0; Application development platforms for IoT; IoT Data sources

 UNIT-II: SENSOR FOR MOBILE AND HANDHELD DEVICES   9

Temperature sensors, Proximity sensor, IR sensors, Image sensors, Motion detection sensors, Accelerometer sensors, Gyroscope sensors, Optical sensors

UNIT-III: SENSOR DATA PROCESSING   9

Sensor Data-Gathering and Data-Dissemination Mechanisms; Sensor Database system architecture; Sensor data-fusion mechanisms; Data-fusion Architectures and models

UNIT-IV: PROGRAMMING FRAMEWORKS FOR INTERNET OF THINGS   9

IoT Programming Approaches: Node-Centric Programming - Database approach - ModelDriven Development - IoT Programming Frameworks: Android Things - ThingSpeak - IoTivity - Node-RED - DeviceHive - Contiki and Cooja – Zetta

UNIT-V: COMMUNICATION TECHNOLOGIES FOR LOW POWER WIRELESS INTERACTIONS   9

Wireless communications in product development – Bluetooth LE - Near Field Communications (NFC) – WiFi; Prototyping Bluetooth LE with Arduino Nano; Power management strategies and practices Case Study

TOTAL: 45 HOURS

COURSE OUTCOMES:
At end of the course students will be able to:

CO1 : Outlines a fundamental full stack architecture for IoT
CO2 : Describes various development technologies in each IoT layer
CO3 : Develops IoT applications using standardized hardware and software platforms.
CO4 : Creates prototype using low power communication technologies.
CO5 : Explains IoT solution development from Product management perspective

TEXT BOOKS:
 1. Kale, Vivek. Parallel Computing Architectures and APIs: IoT Big Data Stream Processing1st edition, CRC Press, 2019.
2. Lea, Perry. Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security, 1st edition,Packt Publishing Ltd, 2018.

REFERENCES:
   1. 1. Fadi Al-Turjman, Intelligence in IoT-enabled Smart Cities, 1st edition, CRC Press,2019
   2. Giacomo Veneri, and Antonio Capasso, Hands-on Industrial Internet of Things: Create a powerful industrial IoT infrastructure using Industry 4.0, 1 st edition, Packt Publishing,2018
WEBSITE REFERENCES :
   1. https://www.silabs.com/support/training/app-103-mobile-app-development-for-iot
   2. https://www.classcentral.com/course/mobile-development-in-iot-73972

CO-PO AND CO-PSO MAPPING:

CO/ PO,PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3		2	2	2	3	3	3	3
CO2	3	3	3	3					3	3	3	3
CO3	3	3	3	3		1	1	1	3	3	3	3
CO4	3	3	3	3		1	1	1	3	3	3	3
CO5	3	3	3	3					3	3	3	3
AVG	3	3	3	3		2	2	2	3	3	3	3

JIT1042	COGNITIVE IOT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Introduce cloud computing and enabling technologies
- To Explore the need for fog and edge computation
- To Impart the knowledge to log the sensor data and to perform further data analytics
- Impart the knowledge to log the sensor data and to perform further data analytics
- Make the students to apply Internet of Things (IoT) data for business solution in various domain in secured manner

UNIT-I : Cognitive IoT – Introduction   9

Cognitive IoT, Need for Cognitive IoT, Current and Future trends of IoT, Cognitive computing and applications. Data Analytics for IoT Regression, Data Analytics for IoT ANN Classification, Data Analytics for IoT Modern DNN's

UNIT-II: Secure Fog-Cloud of Things   9

Secure Fog-Cloud of Things: Architectures, Opportunities &Challenges IoT Architecture and Core IoT, Collaborative and Integrated Edge Security Architecture, A connected ecosystem, Threat and security in IoT.

UNIT-III : GPU Architecture   9

Introduction to GPU's Parallel programming for GPU, Parallel programming in CUDA, CNN

Inference in GPU, CNN Training in GPU. FPGA for Internet of Things Benefits of FPGA, Interfacing FPGAs with IoT-based edge devices, IoT-FPGA based applications, Microsemi's SmartFusion2 SoC FPGA.

UNIT-IV :   IoT Enabling Technologies and Devices   **9**

Big data, Digital twin, Cloud Computing, Sensors, Communications, Analytical software, Edge

Devices.

UNIT-V :   Security in Cognitive IoT   **9**

Security in Cognitive IoT, Security Issues in IoT, A hardware assisted approach for security, Architectural level overview for providing security, Security threats.IoT and Edge Security, Physical and hardware security, Shell security, Cryptography, Software-Defined Perimeter, Blockchains and cryptocurrencies in IoT, Government regulations and intervention.

TOTAL: 45 HOURS

COURSE OUTCOMES:
At end of the course students will be able to:
    CO1 : Integrate the aspects of human cognitive processes in the system design
    CO2 : Comprehend the underlying cognitive process can have many abstractions of a cognitive cycle such as 'Sense', 'Understand', 'Decide' and 'Act'.
    CO3 : Detect any failures of system components and re-configure itself which provides a graceful degradation through self-healing.
    CO4 : Accomplish knowledge about the application, system architecture, resources, system state and behavior.
    CO5 : Analyze security issues in IoT applications

TEXT BOOKS:
    1. Matin, Mohammad Abdul, ed. Towards Cognitive IoT Networks, 1st edition ,Springer International Publishing, 2020.
      2."IoT and Edge Computing for Architects" Perry Lea,"-second edition, Packt, March,2020.
      3."Secure EdgeComputing: Applications, Techniques and Challenges", Mohiuddin Ahmed (Editor), Paul Haskell-Dowland (Editor), CRC press, first edition, August 2021.

REFERENCES:
    1. Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange and Stefan Meissner, Enabling things to talk –Designing IoT solutions with the IoT Architecture Reference Model, 1st edition ,Springer Open, 2016
    2. John Mutumba Bilay, Peter Gutsche, Mandy Krimmel and Volker Stiehl, SAP Cloud Platform Integration: The Comprehensive Guide, 2nd edition, Rheinwerg publishing.2019.

3. Mahalle, Parikshit Narendra, and Poonam N. Railkar, Identity management for internet of things, 1st edition , River Publishers, 2015.

WEBSITE REFERENCES :
1. **https://learn.microsoft.com/en-us/training/modules/run-cognitive-services-iot-edge/**

CO-PO AND CO-PSO MAPPING:

CO/ PO,PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3		2	2	2						
CO2	3	3	3	3										
CO3	3	3	3	3		1	1	1						
CO4	3	3	3	3		1	1	1						
CO5	3	3	3	3										
AVG	3	3	3	3		2	2	2						

JIT1043	PRIVACY SECURITY FOR IoT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Realize IoT security requirements and management tools
- To know the state-of-the-art methodologies in Cyber Physical system.
- To impart knowledge on Model threats and countermeasures.
- To explore the Privacy Preservation and Trust Models in Internet of Things (IoT)
- To apply the concept of Internet of Things Security in the real world scenarios

UNIT-I : INTRODUCTION: SECURING THE INTERNET OF THINGS 9

Introduction – Security Requirements in IoT architectures – Security in Enabling

Technologies – IoT Security Life Cycle – Cryptographic Fundamentals for IoT Security

Engineering - Security Concerns in IoT Applications – Basic Security Practices.

UNIT-II: SECURITY ARCHITECTURE IN THE INTERNET OF THINGS 9

Introduction – Security Requirements in IoT – Insufficient Authentication/Authorization –

Insecure Access Control – Threads to Access Control, Privacy, and Availability – Attacks

Specific to IoT – Malware Propagation and Control in Internet of Things**.**

UNIT-III   :   PRIVACY PRESERVATION   9

Privacy Preservation Data Dissemination - Privacy Preservation for IoT used in SmartBuilding – Exploiting Mobility Social Features for Location Privacy Enhancement in Internet of Vehicles – Lightweight and Robust Schemes for Privacy Protection in Key personal IOT Applications: Mobile WBSN and Participatory Sensing.

UNIT-IV   :TRUST, AUTHENTICATION AND DATA SECURITY   9

Trust and Trust Models for IoT – Emerging Architecture Model for IoT Security and Privacy – preventing Unauthorized Access to Sensor Data – Authentication in IoT – Computational Security for the IoT – Secure Path Generation Scheme for real-Time Green IoT – Security Protocols for IoT Access Networks

UNIT-V: SOCIAL AWARENESS AND CASE STUDIES   9

User Centric Decentralized Governance Framework for Privacy and Trust in IoT – Policy Based Approach for Informed Consent in IoT - Security and Impact of the IoT on Mobile Networks – Security Concerns in Social IoT – Security for IoT Based Healthcare – Smart cities.

TOTAL: 45 HOURS

COURSE OUTCOMES:
At end of the course students will be able to:
    CO1 : Describe the basics of securing Internet of Things.
    CO2 : Explain architecture and threats in IoT.
    CO3 : Analyze various privacy schemes related to IoT
    CO4 : Describe the authentication mechanisms for IoT security and privacy.
    CO5 : Explain security issues for various applications using case studies

TEXT BOOKS:
 1.   Shancang Li, Li Da Xu, "Securing the Internet of Things," Syngress (Elsevier)

publication, 2017, ISBN: 978-0-12-804458-2.

 2.   Fei Hu, "Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and

Implementations," CRC Press (Taylor & Francis Group), 2016, ISBN:978-1-4987- 23190.

3. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A Hands-on approach," VPT

Publishers, 2014, ISBN: 978-0996025515.

REFERENCES:
1. Alasdair Gilchris, "Iot Security Issues," Walter de Gruyter GmbH & Co, 2017.
2. Sridipta Misra, Muthucumaru Maheswaran, Salman Hashmi, "Security Challenges and

Approaches in Internet of Things," Springer, 2016. 6. Brian Russell, Drew Van Duren,

"Practical Internet of Things Security," Packet Publishing Ltd, 2016.

WEBSITE REFERENCES :
1. https://onlinecourses.nptel.ac.in/noc22_cs23/preview
2. https://www.coursera.org/lecture/m2m-iot-interface-design-embedded-systems/iot-ecurity/

CO-PO AND CO-PSO MAPPING:

CO/ PO,PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	-	3	1	-	-	2	2
CO2	3	3	3	2	2	-	-	1	1	2	3	2
CO3	3	3	2	3	1	-	-	1	-	1	2	2
CO4	3	3	3	2	2	-	-	1	1	2	3	2
CO5	3	3	3	3	2	1	1	2	-	2	2	2
AVG	3	3	3	2.0	2	-	2	1	1	2	2	2

CYBER SECURITY

JCB1402	FOUNDATION OF CYBER SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES
- To understand the difference between threat, risk, attack, and vulnerability.
- To learn about security in operating system and networks.
- To analyze the different security available in databases.
- To understand the concept of privacy and security in emerging technologies.
- To learn about management and risks in different technologies.

PREREQUISITE:
- Computer Programming
- Computer Networks

UNIT-I INTRODUCTION TO CYBER SECURITY 9
Introduction -Computer Security - Threats -Harm - Vulnerabilities - Controls - Authentication - Access Control and Cryptography –Web-User Side - Browser Attacks - Web Attacks Targeting Users - Obtaining User or Website Data - Email Attacks

UNIT-II SECURITY IN OPERATING SYSTEM & NETWORKS 9
Security in Operating Systems - Security in the Design of Operating Systems – Root kit - Network security attack- Threats to Network Communications - Wireless Network Security - Denial of Service - Distributed Denial-of-Service.

UNIT-III DEFENCES SECURITY COUNTER MEASURES 9
Cryptography in Network Security - Firewalls - Intrusion Detection and Prevention Systems - Network Management - Databases - Security Requirements of Databases - Reliability and Integrity - Database Disclosure - Data Mining and Big Data.

UNIT-IV PRIVACY IN CYBERSPACE 9
Privacy concepts –privacy principles and policies -authentication and privacy-Data mining – privacy on the Web - email Security - privacy Impacts of Emerging Technologies - where the Field Is Headed.

UNIT-V MANAGEMENT AND INCIDENTS 9
Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster - Emerging Technologies - The Internet of Things - Economics - Electronic Voting - Cyber Warfare- Cyberspace and the Law - International Laws - Cyber crime - Cyber Warfare and Home Land Security.

COURSE OUTCOMES:
At the end of the course, the student should be able to:
- Classify various types of attacks and learn the tools to launch the attacks
- Apply various tools to perform information gathering
- Analyze intrusion techniques to detect intrusion
- Apply intrusion prevention techniques to prevent intrusion
- Explain the basics of cyber security, cyber crime and cyber law

TEXT BOOKS:
1. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5th Edition, Pearson Education, 2015.
2. David Kim & Michael G. Solomon, "FOUNDATIONS" and Custom Edition 1 Jan 1, 2014.

REFERENCES:
1. George K.Kostopoulous, Cyber Space and Cyber Security, CRC Press, 2013.
2. MarttiLehto, PekkaNeittaanmäki, Cyber Security: Analytics, Technology and Automation edited, Springer International Publishing Switzerland 2015
3. Nelson Phillips and EnfingerSteuart, ―Computer Forensics and Investigations‖, Cengage Learning, New Delhi, 2009.

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- https://onlinecourses.nptel.ac.in/noc23_cs62/preview
- https://onlinecourses.nptel.ac.in/noc23_cs44/preview
- https://www.javatpoint.com/cyber-security-tutorial
- https://www.edureka.co/blog/cybersecurity-fundamentals-introduction-to-cybersecurity/
- https://cnitarot.github.io/courses/fc_Fall_2022/2550_intro_history_pub_cnr.pdf

CO-PO MAPPINGS:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	2	-	-	-	-	-	-	-	2	-
CO2	-	2	2	1	2	-	-	-	-	-	-	2
CO3	-	2	2	2	-	-	-	-	-	-	-	2
CO4	2	-	-	2	-	-	1	-	-	1	2	-
CO5	3	-	2	2	2	-	-	-	-	1	-	-

JCB1403	CRYPTOGRAPHY AND CRYPTANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To study about the fundamentals of Cryptography
- To analyze Key Management techniques and importance of number Theory
- To understand the concept of Message Authentication Codes and Hash Functions
- To design a security solution for a given application
- To understand about cyber crimes and the different security practice.

PREREQUISITE:

- Fundamentals of Mathematics

UNIT-I INTRODUCTION TO CRYPTOGRAPHY   9

Number theory – Algebraic Structures – Modular Arithmetic - Euclid's algorithm – Congruence and matrices – Group, Rings, Fields, Finite Fields-Symmetric Key Ciphers- SDES – Block Ciphers – DES – Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Pseudorandom Number Generators – RC4 – Key distribution.

UNIT-II ASYMMETRIC CRYPTOGRAPHY   9

Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem – Chinese Remainder Theorem – Exponentiation and logarithm-Asymmetric Key Ciphers - RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange – Elliptic curve arithmetic – Elliptic curve cryptography.

UNIT-III MESSAGE AUTHENTICATION AND HASH FUNCTION   9

Authentication Requirements - Authentication Function- Message Authentication Codes - Hash Functions - Security of Hash Functions and MACs- Secure Hash Algorithm - Whirlpool, HMAC, CMAC -Digital Signatures - Authentication Protocol - Digital Signature Standard- Authentication Applications- Kerberos -X.509 Authentication Service - Public-key infrastructure

UNIT-IV FIREWALLS AND CRYPTANALYSIS   9

Intruder – Intrusion detection system -Password Management-Virus and related threats- Countermeasures- Firewall design principles- Trusted systems -Practical implementation of cryptography and security

UNIT-V CYBER CRIMES AND SECURITY   9

Cyber Crime and Information Security – classifications of Cyber Crimes – Tools and Methods – Password

Cracking, Keyloggers, Spywares, SQL Injection – Network Access Control – Cloud Security – Web Security – Wireless Security

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- Understand the fundamentals of networks security
- Demonstrate the different cryptographic operations of symmetric cryptographic algorithms
- Develop the different cryptographic operations of public key cryptography.
- Explain the various Authentication schemes to simulate different applications.
- Understand various cyber-crimes and cyber security.

TEXT BOOKS:

1. Forouzan Mukhopadhyay "Cryptography and Network Security" McGraw Hill, 2nd Edition
2. William Stallings, "Cryptography and Network Security - Principles and Practice", Seventh Edition, Pearson Education, 2017.
3. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber-crimes, Computer Forensics and Legal Perspectives", First Edition, Wiley India, 2011.

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2. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 2015.

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- https://ukdiss.com/examples/web-based-crypto-analysis-learning-application.php
- https://developer.mozilla.org/en-US/docs/Web/API/Web_Crypto_API
- https://www.garykessler.net/library/crypto.html
- https://www.cryptomathic.com/news-events/blog/summary-of-cryptographic-algorithms-according-to-nist

CO-PO MAPPINGS:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	-	-	-	-	-	-	2	2
CO2	1	2	2	1	2	-	-	-	-	-	2	2
CO3	2	2	2	2	-	-	-	-	-	-	-	2
CO4	2	2	1	2	-	-	1	-	-	1	2	1
CO5	3	1	2	2	2	-	-	-	-	1	2	2

JCB1501	CYBER FORENSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the process of Digital Cyber Forensics.
- To be aware of the Cyber forensics Environments and standards.
- To study the data and evidence collection activities.
- To understand how to investigate digital evidence.
- To Explore advanced techniques in Cyber Forensics.

PREREQUISITE:

- Cryptography and Cryptanalysis

UNIT-I DIGITAL FORENSICS PROCESS   9

Computer forensic fundamentals - Applying forensic science to computers - Computer forensic services - Benefits of professional forensic methodology -Steps taken by computer forensic specialists, Forensic science, Digital forensics, Digital evidence, Digital forensics process – Identification, Collection, Examination, Analysis, Presentation Phases, Cyber Crime Law.

UNIT-II FORENSICS ENVIRONMENTS & STANDARDS   9

Hardware and software environments – Storage devices - Operating system - File Systems – Metadata - Locating evidence in file systems - Password security – Encryption - Hidden files - Digital evidence.

UNIT-III DATA AND EVIDENCE COLLECTION   9

Identification of Data: timekeeping - Forensic identification - Analysis of technical surveillance devices - Reconstructing past events - Useable file formats - Unusable file formats - Converting files - Investigating network intrusions - Cyber crime - Network forensics - Investigating logs - Network.

UNIT-IV INVESTIGATING DIGITAL EVIDENCE   9

Applying forensic Science to computers – Preparation – Survey – Documentation – Preservation – examination – Reconstruction - Analyzing digital evidence - Locating digital evidence, Categorizing files - Eliminating superfluous files - Event analysis tool - Cloud analysis tool - Lead analysis tool - Volume shadow copy analysis tools.

UNIT-V ADVANCED CYBER FORENSICS   9

Windows forensics evidence collection in linux - Network forensics packet capture using wire shark, t shark and tcp dump - Memory forensics virtual machine- Forensics use - Implementation

-Virtual machines in forensic analysis- Cloud forensics analysis -Cloud storage - Data remnants.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, the student should be able to:
- Identify the need for cybercrime forensics.
- Examine the hardware, software components and standards responsible for seeking evidence.
- Apply techniques for collecting data and evidences.
- Analyze the methods for investigating digital evidences
- Examine advanced techniques for Cyber Forensics.

TEXT BOOKS:
1. Richard Boddingtons, Practical Digital Forensics, PACKT publishing, First Edition, 2016 ANDRÉ ÅRNES.
2. Marjie T.Britz, Computer Forensics and Cyber Crime: An Introduction, Third Edition, Prentice Hall, 2013

REFERENCES:
1. Richard E.Smith, "Internet Cryptography", Third Edition, Pearson Education, 2008
2. Angus M.Marshall, "Digital forensics: Digital evidence in criminal investigation", John – Wiley and Sons, 2008.
3. John R.Vacca, "Computer Forensic"s, Second Edition, Cengage Learning, 2005.
4. John R. Vacca, Charles River Media "Computer Forensics: Computer Crime Scene Investigation", 2nd Edition, , 2005

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- https://www.stannescet.ac.in/cms/staff/qbank/CSE/Notes/CS6004-CYBER%20FORENSICS-1800235714-CS6004%20UNIT%203.pdf
- https://www.geeksforgeeks.org/cyber-forensics/
- https://www.studocu.com/in/document/dr-babasaheb-ambedkar-marathwada-university/cyber-forensic/cyber-forensics-lecture-notes/34989994
- https://www.studocu.com/in/document/kannur-university/network-forensics/cyber-forensics-unit1/17233533

CO-PO MAPPINGS:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	2	-	1	3	-	2	1	3	-	3	1	3
CO-2	1	1	1	-	2	-	2	-	2	-	2	-
CO-3	-	2	1	1	3	-	1	2	3	2	-	2
CO-4	2	1	2	2	2	-	1	2	1	-	3	-
CO-5	2	1	2	2	3	3	1	3	1	-	2	-

JCB1502	INTRUSION DETECTION SYSTEM	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES
- To understand basic concepts of intrusion detection system.
- To learn about Intrusion Prevention Systems, Network IDs protocol and model for intrusion analysis.
- To analyze intrusion detection alerts and logs to distinguish attack types from false alarms
- To understand Intrusion Prevention Systems, Network IDs protocol and model for intrusion analysis.
- To learn agent development for intrusion detection and architectural models of IDs and IPs.

PREREQUISITE:
- Foundations of Cyber Security

UNIT-I INTRODUCTION TO INTRUSION DETECTION   9
History of intrusion detection, Audit, Concept and definition , Internal and external threats to data, Attacks, Need and types of IDS, Information sources,Host based information sources, Network based information sources.

UNIT-II THEORITICAL FOUNDATION OF DETECTION   9
Intrusion prevention systems, Network Ids protocol based Ids, Hybrid Ids, Analysis schemes, Thinking about intrusion, Model for intrusion analysis, Techniques responses ,Requirement of responses, Types of responses, Mapping responses to policy vulnerability analysis, Credential analysis ,Non credential analysis

UNIT-III ARCHITECTURE AND IMPLEMENTATION   9
Introduction to snort, Snort installation scenarios, Installing snort , Running snort on multiple network interfaces, Snort command line options, Step-by-step procedure to compile ,Install snort location of snort files, Snort modes snort alert modes

UNIT-IV SNORT CONCEPTS   9
Working with snort rules, Rule headers, Rule options, Snort configuration file,Plugins, Preprocessors and output modules, Using snort with mysql

UNIT-V CASE STUDY   9
Using ACID and snort snarf with snort, Agent development for intrusion detection, Architecture models of Ids and Ips

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, the student should be able to:
- Understand the basic concepts of intrusion detection system.
- Explain about Intrusion Prevention Systems, Network IDs protocol and model for intrusion analysis.
- Analyze when, where, how, and why to apply Intrusion Detection tools and techniques in order to improve the security posture of an enterprise.
- Understand the fundamentals and history of Intrusion Detection in order to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems.
- Explain about agent development for intrusion detection and architectural models of IDs and IPs.

TEXT BOOK:
1. T. Fahringer, R. Prodan, "A Text book on Grid Application Development and Computing Environment". 6th Edition, Khanna Publishers, 2012
2. Rafeeq Rehman : " Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID," 1st Edition, Prentice Hall , 2003

REFERENCES:
1. Christopher Kruegel, Fredrik Valeur, Giovanni Vigna: "Intrusion Detection and Correlation Challenges and Solutions", 1st Edition, Springer, 2005.
2. Carl Endorf, Eugene Schultz and Jim Mellander " Intrusion Detection & Prevention",1st Edition, Tata McGraw-Hill, 2004.
3. Stephen Northcutt, Judy Novak: "Network Intrusion Detection", 3rd Edition, New Riders Publishing, 2002.

WEB REFERENCES:
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- https://www.knowledgehut.com/blog/security/intrusion-detection-system
- https://www.helixstorm.com/blog/types-of-intrusion-detection-systems/
- https://usemynotes.com/what-is-intrusion-detection-system/
- https://www.cs.colostate.edu/~massey/Teaching/cs356/RestrictedAccess/Slides/356lecture18.pdf

CO-PO MAPPINGS:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	1	2	-	3	-	1	-	1	-	-	-	1
CO-2	3	2	-	2	3	2	-	-	1	2	-	2
CO-3	3	1	-	1	2	1	-	-	2	1	-	1
CO-4	2	2	3	2	3	-	-	-	-	2	2	-
CO-5	1	2	2	2	2	2	1	1	2	1	2	1

JCB1503	HARDWARE SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES
- To know basic components and fundamentals of hardware security.
- To develop an application using various services in security.
- To understand about different attacks and testing.
- To learn the basic and important concepts of hardware design.
- To understand the issues and solutions for hardware security and monitoring.

PREREQUISITE:
- Cryptography and Cryptanalysis

UNIT-I INTRODUCTION 9
Hardware security-Key threats-Security practices-Types-Fault attacks and countermeasures-Hardware design cycle-Measuring hardware security-Secure platforms-Ciphers: historical; block (AES/DES), Stream, (Trivium) Public Key Ciphers (RSA. ECC), Hash Functions (SHA-1)

UNIT-II PRINCIPLES AND APPLICATIONS 9
Physical unclonable functions:-Design-Principles and applications- Hardware random- Number generators: design-Principles and applications-Design and evaluate pufs - Random number generators on an FPGA

UNIT-III ATTACKS AND TESTING 9
Side channels – Overview - Fault attacks and countermeasures Power attacks and countermeasures - Designing Fault attack - Evaluate a counter measure - VLSI testing: attacks and countermeasures, Scan attack on FPGA implementation of DES.

UNIT-IV HARDWARE ARCHITECTURE 9
Hardware trojans-Overview-Attacks and defenses-Malicious 8051 Processor design-IP piracy-Logic encryption-FPGA logic encryption of combinational logic-Reverse engineering: ic layout camouflaging, Gate level reversing, ESL reversing.

UNIT-V CASE STUDY 9
Analysis of notable hardware security breaches - Study of hardware security vulnerabilities in commercial systems-Emerging hardware security technologies – Approaches - Ethical considerations - Hardware security research - Practice- Internet of Things (IoT) Security challenges- Hardware security - Autonomous systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, the student should be able to:
- Demonstrate the main concepts of security, its characteristics, advantages, key technologies.
- Develop and design an application using various tools in hardware environment.
- Understand the basic and important design concepts and issues of attacks and testing.
- Explain about the concept, characteristics and the architecture of hardware.
- Analyze the issue of security and understand the applications of hardware security in various feild.

TEXT BOOK:
1. S. Bhunia and M. Tehranipoor, "Hardware Security: A Hand-on Training Approach, Morgan Kauffman", 2018
2. M. Tehranipoor and C. Wang (Eds.), Introduction to Hardware Security and Trust, Springer, 2011

REFERENCES:
1. Debdeep Mukhopadhyay, "Hardware Security: Design, Threats, and Safeguards", 1st edition, 2015.
2. Mohammad Tehranipoor and Cliff Wang, "Introduction to Hardware Security and Trust, by", kindle edition, 2012.

WEB REFERENCES:
- https://www.amazon.in/Introduction-Hardware-Security-Mohammad-Tehranipoor-ebook/dp/B00F5U36X8
- https://books.google.com/books/about/Introduction_to_Hardware_Security_and_Tr.html?id=bNiw9448FeIC
- https://tehranipoor.ece.ufl.edu/wp-content/uploads/2021/07/01-Intro-to-HW-Security.pdf
- https://catalog.library.vanderbilt.edu/discovery/fulldisplay/alma99104366463960 3276/01VAN_INST:vanui

CO-PO MAPPINGS:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	3	-	2	1	2	-	-	-	-	-	1	1
CO-2	1	2	1	-	1	-	-	-	-	1	1	1
CO-3	1	2	1	1	1	1	-	-	-	1	2	-
CO-4	3	2	3	3	3	2	-	-	-	-	-	2
CO-5	2	3	-	1	3	1	-	-	-	2	1	-

JCB1601	CLOUD SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES
- To know basic components and fundamentals of cloud computing.
- To develop an application using various services in cloud.
- To understand how to design the web application development in cloud.
- To understand the issues and solutions for cloud security and cloud monitoring.
- To learn the basic and important concepts of python to implement in an application.

PREREQUISITE:
- Data Communication and Networking
- Foundations of Cyber Security

UNIT-I INTRODUCTION 9

Cloud fundamentals - Cloud service components - Cloud service, Deployment models - Cloud components - Guiding principle - Utilization, Security, Pricing - Application of cloud computing. Case Study: Open stack and AWS.

UNIT-II CLOUD BASED APPLICATIONS DEVELOPMENT 9

Application architectures - Monolithic-Distributed, Micro Service fundamental - Cloud native applications - 12 factors app - Application integration process - APIfication process- API fundamental-Micro service - API management- Spring boot fundamental - Design of micro service - API tools.

UNIT-III WEB DEVELOPMENT TECHNIQUES 9

Devops fundamentals - Devops role – responsibility - Tools - Containerization process and application-Evolution of app deployment- Docker fundamentals – architecture – Commands – Orchestration – Kubernetes - Docker container.

UNIT-IV CLOUD SECURITY AND MONITORING TOOL 9

Cloud security - Shared responsibility architecture - Security by design principles-Identity - Access management - Cloud security layers illustration - Cloud network - Host - Data security concepts - Security operations - Major cloud service provider tools - Security compliance and regulations - Cloud monitoring - Benefits of cloud monitoring.

UNIT-V BUILDING AN APPLICATION USING PYTHON 9

Developing - Deploying an application in the cloud- Building a python project based on design - Development testing - Deployment of an application using a development framework - Deployment Platform - Case study: python use case and python framework.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, the student should be able to:
- Demonstrate the main concepts of cloud, its characteristics, advantages, key technologies and its various delivery and deployment models.
- Develop and design an application using various tools in cloud environment.
- Acquire the basic and important design concepts and issues of web application development techniques in cloud.
- Structure simple python program for developing an application in cloud.
- Analyze the issue of cloud such as security, energy efficiency and interoperability, and provide an insight into future prospects of computing in the cloud monitoring.

TEXT BOOK:
1. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, "Cloud Computing Concepts, Technology & Architecture", Prentice Hall, 2013.
2. Guo Ning Liu, Qiang Guo Tong, Harm Sluiman, Alex Amies, "Developing and Hosting Applications on the Cloud", IBM Press, 2012.

REFERENCES:
1. Michael J. Kavis "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)", 1st Edition, Wiley, 2014.
2. Kai Hwang, Geoffery C. Fox and Jack J. Dongarra, "Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future of Internet", First Edition, Morgan Kaufman Publisher, an Imprint of Elsevier, 2012.
3. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", Wiley, 2011

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- https://www.tutorialspoint.com/cloud_computing/cloud_computing_security.htm
- https://www.javatpoint.com/what-is-cloud-security
- https://www.ibm.com/topics/cloud-security
- https://www.box.com/resources/what-is-cloud-security
- https://cloud.google.com/learn/what-is-cloud-security

CO-PO MAPPINGS:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	3	3	-	2	3	1	-	1	-	-	1	1
CO-2	2	1	2	-	-	-	-	-	-	1	1	1
CO-3	-	1	3	2	1	-	-	-	1	-	-	-
CO-4	3	3	3	3	1	2	1	1	1	2	1	-
CO-5	1	2	2	3	-	-	1	1	2	1	-	1

		L	T	P	C
JCB1603	**ETHICAL HACKING**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

- To study about the fundamentals of hacking.
- To learn different types of hacking in web.
- To understand attacks in networking.
- To learn about wireless hacking, attacks and various agents in hacking.
- To understand about automation and authentication.

PREREQUISITE:

- Cryptography and Cryptanalysis

UNIT-I INTRODUCTION TO HACKING   9

Introduction to hacking – Terminologies – Penetration test – Vulnerability assessments versus penetration test – Pre-engagement – Rules of engagement -Penetration testing methodologies – OSSTMM – Categories of penetration test – Types of penetration tests – Vulnerability assessment summary -Reports.

UNIT-II ETHICAL HACKING IN WEB   9

Introduction to ethical hacking – Foot printing - Reconnaissance - Scanning networks - Enumeration - System hacking - Malware Threats – Sniffing- Social engineering - Denial of service - Session hijacking - Hacking web servers - Web applications – SQL Injection - Hacking wireless networks - Mobile platforms.

UNIT-III NETWORK ATTACKS   9

Vulnerability data resources – Exploit databases –Promiscuous versus non promiscuous mode – MITM attacks – ARP attacks –SSL strip: stripping https traffic -DNS spoofing – ARP spoofing– DHCP Spoofing -Remote exploitation – Attacking network remote services – Overview of brute force attacks.

UNIT-IV WIRELESS HACKING   9

Wireless hacking – Air crack- Cracking WEP – WPA/WPA2 wireless network using air crack – Evil twin attack –Log-in protection mechanisms – Captcha validation flaw – Captcha RESET flaw – Manipulating user-Agents to bypass captcha.

Authentication bypass attacks – Testing for vulnerability – Automating with burp suite – Session attacks – SQL injection attacks – XSS (Cross-Site Scripting) - Types of cross-Site scripting – Cross-site request forgery (CSRF) – SSRF attacks.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- Understand the fundamentals of hacking and different methodologies in testing.
- Demonstrate the different types of hacking and various applications in web.
- Explain about different attacks, testing, and authentication in networking.
- Understand about wireless hacking, cracking and protection mechanisms.
- Explain the various Authentication schemes to simulate different applications.

TEXT BOOKS:

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, "Computer Forensics and Investigations", Cengage Learning, India Edition, 2016.
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2015.

REFERENCES:

1. Marjie T.Britz, "Computer Forensics and Cyber Crime: An Introduction", 3rd Edition, Prentice Hall, 2013.
2. Kenneth C.Brancik, "Insider Computer Fraud‖ ",Auerbach Publications Taylor & Francis Group–2008.
3. AnkitFadia , "Ethical Hacking‖", Second Edition, Macmillan India Ltd, 2006
4. John R.Vacca, "Computer Forensics", Cengage Learning, 2005

WEB REFERENCES:

- https://www.geeksforgeeks.org/introduction-to-ethical-hacking/
- https://www.hackittech.com/Resources%20pdf/hacking_resources/HackitTech_20210523 130501.pdf
- https://www.javatpoint.com/ethical-hacking
- https://www.synopsys.com/glossary/what-is-ethical-hacking.html
- https://www.knowledgehut.com/blog/security/introduction-to-ethical-hacking

CO-PO MAPPINGS:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	2	2	1	1	2	-	1	1	1	-	2	-
CO-2	1	1	2	1	-	1	1	-	-	1	-	1
CO-3	-	2	1	-	1	-	-	2	2	-	1	2
CO-4	2	2	-	2	1	1	-	1	2	-	-	-
CO-5	1	1	1	2	1	-	3	1	-	2	-	-

JCB1702	WEB APPLICATION SECURITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To reveal the underlying in web application.
- To identify and aid in fixing any security vulnerabilities during the web development process.
- To understand the security principles in developing a reliable web application.
- To learn about different industry tools in web security.
- To understand about various testing and security.

PREREQUISITE:

- Web Technology

UNIT-I INTRODUCTION TO WEB APPLICATIONS   9

History of web applications interface -Web application Vs Cloud application -Security fundamentals- Input validation - Attack surface reduction rules of thumb- Classifying and prioritizing threats

UNIT-II WEB APPLICATION SECURITY FUNDAMENTALS   9

Origin policy - Exceptions to the same- Cross-site scripting and cross-site request forgery – Reflected XSS - HTML injection

UNIT-III WEB APPLICATION VULNERABILITIES   9

Vulnerabilities in traditional client server application and web applications- Client state manipulation-Cookie based attacks,-SQL injection, Cross domain attack (XSS/XSRF/XSSI)- Http header injection - SSL vulnerabilities and testing - Proper encryption use in web application- Session vulnerabilities and testing - Cross-site request forgery.

UNIT-IV WEB APPLICATION MITIGATIONS   9

Http request - Http response, rendering and events - Html image tags - Image tag security - Issue - Java script on error – Java script timing - Port scanning - Remote scripting - Running remote code - frame and iframe - Browser sandbox - policy goals, same origin policy - Library import - Domain relaxation

UNIT-V SECURE WEBSITE DESIGN   9

Introduction- Architecture and Design Issues for Web Applications - Deployment Considerations Input Validation – Authentication – Authorization - Configuration Management - Sensitive Data - Session Management – Cryptography - Parameter Manipulation - Exception Management.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- Identify the vulnerabilities in the web applications.
- Identify the various types of threats and mitigation measures of web applications.
- Apply the security principles in developing a reliable web application.
- Use industry standard tools for web application security.
- Apply Penetration testing to improve the security of web application

TEXT BOOKS:

- Sullivan, Bryan, and Vincent Liu. Web Application Security, A Beginner's Guide. McGraw
  Hill Profe ssional, 2011.
- Stuttard, Dafydd, and Marcus Pinto. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws. John Wiley Sons, 2011

REFERENCES:

3. Behrouz A. Ferouzan, DebdeepMukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata McGraw Hill, 2015.
4. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 2015.

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- Web Application Security [Book] (oreilly.com)
- Web Application Security: Exploitation and Countermeasures for Modern Web ... - Andrew Hoffman - Google Books amazon.com/Web-Application-Security-Beginners-Guide/dp/0071776168 https://www.garykessler.net/library/crypto.html
- https://www.cryptomathic.com/news-events/blog/summary-of-cryptographic-algorithms-according-to-nist

CO-PO MAPPINGS:

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CO-2	2	2	2	2	2	-	-	-	-	2	1	1
CO-3	2	2	2	2	1	-	2	-	-	-	-	2
CO-4	2	-	-	2	-	-	1	-	-	1	2	1
CO-5	2	1	2	2	2	-	2	-	-	1	1	2