# Savitribai Phule Pune University

**Degree Program**
**B.Sc. (Information Technology)**

With

**Major Course : Information Technology**
(Faculty of Science and Technology)

**Syllabi for**

**S.Y.B.Sc. (Information Technology)**

Choice Based Credit System (CBCS) Syllabus

**Under National Education Policy (NEP)**

**To be implemented from the Academic Year 2025-2026**

**In Second Year,** the "Subject 1" will be Major Subject and the Minor subject will be chosen from "Subject 2 or Subject 3". Subject 2 and Subject 3 will not be available as Major Subjects in Second Year and Third Year.

## Level:- 5.0 (Second Year) Sem:-III

| **Course Type** | **Course Code** | **Course Title** | **Course Credits** | | **Teaching Scheme Hr/Week** | | **Evaluation Scheme and Max Marks** | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | TH | PR | TH | PR | CE | EE | Total |
| Major Core (4+2) | IT201MJ | Object Oriented Programming using Python | 2 | | 2 | | 15 | 35 | 50 |
| | IT202MJ | Wireless Networking | 2 | | 2 | | 15 | 35 | 50 |
| | IT203MJP | Practical Based on IT201MJ + IT202MJ | | 2 | | 4 | 15 | 35 | 50 |
| VSC 2(T/P) | IT221VSC | E-commerce | 2 | | 2 | | 15 | 35 | 50 |
| FP/OJT/ CEP(2) | IT231FP | Mini Project | | 2 | | 4 | 15 | 35 | 50 |
| Minor (2T+2P) | IT241MN | Public Cloud -Google, AWS, Azure | 2 | | 2 | | 15 | 35 | 50 |
| | IT242MNP | Practical Based on IT241MN | | 2 | | 4 | 15 | 35 | 50 |
| GE/OE (2T) | OE201IT | Content Writing / Script Writing | 2 | | 2 | | 15 | 35 | 50 |
| IKS | IT201IKS | From University Basket | 2 | | 2 | | 15 | 35 | 50 |
| AEC(2) | AEC201ENG | Soft Skill - I | 2 | | 2 | | 15 | 35 | 50 |
| CC(2) | CC201PE/NSS /NCC | Course from University Basket | 2 | | 2 | | 15 | 35 | 50 |
| **TOTAL** | | | 16 | 06 | 16 | 12 | | | 550 |

## Level:- 5.0 (Second Year) Sem:-IV

| Course Type | Course Code | Course Title | Course Credits | | Teaching Scheme Hr/Week | | Evaluation Scheme and Max Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | TH | PR | TH | PR | CE | EE | Total |
| Major Core (4+2) | IT251MJ | Exploratory Data Analysis | 2 | | 2 | | 15 | 35 | 50 |
| | IT252MJ | Cryptography & Network Security | 2 | | 2 | | 15 | 35 | 50 |
| | IT253MJP | Practical Based on IT251MJ + Practical Based on IT252MJ | | 2 | | 4 | 15 | 35 | 50 |
| VSC 2(T) | IT231VSC | Software Engineering | 2 | | 2 | | 15 | 35 | 50 |
| FP/OJT/ CEP(2) | IT282FP | Mini Project | | 2 | | 4 | 15 | 35 | 50 |
| Minor (2T+2P) | IT291MN | Automation tools for cloud Deployment | 2 | | 2 | | 15 | 35 | 50 |
| | IT292MNP | Practical Based on IT291MN | | 2 | | 4 | 15 | 35 | 50 |
| GE/OE (2P) | OE251ITP | Practical Based on Script Writing | | 2 | | 4 | 15 | 35 | 50 |
| SEC 2(T) | SEC251IT | Linux Operating System | 2 | | 2 | | 15 | 35 | 50 |
| AEC(2) | AEC251ENG | Soft Skill - II | 2 | | 2 | | 15 | 35 | 50 |
| CC(2) | CC251PE/NSS/NCC | From University Basket | 2 | | 2 | | 15 | 35 | 50 |
| **TOTAL** | | | 14 | 08 | 14 | 16 | | | 550 |

**Exit Option:** Award of UG Diploma in Major and Minor with 88 credits and an additional 4 credit score as per university guidelines OR Continue with Major and Minor.

# Semester-III

**Savitribai Phule Pune University**
**S.Y.B.Sc. (Information Technology)**
**Subject Code :** IT201MJ
**Title :** Object Oriented Programming using Python

| Teaching Scheme | No. of Credits | Examination Scheme |
|---|---|---|
| 2 hours/week | 2 | CE:15 marks<br>EE:35 marks |

**Prerequisites**

1. Fundamental concepts of Python

**Course Objectives:-**

- To understand the principles of Object-Oriented Programming (OOP).
- To apply OOP concepts using Python.
- To implement real-world problems using Python classes and objects.
- To understand inheritance, polymorphism, encapsulation, and abstraction.
- To explore exception handling in Python.

**Course Outcomes:-**

**After completing the course, students will be able to:**

1. Understand and apply OOP concepts in Python.
2. Design and develop applications using Python classes and objects.
3. Implement encapsulation, inheritance, and polymorphism effectively.
4. Utilize file handling and exception handling for robust programming.

**Course Contents**

| | | |
|---|---|---|
| **Chapter 1** | **Introduction to OOP & Classes in Python** | **5 hours** |

1.1 Basics of Object-Oriented Programming (OOP) – Need for OOP, Procedural vs. OOP, OOP Principles
1.2 Classes and Objects – Defining a Class, Creating Objects, Instance Variables & Methods
1.3 The `self` Parameter, Class Attributes vs. Instance Attribute
1.4 Constructor (`__init__()` method) and Destructor

| | | |
|---|---|---|
| **Chapter 2** | **Encapsulation & Data Hiding** | **5 hours** |

2.1 Data Hiding and Access Modifiers – Public, Private, and Protected Members
2.2 Getters and Setters – Using Property Decorators (@property)
2.3 Name mangling in Python

| | | |
|---|---|---|
| **Chapter 3** | **OOP with Modules and Packages** | **8 hours** |

3.1 Introduction to Modules, Standard Python Modules Overview of commonly used built-in modules: math, random, datetime, os, sys, time
3.2 Creating User-Defined Modules Writing your own .py files as modules
3.3 Introduction to Packages Using __init__.py & its role, Importing from packages

| | | |
|---|---|---|
| **Chapter 4** | **Error Handling in OOP** | **4 hours** |
| 4.1 Try-except in modular code<br>4.2 Raising and handling custom exceptions<br>4.3 Creating a custom exception class in a module | | |
| **Chapter 5** | **GUI and Object-Oriented Programming** | **8 hours** |
| 5.1Review of GUI Basics Recap of Tkinter basics (widgets, layout managers, events)<br>5.2 Advanced Widgets and Controls Treeview widget (displaying tables)Notebook (Tabbed interfaces) Spinbox, Scale, Progressbar Widget customization (fonts, styles, colors)<br>5.3 File Dialogs and Data Integration Using filedialog for file I/O messagebox and simpledialog Reading/writing files from GUI (text, CSV, JSON) | | |

**Reference Books:**


1. **Kenneth A. Lambert**, The Fundamentals of Python: First Programs, Cengage Learning, ISBN: 978-1111822705
2. **R. G. Dromey**, How to Solve it by Computer, Pearson Education India, ISBN-13: 978-8131705629
3. **Taneja Sheetal and Kumar Naveen**, Python Programming: A Modular Approach, Pearson India, ISBN: 978-9332585348
4. **Mark Lutz**, Programming Python, O'Reilly Media, ISBN: 978-0596158101
5. **Erich Gamma et al.**, Design Patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley, ISBN: 978-0201633610


**E-Books and Online Learning Material**

1. W3Schools Python OOP
2. NPTEL – The Joy of Computing using Python
3. Programming, Data Structures, and Algorithms using Python

**Savitribai Phule Pune University**
**S.Y.B.Sc. (Information Technology)**
**Subject Code :** IT202MJ
**Title :** Wireless Networking

| Teaching Scheme | No. of Credits | Examination Scheme |
|---|---|---|
| 2 hours / week | 2 | CE: 15 marks<br>EE: 35 marks |

**Prerequisites**
**1.** Principle of Communication,
2. Basic of Computer Network

**Course Objectives: -**

- To understand the fundamentals of Wireless Communication.
- To explore different wireless communication technologies such as Wi-Fi, Bluetooth, Zigbee, and 5G
- To understand the concept about Wireless networks, protocol stack and standards
- To learn and analyze Wireless Network Security Challenges
- To Emerging Trends in Wireless Networking

**Course Outcomes: -**
**After completing the course, students will be able to:**

CO1 : Describe the fundamental concepts of wireless communication and Wireless Generations.
CO2 : Identify and choose wireless network standard, protocol stack and standards.
CO3 : Appraise the importance of WPAN, WSN and Ad-hoc Networks.
CO4 : Analyze various Wireless Network Security Standards.
CO5 : Design and develop basic applications using wireless networking concepts in real-world scenarios such as IoT, smart cities,

**Course Contents**

| **Chapter 1** | **Introduction to Wireless Networking** | **6 hours** |
|---|---|---|

1.1 Basics of wireless communication
1.2 Multiple Access Techniques: FDMA, TDMA, CDMA.
1.3 Spread Spectrum Techniques **:** DSSS, FHSS
1.4 Evolution of wireless generations – 1G to 5G (Based on technological differences and advancements)
1.5 Wireless Networking
1.5.1 Advantage of Wireless Networking
1.5.2 Needs of Wireless Networking

| **Chapter 2** | **Wireless Network Standards & Protocols** | **6 hours** |
|---|---|---|

2.1 IEEE 802.11 (Wi-Fi) standards and architecture
2.2 WLAN components: Access points, clients, SSID, BSS, ESS
2.2 Bluetooth: Bluetooth architecture, Bluetooth protocol stack, Bluetooth frame structure
2.3 Zigbee: Architecture, topologies, applications, Z wave: Protocol architecture, applications
2.4 RFID: working of RFID system, types of RFID tags, RFID frequencies, applications

| Chapter 3 | Wireless Network Type | 8 hours |
|---|---|---|
| 3.1 Infrastructure-based Wireless Networks<br>3.2 Ad-hoc wireless networks<br>3.3 Wireless Sensor Networks (WSN)<br>3.4 Wireless Mesh Network (WMN)<br>3.5 Cellular Network Architecture<br>3.6 Software-Defined Wireless Networks (SDWN) | | |
| **Chapter 4** | **Wireless Network Security** | **5 hours** |
| 4.1 Wireless Network Security Threats<br>4.2 Types of Wireless Security Encryption ( WEP,WPA,WPA2,WPA3)<br>4.3 Intrusion Detection Systems (IDS) in wireless environments<br>**4.4** Best practices for securing wireless network | | |
| **Chapter 5** | **Emerging Trends in Wireless Networking** | **5 hours** |
| 5.1 Role of wireless networking in IoT<br>5.2 Communication between **IoT devices using MQTT, CoAP**<br>**5.3 Case studies:** Wireless Sensor Networks in Smart cities , Helathcare, Agriculture, Automation.<br>5.4 Future trends: AI in Wireless Networks | | |

**Reference Books:**


6. Wireless Communications- Principles & Practice, Theodore S. Rappaport, Prentice Hall Series. ISBN: 0130422320.
7. Wireless Communications and Networks", William Stallings, Pearson / Prentice Hall. ISBN: 9780131967908
8. Wireless Networks, Nicopolitidia, M S Obaidat, GI Papadimitriou, Wiley India (Student Edition, 2010). ISBN : 8126522208
9. Wireless Networking Complete by Pei Zheng, Larry L. Peterson, Bruce S. Davie, Adrian Farrel. ISBN: 9780123785701


**E-Books and Online Learning Material**

4. http://ebooks.lpude.in/computer_application/mca/term_6/DCAP311_DCAP607_WIRELESS_NETWORKS.pdf
5. https://doi.org/10.3390/books978-3-03842-780-3
6. https://web.stanford.edu/~dntse/wireless_book.html
7. https://archive.nptel.ac.in/courses/117/102/117102062
8. https://archive.nptel.ac.in/courses/106/105/106105160

**Savitribai Phule Pune University**
**S.Y.B.Sc.(Information Technology)**
**Subject Code:** IT203MJP
**Title:** Practical Based on Object Oriented Programming using Python and Wireless Networking

| Teaching Scheme | No. of Credits | Examination Scheme |
|---|---|---|
| 4 hours / week | 2 | CE : 15 marks<br>EE : 35 marks |

**Prerequisites :**

**For Practical Based on Object Oriented Programming using Python:**

1. Basic understanding of Python programming
2. Knowledge of fundamental programming concepts

**For Wireless Networking :**

1. Computer networks and communication protocols.
2. Basic programming skills in MATLAB

**Course Objectives:-**

**For Practical Based on Object Oriented Programming using Python:**

- To understand the principles of Object-Oriented Programming (OOP).
- To apply OOP concepts using Python.
- To develop problem-solving skills using class-based programming.
- To implement, test, debug, and execute Python programs based on OOP.

**For Wireless Networking :**

- To Provide hands-on experience in wireless communication and networking concepts.
- To analyze a wireless protocols such as IEEE 802.11, Bluetooth, and Zigbee.
- To simulate and implement wireless networks using tools like MATLAB,
- To Develop real-world applications of wireless networking.

**Course Outcomes:-**

**After completing this course, students will be able to:**

**For Practical Based on Object Oriented Programming using Python:**

CO1: Implement OOP concepts like classes, objects, inheritance, polymorphism, encapsulation, and abstraction.
CO2: Apply various OOP principles to solve real-world problems.
CO3: Develop modular and reusable code using Python classes and objects.

**For Wireless Networking :**

CO4 : Understand wireless networking fundamentals and key protocols.
CO5 : Configure and analyze Wi-Fi and Bluetooth networks using simulation tools
CO6 : Design and simulate wireless architectures like WSN, MANET.
CO7 : Evaluate wireless security mechanisms like WPA2

**Practical Assignments**

**Object Oriented Programming using Python :**

**Assignment 1: Introduction to OOP**

1. Explain the difference between procedural and object-oriented programming with examples in Python.
2. Write a Python program to define a class `Student` with instance variables and methods to display student details.

**Assignment 2: Classes and Objects**

1. Create a class `Book` with attributes like title, author, and price. Create objects of this class and display their attributes.
2. Implement a constructor method to initialize the class attributes.

**Assignment 3: Self and Class Attributes**

1. Demonstrate the use of the `self` parameter in Python with an example.
2. Write a Python program to show the difference between class attributes and instance attributes.

**Assignment 4: Constructors and Destructors**

1. Write a program to implement constructors using the `__init__()` method.
2. Create a destructor method in a class and show when it is called.

**Assignment 5: Encapsulation and Access Modifiers**

1. Create a class with public, protected, and private members. Demonstrate access to each.
2. Write a Python class using name mangling to hide class members.

**Assignment 6: Getters, Setters, and Property Decorators**

1. Write a class with getter and setter methods using property decorators.
2. Modify a private attribute using a setter and access it using a getter.

**Assignment 7: Modules and Built-in Modules**

1. Use built-in modules `math`, `random`, and `datetime` in a Python program.
2. Write a program using the `os` and `sys` modules to display system-related information.

**Assignment 8: User-defined Modules**

1. Create a module containing a class `Calculator` with basic arithmetic operations.
2. Import and use the `Calculator` module in another Python script.

**Assignment 9: Python Packages**

1. Create a package with submodules and an `__init__.py` file.
2. Import classes/functions from different modules within the package and use them.

**Assignment 10: Try-Except for Error Handling**

1. Write a Python program using try-except to handle division by zero and invalid input
2. Demonstrate multiple exception handling using try-except-else-finally blocks.

**Assignment 11: Custom Exception Handling**

1. Define and raise a custom exception class.
2. Handle the custom exception in a try-except block.

**Assignment 12: GUI Basics with Tkinter**

1. Create a simple GUI with Tkinter including Label, Entry, and Button widgets.
2. Handle button click events to perform a basic operation (e.g., addition).

**Assignment 13: Advanced Widgets in Tkinter**

1. Create a GUI with a Tree view widget to display tabular data.
2. Implement a Notebook interface with multiple tabs.

**Assignment 14: File Dialogs and Message Boxes**

1. Use file dialog to open and save text files in a GUI application.
2. Display information using messagebox and simpledialog widgets.

**Assignment 15: File I/O Integration with GUI**

1. Read from and write to a text/CSV file using GUI components.
2. Create a GUI to input and store user data in a JSON file

**Wireless Networking :**

**Assignment 1:**

- Introduction to MATLAB for wireless communication.
- Simulation of Wireless Signal Transmission – Demonstrating Basic Wireless Signal Propagation using MATLAB

**Assignment 2:**

- Study of TDMA /FDMA /CDMA Using MATLAB

**Assignment 3:**

- Bluetooth Device Pairing and Data Transmission Using MATLAB.
- To establish a real-time Bluetooth connection between MATLAB and a Bluetooth-enabled device.

**Assignment 4:**

- To simulate a Zigbee-based wireless network using MATLAB.
- To analyze signal propagation, packet transmission, and network performance.

**Assignment 5:**

- To simulate a wireless sensor network using MATLAB

**Assignment 6:**

- **To study GSM (Global System for Mobile Communications) and GPRS (General Packet Radio Service) network:**
  - Explain **GSM architecture** (BTS, BSC, MSC, HLR, VLR, etc.).
  - Discuss **GSM frequency bands** and how communication takes place
  - Explain **GPRS** and how it extends GSM for packet-switched data.
  - Compare GSM vs. GPRS in terms of **speed, data transmission, and applications.**

**Assignment 7:**

- **To study 5G cellular network**:
  - Explain the key differences between **4G and 5G** in terms of speed, latency, spectrum usage, and architecture.
  - Discuss **5G frequency bands** (sub-6 GHz and mm Wave) and their impact on network performance.
  - Explore real-world **5G deployments** and adoption trends globally.

**Savitribai Phule Pune University**
**S.Y.B.Sc. (Information Technology)**
**Subject Code :** IT221VSC
**Title:** E-Commerce

| Teaching Scheme | No. of Credits | Examination Scheme |
|---|---|---|
| 2 hours / week | 2 | CE: 15 marks<br>EE: 35 marks |

**Course Objectives: -**

- To understand the concepts, technologies, and tools used in e-commerce.
- To learn core business models and marketing strategies in e-commerce.
- To develop skills to analyze e-commerce business models and online strategies.
- To learn the legal, social, and ethical considerations in e-commerce.

**Course Outcomes: -**

**After completing the course, students will be able to-**

CO1 : Describe different e-commerce business models.
CO2 : Analyze the impact of e-commerce on businesses and consumers.
CO3 : Recognize the legal and security challenges in online businesses.
CO4 : Develop an understanding of e-commerce technologies and platforms.

**Course Contents**

| **Chapter 1** | **Introduction to E Commerce** | **6 hours** |
|---|---|---|

1.1 **Introduction To Electronic Commerce :** Definition, Features of E-Commerce, Need to study e-commerce, Scope of e-commerce
1.2 Unique features of E-Commerce
1.3 **History and Evolution of E-commerce** : History and Evolution of E-commerce, Importance of E-Commerce in the Modern Business Environment, Difference between E-Commerce and E-Business
1.4 **E-Commerce Architecture Types** : Client-Server Architecture, Two-Tier Architecture, Three-Tier Architecture
1.5 **Types of E-Commerce Models** : B2C, B2B, C2C, C2B, P2P, B2G
1.6 Advantages and Limitations of E-Commerce
1.7 Uses of E-Commerce

| **Chapter 2** | **Internet Service Provider** | **4 hours** |
|---|---|---|

2.1 Electronic Commerce – A Generic Framework
2.2 ELECTRONIC DATA INTERCHANGE (EDI) – Definition, Components of EDI, Advantages & Disadvantages of EDI, EDI Standards
2.3 Issues involved in E-Commerce
2.4 **Basic Concepts of Internet :** Definition, Domain Name System, Advantages of Internet, Requirements of Internet
2.5 Internet Service Provider, Types of Internet Service Providers
2.6 World Wide Web, WWW Technologies
2.7

| **Chapter 3** | **Electronic Payment Systems** | **6 hours** |
|---|---|---|

3.1 Electronic Payment System : Introduction, Types of Electronic Payment Systems, Traditional Payment System vs Electronics Payment System
3.2 **E-Commerce Platforms** : Overview of major platforms like Amazon, eBay, Shopify, etc.
3.3 Social networks and online communities, Online auctions, E-commerce portals

3.4 **E-Commerce Payment Systems:** Credit Cards, Debit Card, Smart Card, E-Money, PayPal, Digital Wallets, Electronic Fund Transfer (EFT) etc.

3.5 Electronic billing presentment and Electronics payments and Protocols

| **Chapter 4** | **Legal, Ethical, and Security Issues in E-Commerce** | **7 hours** |
|---|---|---|

4.1 **Legal Aspects**: Consumer protection, digital contracts, data privacy, and intellectual property

4.2 **Cybersecurity in E-Commerce**: Secure online payments, fraud prevention, and safe data handling

4.3 **Ethical Issues**: Privacy concerns, online transparency, and responsible marketing

4.4 **Security Issues** : Security Requirements in Electronic Payment Systems , Threats in Computer Systems: Virus, Cyber Crime Network Security: Encryption, Security Protocols in Security –SSL, SHTTP

4.5 Protecting Web server with a Firewall, Firewall and the Security Policy, Network Firewalls and Application Firewalls, Proxy Server.

| **Chapter 5** | **Digital Marketing Concepts & Optimizing E-Commerce System** | **7 hours** |
|---|---|---|

5.1 Digital Marketing :- Definition, Online Advertisement, Display Ad Marketing,

5.2 E-mail Marketing, Affiliate Marketing, Social Marketing, Mobile Marketing, Local Marketing, Online Marketing Metrics

5.3 Search Engine Optimization, Working mechanisms of Search Engines, On Page SEO, Off Page SEO, Page Ranks

5.4 Using Google Analytics, Social Media Analytics

5.5 Recommendation Systems: Collaborative, Content Based, Use of Recommendation Systems in E-commerce

**Reference Books:**


1. **E-Commerce 2025: Business. Technology. Society** by Kenneth C. Laudon and Carol Guercio Traver
2. **E-Commerce: Business, Technology, Society** by Kenneth C. Laudon and Carol Guercio Traver
3. **Digital Marketing for Dummies** by Ryan Deiss and Russ Henneberry
4. **Introduction to E-Commerce** by Jeffrey F. Rayport and Bernard J. Jaworski
5. **Electronic Commerce** , by Elias. M. Awad, Prentice-Hall of India Pvt Ltd.
6. **Electronic Commerce-A Manager's guide,** by RaviKalakota, Andrew B. Whinston, " Addison-Wesley.

**Savitribai Phule Pune University**
**S.Y.B.Sc. (Information Technology)**
**Subject Code :** IT231FP
**Title :** Mini Project

| Teaching Scheme | No. of Credits | Examination Scheme |
|---|---|---|
| 4 hours / week | 2 | CE: 15 marks<br>EE: 35 marks |

**Prerequisites :**

Knowledge of Particular Subject in which project has to do.

**Course Objectives:**

- Apply theoretical knowledge
- Enhance practical skills
- Prepare for larger projects:

**Course Outcomes (COs) : -**

**After completing the Project, students will be able to-**

CO1 : Demonstrate practical application
CO2 : Showcase innovative thinking
CO3 : Prepare for professional practice
CO4 : Enhance communication skills
CO5: Work in Team

**Project Guidelines**

- Students should work in a team of minimum 1 and maximum 2 students.
- Students can choose a project topic and implement the same using any language/technology covered in the curriculum so far. The operating environment must be Windows
- Project guide must conduct project presentations (minimum 2) to monitor the progress of the project groups.
- At the end of the project, the group should prepare a Report/Documentation hard copy.
- The final project presentation with demonstration (EE) will be evaluated by the project guide (appointed by the college) and one external examiner (appointed by the University).

**Evaluation Guidelines:**

| CE **(15 Marks)** | | EE **(35 Marks)** | | |
|---|---|---|---|---|
| First Presentation | Second Presentation | Project Logic/ Presentation | Project Documentation | Viva |
| 7 | 8 | 20 | 10 | 5 |

**Savitribai Phule Pune University**
**S.Y.B.Sc. (Information Technology)**
**Subject Code :** IT241MN
**Title** : Public Cloud –Google, AWS, Azure

| **Teaching Scheme** | **No. of Credits** | **Examination Scheme** |
|---|---|---|
| 2 hours / week | 2 | CE: 15 marks<br>EE: 35 marks |

**Prerequisites:**

1) Understanding cloud computing fundamentals, service models (IaaS, PaaS, SaaS), and deployment models (Public, Private, Hybrid).
2) Knowledge of key cloud components such as compute, storage, and networking, along with familiarity with major cloud providers (AWS, Azure, GCP).
3) Ability to apply cloud services for application deployment, manage resources efficiently, and utilize automation tools for scalability.
4) Understanding performance tuning, cost optimization, security best practices, and compliance requirements for cloud-based applications.

- **Course Objectives:**
- Overview of the basic concepts, services, and components of public cloud platforms.
- Understand the functionality and applications of public cloud services.
- How to apply cloud service models (IaaS, PaaS, SaaS) for deployment.
- How to utilize key cloud services (compute, storage, and networking) to build and manage cloud-based applications.
- How to design and deploy basic cloud applications using public cloud services.
- How to **o**ptimize cloud applications for performance, cost efficiency, and security compliance.

**Course Outcomes:**

**After completing this course, students will be able to:**

CO1 : Recall and identify the basic concepts, services, and components of public cloud platforms.
CO2 : Explain and describe the functionality and applications of public cloud services.
CO3: Apply cloud service models (IaaS, PaaS, SaaS) for deploying applications.
CO4 : Utilize key cloud services (compute, storage, and networking) to build and manage cloud-based applications.
CO5 : Design and deploy basic cloud applications using public cloud services.
CO6 : Optimize cloud applications for performance, cost efficiency, and security compliance.

**Course Contents**

| **Chapter 1** | **Introduction to Public Cloud Platforms** | **6 hours** |
|---|---|---|

1.1 Introduction to Cloud Computing
1.2 Overview of Public Cloud Providers
1.3 Cloud Service Models-IaaS (Infrastructure as a Service), PaaS (Platform as a Service), SaaS (Software as a Service)
1.4 Cloud Deployment Models: Public, Private, and Hybrid Cloud., Multi-cloud environments.
1.5 Introduction to Google Cloud Platform (GCP), AWS, and Azure.
1.6 Comparative Analysis of Features, Pricing, and Use Cases.
1.7 Core Cloud Services (Compute, Storage, Networking)
1.8 Cloud Market Trends and Adoption in Enterprises

| Chapter 2 | Google Cloud Platform (GCP) | 5 hours |
|---|---|---|

2.1 Introduction to Google Cloud Platform
2.2 Key GCP Services: Compute Engine, Cloud Storage, Cloud SQL, BigQuer, Data analytics platform.
2.3 GCP Pricing and Billing
2.4 Deploying Applications on GCP

| Chapter 3 | Amazon Web Services (AWS): Compute and Storage Services | 8 hours |
|---|---|---|

3.1 Introduction to AWS
3.2 Key AWS Services: EC2 (Elastic Compute Cloud), S3 (Simple Storage Service), RDS (Relational Database Service), Server less Computing with AWS Lambda,
3.3 Compute Engine: Virtual Machines and Auto-Scaling
3.4 AWS Pricing and Billing
3.5 Deploying Applications on AWS
3.6 Hands-on Lab: Launch and manage VMs in each platform
3.7 Kubernetes Engine (GKE) and Containerization.
3.8 Virtual Private Cloud (VPC), Firewalls, Load Balancers
3.9 BigQuery for Data Analytics
3.10 AI & Machine Learning Services in GCP

| Chapter 4 | Microsoft Azure: Compute and Storage Services | 6 hours |
|---|---|---|

4.1 Introduction to Microsoft Azure Architecture
4.2 Key Azure Services: Virtual Machines (VM), Azure Functions, App Services
4.3 Storage & Database Services: Azure Blob Storage, Azure SQL Database, Cosmos DB
4.4 Block & File Storage: EBS, File store, Azure Disk/File 4.4
4.5 Networking & Security in Azure
4.6 Data Encryption & Security Best Practices.
4.7 Azure Pricing and Billing
4.8 Deploying Applications on Azure
4.9 Hands-on Lab: Upload, retrieve and manage data in each platform

| Chapter 5 | Deploying Applications in cloud computing | 5 hours |
|---|---|---|

5.1 Introduction
5.2 Cloud Migration
5.3 Challenges and Benefits of cloud Migration
5.4 Moving Applications to Cloud
5.5 Application Hosting in Azure
5.6 Google Cloud Applications

**Reference Books:**


1. "Cloud Computing: From Beginning to End" by Ray J. Rafaels
2. "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl
3. "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)" by Michael J. Kavis
4. "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" by George Reese
5. "The Basics of Cloud Computing: Understanding the Fundamentals of Cloud Computing in Theory and Practice" by Derrick Rountree and Ileana Castrillo

6. Cloud Computing Basics: Understanding AWS, Azure, and Google Cloud Paperback – 23 November 2024 by Thompson Carter (Author)
7. The Cloud Service Provider's Handbook: Best Practices for AWS, Azure, Google Cloud, and IBM Cloud by William M Floyd (Author)
8. Fundamentals of AWS GCP Azure Cloud Technology by Sheikh Muhammad Ibraheem

**E-Books and Online Learning Material**

1. Google Cloud Training and Certification: *Link:* Google Cloud Training
    - AWS Training and Certification: *Link:* AWS Training and Certification
    - Microsoft Learn: Azure Fundamentals: *Link:* Describe cloud computing - Training | Microsoft Learn
2. Coursera: Cloud Computing Specialization :*Link:* Cloud Computing Courses & Tutorials
   edX: Cloud Computing Courses: *Link:* Best Online Cloud Computing Courses and Programs
3. https://www.datacamp.com/cheat-sheet/aws-azure-and-gcp-service-comparison-for-data-science-and-ai

**Savitribai Phule Pune University**

**S.Y.B.Sc.(Information Technology)**

**Subject Code:** IT242MNP

**Title:** Practical Based on Public Cloud –Google, AWS, Azure

| Teaching Scheme | No. of Credits | Examination Scheme |
|---|---|---|
| 4 hours / week | 2 | CE: 15 marks<br>EE:35marks |

**Prerequisites**

1. A foundational understanding of cloud computing concepts, including networking, storage, compute, and application development
2. Problem solving approach

**Course Objectives:-**

- Understand cloud computing concepts, including public cloud platforms, service models (IaaS, PaaS, SaaS), and deployment models (Public, Private, Hybrid, Multi-cloud).
- Explore and configure key services in Google Cloud Platform (GCP) such as Compute Engine, Cloud Storage, Cloud SQL, and BigQuery.
- Explore and configure key services in Amazon Web Services (AWS) including EC2, S3, RDS, and Lambda for cloud applications.
- Explore and configure key services in Microsoft Azure, such as Virtual Machines, Azure Blob Storage, Azure SQL Database, and Azure Functions.
- Deploy applications on GCP, AWS, and Azure using cloud computing services to gain hands-on experience with cloud deployments.
- Compare pricing, billing models, and cost optimization strategies across GCP, AWS, and Azure to understand cloud cost manage

**Course Outcomes:-**

**After completing the course, students will be able to-**

CO1: Explain cloud computing concepts, public cloud platforms, service models, and deployment models.
CO2 : Explore and configure key services in Google Cloud Platform (GCP).
CO3: Explore and configure key services in Amazon Web Services (AWS).
CO4 : Explore and configure key services in Microsoft Azure.
CO5 : Deploy applications on GCP, AWS, and Azure using cloud services.
CO6: Compare pricing, billing, and cost optimization strategies across different cloud providers.

**Practical Assignments**

1) Setting up a free-tier account on GCP, AWS, and Azure to explore available cloud services.
2) Exploring and comparing cloud service models (IaaS, PaaS, and SaaS) with real-world examples.
3) Deploying a Virtual Machine (VM) on Google Cloud Compute Engine and configuring networking.
4) Deploying a Virtual Machine on AWS EC2 with security group settings and key pairs.
5) Deploying a Virtual Machine on Microsoft Azure and configuring firewall rules.
6) Creating and managing cloud storage on GCP Cloud Storage, AWS S3, and Azure Blob Storage.
7) Implementing Cloud Databases – Setting up Cloud SQL (GCP), RDS (AWS), and Azure SQL Database.
8) Writing and executing queries on Google BigQuery for data analytics.

9) Deploying a serverless function using AWS Lambda and testing its execution.
10) Creating and deploying a function in Azure Functions and triggering it.
11) Deploying a sample web application on GCP App Engine and configuring custom domains.
12) Deploying a sample web application on AWS Elastic Beanstalk and testing performance.
13) Deploying a sample web application on Azure App Services with auto-scaling features.
14) Exploring cost estimation tools for GCP, AWS, and Azure to estimate deployment costs.
15) Comparing pricing and billing models of GCP, AWS, and Azure and suggesting cost-optimization strategies.

# Semester-IV

**Savitribai Phule Pune University**
**S.Y.B.Sc. (Information Technology)**
**Subject Code** : IT251MJ
**Title :** Exploratory Data Analysis

| Teaching Scheme | No. of Credits | Examination Scheme |
|---|---|---|
| 2 hours/week | 2 | CE: 15 marks<br>EE: 35 marks |

**Prerequisites :**
Python, Fundamentals of statistics concepts.

**Course Objectives:**

1. To understand the fundamental concepts of exploratory data analysis using Python.
2. To find missing values in data and identify the correlation between different variables.
3. To understand and interpret results obtained from graphical analysis
4. To understand how to create a dashboard.

**Course Outcomes(COs) :**
**After completing the course, students will be able to-**

CO1 : Understand the fundamentals of EDA
CO2 : Implement the data visualization using matplotlib and seaborn library.
CO3 : Understanding basics of python for performing data analysis.
CO4 : Understand the hypothesis testing and explore techniques of time-series analysis
CO5 : Identify and transform erroneous data using different data Wrangling techniques for Analyzing.
CO6: Import, clean, and explore data to perform preliminary analysis.
CO7 : Understand Advance data visualization using tableau.

**Course Contents**

| **Chapter 1** | **Fundamentals of EDA** | **4 hours** |
|---|---|---|

1.1 Meaning of Exploratory Data Analysis
1.2 Importance of Data Analysis
1.3 Different types of data analysis.
1.4 Data analysis vs exploratory data analysis;
1.5 Main phases/steps involved in exploratory data analysis,
1.6 Advantages and Applications areas of EDA.
1.7 The software tools required for/used in EDA.
1.8 Different types of Exploratory Data Analysis
1.9 EDA techniques: Univariate non-graphical, Multivariate non-graphical, Univariate graphical, Multivariate graphical.

| Chapter 2 | Understanding Data Analysis | 8 hours |
|---|---|---|

2.1 Significance of EDA – Making sense of data.
2.2 Types of data qualitative and quantitative data;
2.3 Measurement scales-Comparing EDA with classical and Bayesian analysis.
2.4 Python libraries : Python libraries numpy, pandas, scipy. Data preprocessing: Steps involved in data preprocessing.
2.5 Data transformation techniques/Data Wrangling**:** functionalities of data Wrangling, Combining and Merging Datasets, filtering dataset, removing duplication, Reshaping and Pivoting.

| Chapter 3 | Graphical Exploratory Data Analysis | 8 hours |
|---|---|---|

3.1 Python libraries for visualization : matplotlib and seaborn, Difference between seaborn and matplotlib libraries.
3.2 Visual Aids for EDA : Implementing various types of Plots using matplotlib and seaborn Line plot, Bar plot, Scatter plot, Table chart, Box plot, Histogram plot, Pie chart, etc.

| Chapter 4 | EDA Methods and Techniques | 6 hours |
|---|---|---|

4.1 EDA methods: Data visualization, Correlation analysis and its types, Dimension reduction (PCA), Clustering (k-means and hierarchical clustering), Outlier detection (Z- score ,IQR).

4.2 Types of analysis : Univariate, Bivariate and Multivariate analysis, Multivariate analysis using Titanic dataset.

4.3 Grouping dataset: Understanding groupby(), groupby mechanics, cross tabulation.

| Chapter 5 | Descriptive Statistics and Inferential Statistics | 4 hours |
|---|---|---|

5.1 Understanding statistics
5.2 Types of statistics (descriptive and inferential), Frequency Distribution, Measures of central tendency (Mean, Median, Mode), Inferential Statistics: Hypothesis testing, Types of hypothesis testing, Z- test , T-test
5.3 Regression Analysis, Types of regression (simple, multiple, polynomial, logistic).
5.4 Advanced data visualization tool: Tableau-Connecting to data, Creating Sheets and Dashboards.

**Text Books:**


1. "Hands-On Exploratory Data Analysis with Python", Suresh Kumar Mukhiya, UsmanAhmed. Packt Publication.
2. "Python for Data Analysis", Wes Mckinney, O'REILLY Publication. 2017
3. Fundamental of mathematical statistics-S C Gupta & V K Kapoor Published by Sultan Chand & Sons.


**Reference Books:**


1. Data Science Fundamentals and Practical Approaches, Gypsy Nandi, Rupam Sharma, BPB Publications, 2020.
2. Hands-On Introduction to Data Science ,Chirag Shah, University of Washington Cambridge University Press.

**Online Resources:**

1) https://www.coursera.org/lecture/data-analysis-with-python/exploratory-data-analysis-iNeWs
2) https://www.tableau.com/learn/tutorials/on-demand/getting-started
3) https://www.w3schools.com/python/
4) https://www.slideshare.net/JamieDornan2/exploratory-data-analysis-a-comprehensive-guide-to-edapdf
5) https://www.geeksforgeeks.org/exploratory-data-analysis-eda-types-and-tools/

**Savitribai Phule Pune University**
**S.Y.B.Sc. (Information Technology)**
**Subject Code :** IT252MJ
**Title :** Cryptography & Network Security

| Teaching Scheme | No. of Credits | Examination Scheme |
|---|---|---|
| 2 hours / week | 2 | CE: 15 marks<br>EE: 35 marks |

**Prerequisites**

1. Fundamental concepts of Computer
2. Basic knowledge of Networking and Data Communication.
3. Algorithmic and problem-solving skills.
4. Strong foundation in mathematics- Basic knowledge of Discrete Mathematics and Linear Algebra

**Course Objectives: -**

1. To gain sound necessary knowledge of Cryptography and Network Security
2. To understand various cryptographic techniques.
3. To know about various encryption, decryption and intrusion detection techniques
4. To get acquainted with symmetric and asymmetric cryptographic algorithms.
5. Understand Security Concepts: Explore Cryptographic Techniques Analyze Network Security Protocols
6. Understand Key Management and Digital Certificates

**Course Outcomes: -**

**On completion of the course, students would be able to:**

CO1 : Understand the concept of OSI Reference Model and TCP/IP.
CO2 : To know the components of the Network Security.
CO3: Summarize the encryption, decryption and intrusion detection techniques and its solutions to overcome the attacks.
CO4 : Understand cryptographic algorithms to design secure applications.
CO5: Understand top down approach of data communication from one user to another user
CO6 : Develop attitude to apply appropriate encryption technique for the problem.

## Course Contents

| Unit 1 | Computer Security Essentials | 2 hours |
|---|---|---|

1.1 Computer and Network Security – an Introduction
1.2 Need for Security
1.3 Security Approaches and Principles
1.4 OSI Security Architecture
1.5 Types of security Attacks (General view and Technical view, Active and Passive attacks)
1.6 Security Services and Mechanisms

| Unit 2 | Network and Internet Security User Authentication | 4 hours |
|---|---|---|

2.1 Network Security Model
2.2Email Security (Domain Key Identified Mail (DKIM))
2.3 Wireless Network Security (IEEE 802.11i Wireless LAN Security, Wireless Application Protocol (WAP) Security, WAP End-to-End Security)
2.4 Pretty Good Privacy (PGP) and S/MIME.

2.5 User Authentication :
1. Remote User-Authentication Principles
2. Remote User-Authentication Using Symmetric Encryption
3. Remote User-Authentication Using Asymmetric Encryption

**2.6** Application Layer Security:
1. Email privacy: PGP and S/MIME
2. SSL Architecture –Handshake ,Change Cipher Space, Alert And Record Protocols
3. SSL Message Formats – Transport Layer Security

**2.7** Transport Level Security**:** Transport Layer Security, Web Security Issues HTTPS, Secure Shell (SSH)

| **Unit 3** | **Symmetric Key Cryptographic Algorithms** | **12 hours** |
|---|---|---|

3.1 Introduction, Algorithm Types and Modes
3.2 Symmetric Cipher Model (Plain Text and Cipher Text, Cryptography, Cryptanalysis, Brute-Force Attack)
3.3 Encryption and Decryption
3.4 Substitution Techniques (Caesar Cipher, Monoalphabetic Ciphers, Playfair Cipher, Hill Cipher, Polyalphabetic Ciphers, One-Time Pad)
3.5 Transposition Techniques (Single Columnar, Double Columnar) - Rail Fence technique, Simple Columnar transposition Technique
3.6 Steganography (Applications, Limitations)
3.7 Key Range and Key Size
3.8 Possible Types of Attacks
3.9 Block Cipher Principles and modes of operations
3.10 Introduction to Data Encryption Standard (DES), Advanced Encryption Standard (AES)
3.11 Stream Ciphers
3.12 RC4 , RC5 , Blowfish

| **Unit 4** | **Asymmetric Key Cryptographic Algorithms** | **5 hours** |
|---|---|---|

4.1 Asymmetric Key Cryptography – Introduction, History and Outline
4.2 Principles of Public Key Cryptosystems
4.3 RSA Algorithm - algorithm and example
4.4 Diffie Hellman Key Exchange algorithm and example
4.5 Digital Signatures-Direct Digital Signature, Digital Signature Standard (DSS)
4.6 Knapsack Algorithm

| **Unit 5** | **Public Key Infrastructure** | **3 hours** |
|---|---|---|

5.1 Introduction
5.2 Digital Certificates, Creation of Digital Certificates
5.3 Private Key Management (PKI and PKIX Model)
5.4 Public Key Cryptographic Standards (PKCS), PKI and XML Security
5.5 Public key – distribution of secret keys, elliptic curve cryptography

| Unit 6 | Cryptographic Hash Functions | 4 hours |
|---|---|---|

6.1 Introduction and Applications
6.2 Simple Hash Functions (XOR and rotated XOR, XOR with Cipher Block Chaining (CBC) mode)
6.3 Requirements and Security 6
6.4 Hash Functions based on Cipher Block Chaining
6.5 Secure Hash Algorithms (SHA), SHA-3, SHA-256

**Reference Books:**


1. Matt Bishop and Sathyanarayana, Introduction to Computer Security, Pearson Education, 2005.
2. Behourz A Forouzan, Cryptography And Network Security, McGraw Hill Education, 2015.
3. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning
4. William Stallings, Network Security Essentials: Applications and Standards, Prentice Hall India, 4th Edition
5. Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud" William Stallings Publisher: Addison-Wesley 2015
6. William Stallings, Cryptography and Network Security, Prentice Hall, 2018.
7. Atul Kahate, Cryptography and Network Security, TMH, 2019.
8. V.K. Pachghare, Cryptography and Information Security, PHI Learning, Private Limited.
9. Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, Hand-book of Applied Cryptography, Taylor & Francis Excl. Spl Reprint, 2018.
10. Margaret Cozzens, Steven J Miller, The Mathematics of Encryption, American Mathematical Society, 2017.
11. Bruce Schneier, Applied Cryptography, John Wiley and Sons, 2012.
12. Mark Stamp, Information Security: Principles and Practice, John Wi-ley and Sons, 2020.
13. S. Bose, Cryptography And Network Security, Pearson Education India, 2016.
14. Bernard L., Menezes, Ravinder Kumar , Cryptography, Network Security, and Cyber Laws, Cengage Learning India Pvt. Ltd.,2018.


**E-Books and Online Learning Material**

[1] https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-857-networkand-computer-security-spring-2014/lecture-notes-and-readings/
[2] https://nptel.ac.in/courses/106/105/106105031/
[3] https://www.khanacademy.org/computing/computer-science/cryptography
[4] https://www.tutorialspoint.com/cryptography/index.htm
[5] https://www.edureka.co/blog/what-is-cryptography/
[6] https://www.geeksforgeeks.org/cryptography-introduction/
[7] https://www.khanacademy.org/computing/computer-science/cryptography/crypt/v/introto-cryptography

**Savitribai Phule Pune University**
**S.Y.B.Sc.(Information Technology)**
**Subject Code:** IT253MJP
**Title:** Practical Based on Exploratory Data Analysis and Cryptography & Network Security

| Teaching Scheme | No. of Credits | Examination Scheme |
|---|---|---|
| 4 hours / week | 2 | CE: 15 marks<br>EE: 35 marks |

**Prerequisites:**

**For Practical Based on Exploratory Data Analysis :**

1. Exploratory Data Analysis,
2. Python

**For Practical Based on Cryptography & Network Security**:

1. Strong foundation in mathematics.
2. Algorithmic and problem-solving skills.
3. Intermediate Level Skills of Python Programming.

**Course Objectives:-**

**For Practical Based on Exploratory Data Analysis :**

1. To understand the fundamental concepts of exploratory data analysis using Python.
2. To find missing values in data and identify the correlation between different variables.
3. To understand and interpret results obtained from graphical analysis.
4. To understand how to create a dashboard.

**For Practical Based on Cryptography & Network Security**:

1. To enable students learn different encryption technique
2. To enable students learn symmetric and asymmetric algorithms

**Course Outcomes:-**

**On completion of the course, student will be able to–**

**For Practical Based on Exploratory Data Analysis :**

CO1 : Understand the fundamentals of EDA
CO2: Implement the data visualization using matplotlib and seaborn library.
CO3: Understanding basics of python for performing data analysis.
CO4: Understand the hypothesis testing.
CO5 : Identify and transform erroneous data using different data Wrangling techniques for Analyzing.
CO6: Import, clean, and explore data to perform preliminary analysis.
CO7: Understand Advance data visualization using tableau.

**For Practical Based on Cryptography & Network Security** :

CO8 : Implement cryptographic algorithms.
CO9 : Develop understanding of substitution and transposition techniques
CO10 : Develop understanding of Symmetric and Asymmetric algorithm
CO11 : Design secure applications.
CO12: Develop attitude to apply appropriate encryption technique for the problem.

## Practical Assignments

### Exploratory Data Analysis

1. Write a Program in Python to Read and write different types of Files (csv, json, txt etc).
2. Python program to import libraries for loading & read a dataset. (Use head(), tail(), shape, info() , describe() ,columns)
3. Write a python program to reshaping data- Convert categorical data into numerical value using dataset.
4. Implementation of data cleaning –finding ,missing data ,removing and filling missing data.
5. Write a python program implementing data wrangling operations- filtering and removing duplication of data and program to Implement data transformation -Combine data frames/datasets using join(), merge(), concat() etc.
6. Using iris inbuilt dataset perform the following
    a. Display details of all flowers of type virginica in ascending order of petal length.
    b. Display details of first five flowers of type setosa having maximum petal length.
7. Write a python program to represent data using Histogram.
8. Write a python program to representation of data using Pie chart,Pair plot/chart,Scatter plot,
9. Write a python program to implement Univariate,Bivariate and Multivariate analysis.
10. Write a python program to implement correlation matrix and plot a correlation graph using a dataset.
11. Write a python program to implement cross tabulation using crosstab( ) function.
12. Python program to implement data transformation - grouping data using group by.
13. Implementation of measures of central tendency (mean, median and mode) and measures of dispersion (range, variance) using python.
14. Program to get statistical characteristics of dataset using pandas.
15. Python program to implement Simple regression analysis.
16. Create a simple dashboard using tableau.
17. Implementation of hypothesis testing –> T-test using python.
18. To compute weighted averages in Python either defining your own functions or using Numpy.

### Cryptography & Network Security

**Assignment 1 : Substitution Technique**
Write a Program to implement Following substitution techniques in Python :( Any Four)
Caesar Cipher, Monoalphabetic Ciphers, Playfair Cipher, Hill Cipher, Polyalphabetic Ciphers, One Time Pad.

**Assignment 2 : Transposition Technique**
Write a Program to implement Transposition techniques in Python. ( Any Two)

**AES Algorithm : AES Algorithm**
Write a Program to implement AES Algorithm

**Assignment 4 : RSA Algorithm**
Write a Program to implement RSA Algorithm

**Assignment 5 : Diffie Hellman Key Exchange Algorithm**
Write a Program to implement Diffie Hellman Key Exchange Algorithm

**Assignment 6 : Knapsack Algorithm**
Write a Program to implement Knapsack algorithm.

**Assignment 7 : SHA Algorithm**
Write a Program to implement SHA Algorithm

**Reference Books:**


1. "Hands-On Exploratory Data Analysis with Python", Suresh Kumar Mukhiya, Usman Ahmed. Packt Publication.
2. "Python for Data Analysis", Wes Mckinney, O'REILLY Publication. 2017.


**Online Resources:**

1. https://www.tableau.com/learn/tutorials/on-demand/getting-started
2. https://www.w3schools.com/python/
3. https://www.tutorialspoint.com/cryptography/index.htm
4. https://www.khanacademy.org/computing/computer-science/cryptography

**Savitribai Phule Pune University**
**S.Y.B.Sc. (Information Technology)**
**Subject Code :** IT231VSC
**Title:** Software Engineering

| Teaching Scheme | No. of Credits | Examination Scheme |
|---|---|---|
| 2 hours / week | 2 | CA : 15 marks<br>UA : 35 marks |

**Prerequisites**

Knowledge of DBMS and ER Model

**Course Objectives: -**

- To learn and understand the principles of System and Software Engineering
- To understand the technique of visualizing and analyzing the software requirements.
- To understand and practice the design processes

**Course Outcomes: -**

**On completion of the course, students will be able to:**

CO1 : Compare and contrast various Software Engineering models
CO2 : To know about the system engineering
CO3 : Identify requirements analyze and prepare model
CO4 : To gain thorough knowledge of designing DFD
CO5: Prepare the SRS, Design document, Project plan of a given software system

| **Chapter 1** | **Introduction to Software Engineering** | **5 Lectures** |
|---|---|---|

1.1 Definition of Software Engineering
1.2 Characteristics of Software
1.3 General Principles
1.4 Software Application Domain
1.5 Need for software Engineering
1.6 Software Engineering : A layered technology

| **Chapter 2** | **Software Development Life Cycle (SDLC)** | **8 Lectures** |
|---|---|---|

2.1 Introduction
2.2 Activities of SDLC
2.3 A Generic Process Model
2.4 Software Paradigms
  2.4.1 Waterfall Model
  2.4.2 Incremental Process Models
  2.4.3 Evolutionary process Models (Prototyping and Spiral Model)
  2.4.4 RAD Model
  2.4.5 Concurrent Models

| Chapter 3 | Requirement Engineering | 7 Lectures |
|---|---|---|

3.1 Introduction
3.2 Requirement Engineering Tasks
- 3.2.1 Inception
- 3.2.2 Elicitation
- 3.2.3 Elaboration
- 3.2.4 Negotiation
- 3.2.5 Specification
- 3.2.6 Validation

3.3 Software Requirement Specification (SRS)
- 3.3.1 Developing Use Cases (UML)

3.4 Feasibility Study

| Chapter 4 | Analysis and Design Engineering | 6 Lecture |
|---|---|---|

4.1 Introduction to DFD
4.2 Basic Notations
4.3 Context Level DFD
4.4 1st Level DFD
4.5 2nd Level DFD
4.6 Input and Output Screen Design
4.7 Cover at least three case studies on above topics

| Chapter 5 | Agile Development | 4 Lectures |
|---|---|---|

5.1 What is Agility?
5.2 Agile Process
- 5.2.1 Agility Principles
- 5.2.2 The Politics of Agile Development

5.3 Extreme Programming (XP)

**Reference Books :**


1. Software Engineering : A Practitioner's Approach (Seventh Edition) by Roger S. Pressman, McGraw Hill International Edition
2. System Analysis, Design and Introduction to Software Engineering (SADSE) - S. Parthsarthy, B.W. Khalkar
3. System Analysis and Design (Second Edition) by Elias M. Awad, Galgotia Publications Pvt. Ltd.
4. A Concise Introduction to Software Engineering – Pankaj Jalote , Springer ISBN: 978-1-84800-301-9

**Savitribai Phule Pune University**
**S.Y.B.Sc. (Information Technology)**
**Subject Code :** IT282FP
**Title :** Mini Project

| Teaching Scheme | No. of Credits | Examination Scheme |
|---|---|---|
| 4 hours / week | 2 | CE: 15 marks<br>EE: 35 marks |

**Prerequisites :**
Knowledge of Particular Subject in which project has to be done.

**Course Objectives:**

- Apply theoretical knowledge
- Enhance practical skills
- Prepare for larger projects

**Course Outcomes (COs) : -**
**After completing the Project, students will be able to-**
CO1 : Demonstrate practical application
CO2 : Showcase innovative thinking
CO3 : Prepare for professional practice
CO4 : Enhance communication skills
CO5 : Work in Team

**Project Guidelines**

- Students should work in a team of minimum 1 and maximum 2 students.
- Students can choose a project topic and implement the same using any language/technology covered in the curriculum so far. The operating environment must be Windows
- Project guide must conduct project presentations (minimum 2) to monitor the progress of the project groups.
- At the end of the project, the group should prepare a Report/Documentation hard copy.
- The final project presentation with demonstration (EE) will be evaluated by the project guide (appointed by the college) and one external examiner (appointed by the University).

**Evaluation Guidelines:**

| CE **(15 Marks)** | | EE **(35 Marks)** | | |
|---|---|---|---|---|
| First Presentation | Second Presentation | Project Logic/ Presentation | Project Documentation | Viva |
| 7 | 8 | 20 | 10 | 5 |

**Savitribai Phule Pune University**
**S.Y.B.Sc. (Information Technology)**
**Subject Code :** IT291MN
**Title :** Automation Tools for Cloud Deployment

| **Teaching Scheme** | **No. of Credits** | **Examination Scheme** |
|---|---|---|
| 2 hours / week | 2 | CE: 15 marks<br>EE: 35 marks |

**Prerequisites:** To successfully achieve the Course Outcomes (COs), students should have:

- Basic Knowledge of Cloud Computing
- Familiarity with IT Infrastructure
- Foundational Programming & Scripting Skills
- Understanding of DevOps & CI/CD Concepts

**Course Objectives: -**

- Understand the fundamentals of cloud computing and the need for automation in deployment.
- Apply Infrastructure as Code (IaC) tools for automated cloud infrastructure management.
- Implement configuration management and CI/CD pipelines to automate cloud deployments.
- How to evaluate cloud automation tools and apply best practices for efficient and secure deployment.
- How to design and develop cloud automation scripts using industry-standard tools and techniques.
- How to optimize and enhance cloud automation strategies by integrating advanced cloud technologies and security best practices.

**Course Outcomes:**

**After completing the course, students will be able to:**

CO1 : Understand the fundamentals of cloud computing and the importance of automation in deployment.
CO2 : Apply Infrastructure as Code (IaC) tools to automate cloud infrastructure management efficiently.
CO3: Implement configuration management and CI/CD pipelines for automating cloud-based application deployments.
CO4 : Evaluate cloud automation tools and apply best practices for secure and efficient cloud deployments.
CO5 : Design and develop cloud automation scripts using industry-standard tools and techniques to optimize deployment workflows.
CO6 : Optimize and enhance cloud automation strategies by integrating advanced cloud technologies and security best practices.

**Course Contents**

| **Chapter 1** | **Introduction to Cloud Computing and Automation** | **7 hours** |
|---|---|---|

1.1 **Introduction to Cloud Computing:** Definition and characteristics, Cloud service models: IaaS, PaaS, And SaaS. Cloud deployment models: Public, Private, Hybrid.
Benefits and challenges of cloud deployment,

1.2 **Need for Automation in Cloud Deployment:** Benefits of automation, Speed, efficiency, consistency, Challenges of manual deployment, Use cases of automation in cloud environments.

1.3 **Automation Concepts in Cloud:** Infrastructure as Code (IaC), Configuration management basics, Continuous Integration and Continuous Deployment (CI/CD).

1.4 **Overview of Cloud Platforms:** AWS, Azure, and Google Cloud Platform (GCP), Native automation tools: Cloud Formation, Azure Resource Manager, GCP Deployment Manager.

| **Chapter 2** | **Infrastructure as Code (IaC) Tools** | **6 hours** |
|---|---|---|

2.1 Introduction to Infrastructure as Code (IaC)
2.2 Terraform
2.3 AWS CloudFormation
2.4 Comparison of IaC Tools

| **Chapter 3** | **Configuration Management and CI/CD Tools** | **8 hours** |
|---|---|---|

3.1 **Configuration Management:** Definition and significance, Tools: Ansible, Chef, Puppet, Automating cloud configuration with Ansible, Managing cloud instances with Ansible playbooks.

3.2 **Continuous Integration and Continuous Deployment (CI/CD):** CI/CD concepts and benefits, Tools: Jenkins, GitLab CI/CD, GitHub Actions. Automating deployment processes in cloud environments.

3.3 **CI/CD Pipeline Deployment:** Creating CI/CD pipelines, Automating testing and deployment, Integrating Docker and Kubernetes with CI/CD pipelines.

| **Chapter 4** | **Cloud Automation Best Practices and Security** | **9 hours** |
|---|---|---|

4.1 **Best Practices for Cloud Automation:** Automation principles Error handling and logging. Monitoring and scaling automated services.

4.2 **Security and Compliance in Cloud Automation:** Security risks in cloud automation, Automating security enforcement, Secure IaC practices, Automating compliance checks.

4.3 **Cloud Automation Case Studies:** Real-world cloud automation projects, Examples from AWS, Azure, and GCP.

4.4 **Emerging Trends in Cloud Automation:** AI-driven cloud automation, Serverless frameworks, Cloud-native DevOps and GitOps. Future of automation in cloud deployment.

**Reference Books:**


1. "Cloud Computing: From Beginning to End" by Ray J. Rafaels
2. "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl
3. "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)" by Michael J. Kavis
4. "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" by George Reese
5. "The Basics of Cloud Computing: Understanding the Fundamentals of Cloud Computing in Theory and Practice" by Derrick Rountree and Ileana Castrillo


**E-Books and Online Learning Material**

1. Google Cloud Training and Certification: *Link:* Google Cloud Training
   b. AWS Training and Certification: *Link:* AWS Training and Certification
   c. Microsoft Learn: Azure Fundamentals: *Link:* Describe cloud computing - Training | Microsoft Learn

2. Coursera: Cloud Computing Specialization :*Link:* Cloud Computing Courses & Tutorials
   edX: Cloud Computing Courses: *Link:* Best Online Cloud Computing Courses and Programs

**Savitribai Phule Pune University**

**S.Y.B.Sc.(Information Technology)**

**Subject Code:** IT292MNP

**Title:** Practical Based on Automation Tools for Cloud Deployment

| Teaching Scheme | No. of Credits | Examination Scheme |
|---|---|---|
| 4 hours / week | 2 | CE:15 marks<br>EE:35 marks |

**Prerequisites:**

- Basic Understanding of Cloud Computing
- Familiarity with cloud service models (Iaas, Paas, SaaS)
- Knowledge of major cloud providers (e.g. AWS , Azure, Google Cloud)
- Fundamental Networking Concepts
- Familiarity with virtual networks and subnets
- Operating System Proficiency

**Course Objectives:-**

- Understand cloud computing fundamentals, including service & deployment models, benefits, and challenges.
- Implement IaC using Terraform and CloudFormation for cloud resource management.
- Automate cloud configuration with Ansible, Chef, Puppet, and integrate CI/CD pipelines.
- Apply security, monitoring, compliance, and error-handling best practices in cloud automation.
- Explore AI-driven automation, serverless frameworks, and GitOps in cloud automation trends.
- Analyze real-world case studies and implement cloud automation across AWS, Azure, and GCP.

**Course Outcomes:-**

**After completing the course, students will be able to-**

CO1 : Explain fundamental concepts of cloud computing and automation.

CO2 : Implement automation using Infrastructure as Code (IaC) tools like Terraform and Cloud Formation.

CO3 : Automate cloud configuration using tools like Ansible and integrate CI/CD pipelines.

CO4 : Implement best practices for security, monitoring, and compliance in cloud automation.

CO5 : Explore and experiment with emerging trends in cloud automation like AI-driven automation and GitOps.

**Practical Assignments**

1) **Exploring Cloud Platforms-**Create a free-tier account on AWS/Azure/GCP and explore basic cloud services.
2) **Deploying a Virtual Machine (VM) on Cloud-**Deploy an EC2 instance in AWS, a Virtual Machine in Azure, or a Compute Engine in GCP.

3) **Manual vs Automated Deployment-**Deploy a sample application manually, then automate the process using a cloud-native tool (AWS CloudFormation, ARM Templates, GCP Deployment Manager).
4) **Writing a Terraform Script for Cloud Infrastructure-**Use Terraform to provision a simple infrastructure with a VM and a security group.
5) **Deploying an AWS S3 Bucket using Terraform-**Write a Terraform script to create an S3 bucket with versioning enabled.
6) **Using AWS CloudFormation to Deploy a Web Server-** Deploy an EC2 instance with an Apache/Nginx web server using a CloudFormation template.
7) **Comparing Terraform and CloudFormation -** Modify an existing CloudFormation template and convert it into an equivalent Terraform script.
8) **Automating Configuration with Ansible-** Write an Ansible playbook to install and configure a web server on a cloud instance.
9) **Using Jenkins for CI/CD-** Install Jenkins and set up a basic CI/CD pipeline to deploy a sample application on AWS/Azure/GCP.
10) **Automating Deployment with GitHub Actions -**Configure a GitHub Actions workflow to deploy an application to the cloud.
11) **Building a CI/CD Pipeline with Docker and Kubernetes-**Deploy a containerized application using a CI/CD pipeline that integrates Docker and Kubernetes.
12) **Monitoring Cloud Services with CloudWatch/Azure Monitor-** Set up monitoring for a cloud-based application using AWS CloudWatch or Azure Monitor.
13) **Implementing Security in IaC-**Write secure Terraform scripts with best security practices (e.g., least privilege IAM roles).
14) **Automating Compliance Checks-**Use AWS Config, Azure Policy, or GCP Security Command Center to automate compliance checks.
15) **Exploring AI-driven Cloud Automation (Bonus Practical)-** Use AI-based automation tools like AWS AI Services, Azure AI, or GCP AutoML for automating a cloud task.

**Savitribai Phule Pune University**
**S.Y.B.Sc. (Information Technology)**
**Subject** Code : SEC251IT
**Title :** Linux Operating System

| Teaching Scheme | No. of Credits | Examination Scheme |
|---|---|---|
| 2 hours / week | 2 | CE: 15 marks<br>EE: 35 marks |

**Prerequisites:**

- Familiarity with any Operating System (e.g., Windows).
- Understanding of basic IT concepts like file management and processes.

**Course Objectives: -**

- To provide a foundational understanding of Linux, its history, evolution and shell types.
- To introduce key Linux utilities for system information, user management, and session/terminal management.
- To explain the Linux file system, file handling commands, file permissions, and command linking techniques.
- To familiarize students with the vi editor's modes and key operations along with basic shell concepts and redirection.
- To provide theoretical knowledge of shell scripting, including variables, conditionals, loops, and input/output redirection

**Course Outcomes: -**

**After completing the course, students will be able to-**

CO1 : Understand the fundamental concepts of the Linux operating system.
CO2 : Navigate and manage Linux systems.
CO3 : Comprehend and write basic shell scripts.

**Course Contents**

| **Chapter 1** | **Introduction to Linux Operating System** | **6 hours** |
|---|---|---|

1.1 Introduction to Operating System
1.2 Types of Operating Systems
1.3 History, Evolution, and Overview of Linux
1.4 Linux Releases: Ubuntu, CentOS, Kali
1.5 Features and Advantages of Linux
1.6 Architecture of Linux (Including Overview of Linux Kernel)
1.7 Shell: Bourne, Korn, Cshell, Bash

| **Chapter 2** | **General Purpose Utilities** | **6 hours** |
|---|---|---|

2.1 System Information: uname: Knowing Your Machine Characteristics, who: Who Are the Users? , tty: Knowing Your Terminal
2.2 User Management: passwd (Changing Your Password)
2.3 Session/Terminal Management: cal: The Calendar, date: Displaying the System Date, echo: Displaying Messages, printf: An Alternative to echo, bc: The Calculator, script: Recording Your Session, stty: Displaying and Setting Terminal Characteristics.

| Chapter 3 | Linux File Management and Command Line Basics | 6 hours |
|---|---|---|

3.1 Concept of Directories: Home directory, Directory handling commands: cd, mkdir, rmdir, pwd
3.2 File Concept: File types, File system tree
3.3 File Handling Commands: ls, cat, cp, mv, rm, wc, more, cmp, diff
3.4 Basic File Attributes: Viewing and changing file attributes (e.g., permissions, ownership), chmod: Changing file or directory permissions
3.5 File Filters: cut, paste, sort, uniq, head, tail, grep
3.6 Command Linking: Using Pipe (|) Operator, Command Substitution (e.g., $(command))

| Chapter 4 | The vi Editor | 6 hours |
|---|---|---|

4.1 The vi Editor Overview: Introduction to vi, The vi Interface.
4.2 vi Basic Operations: Entering vi, Modes of vi: Command mode, Input mode (Insert mode), Ex mode, Switching between modes (e.g., i, o, a, Esc).
4.3 vi Command Mode Operations: Cursor Movements, Basic navigation using h, j, k, l, Word navigation using b, e, w, Moving to line extremes using 0, |, $, Absolute movement using G, Editing Commands, Deleting characters, words, and lines (d, x, dd), Joining lines (J) , Undo/Redo operations (u, Ctrl+r), Repeating commands (using the repeat factor.)
4.4 vi Input Mode Operations: Switching to Input Mode, Inserting and replacing text
4.5 vi Saving and Exiting: Saving Files- :w, :x, :q , :wq, Selecting and writing lines to another file- :w filename, Exiting vi- q! ,:x, ZZ
4.6 Searching and Replacing in vi: Searching for Patterns: Forward search /pattern, Backward search ?pattern, Repeat Search, Search and Replace (:s/pattern/replacement/g)

| Chapter 5 | Shell Scripting Fundamentals | 6 hours |
|---|---|---|

5.1 Introduction to Shell Scripting- What is Shell Scripting?, Definition of shell scripting and its role in automating tasks, Overview of common shell environments (Bash, Zsh, etc.), Difference between shell commands and shell scripts.
5.2 Writing Basic Shell Scripts- Creating a Script File: How to create a basic shell script (.sh file). Setting file permissions (chmod +x script.sh), Writing a simple "Hello, World!" script, Understanding the shebang (#!/bin/bash), Executing a Script: Running a script directly or with the bash command, Troubleshooting common errors when running shell scripts.
5.3 Variables in Shell Scripting- Defining Variables: Assigning values to variables (e.g. var=value), Accessing variables ($var, ${var}), Using environment variables and user-defined variables. Special Variables: $0, $1, $2, ..., $#, $@, $?, etc. (positional parameters and exit status).
5.4 Conditional Statements in Shell Scripting- Using if Statements: Syntax and structure of if, elif, and else statements, Comparison operators (e.g., -eq, -ne, -lt, -gt, -le, -ge, =, !=), Example: Simple script using if to check file existence. Using test Command or [ ] for Conditions (file checks, string comparisons).
5.5 Loops in Shell Scripting-for Loop, while Loop, until Loop, Breaking and Continuing in Loops
5.6 Input and Output in Shell Scripts-Reading User Input, Displaying Output, Redirecting Output

**Reference Books:**


1. Richard Petersen ,Linux The Complete Reference, McGraw Hill, 6th edition ISBN Number 978-0071492478
2. Richard Fox, Linux with Operating System Concepts, CRC Press, 2nd Edition, ISBN Number 978-1-032-06670-7
3. Sumitabha Das, Unix Concepts and Applications, McGraw-Hill Education (India) Pvt Limited, 2006, ISBN Number 978-0070635463
4. Sobel M.: A Practical Guide to Linux Commands, Editors, and Shell Programming, Pearson Education, 2006.


**E-Books and Online Learning Material:**

9. Online Linux Compiler: https://www.onlinegdb.com/online_bash_shell
10. Shell Scripts and Programs : https://www.shellscript.sh/
11. Linux Basic Commands: https://maker.pro/linux/tutorial/basic-linux-commands-for-beginners
12. Linux Basic Commands: https://www.guru99.com/must-know-linux-commands.html