



**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	Relational Database Management System	2		2		15	35	50
	IT203MJP	Practical Based on IT201MJ + IT202MJ		2		4	15	35	50
VSC (2)	IT221VSC	E-commerce	2		2		15	35	50
FP/OJT/ CEP(2)	IT231FP	Mini Project		2		4	15	35	50
Minor (2+2)	IT241MN	Wireless Networking OR Public Cloud -Google, AWS, Azure	2		2		15	35	50
	IT242MNP	Practical Based on IT241MN		2		4	15	35	50
GE/OE * (2)	OE201IT OE202IT OE203IT OE204IT	E commerce I / Web Design I / Digital Marketing I/ AI for everyone I	2		2		15	35	50
IKS	IT201IKS	Indian Knowledge System in Computing	2		2		15	35	50
AEC(2)	AEC201-T	Course from University Basket	2		2		15	35	50
CC(2)	CC201-T	Course from University Basket	2		2		15	35	50
<b>TOTAL</b>			16	06	16	12			550

\* These subjects are offered to *other faculty students* under GE/OE Vertical. The students of B.Sc. (Information Technology) will opt the subjects offered by other faculty given in University Basket

**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	Python Ecosystem : A Practical Approach with Libraries and Framework	2		2		15	35	50
	IT252MJ	Exploratory Data Analysis	2		2		15	35	50
	IT253MJP	Practical Based on IT251MJ + IT252MJ		2		4	15	35	50
VSC (2)	IT231VSC	Software Engineering	2		2		15	35	50
FP/OJT/ CEP (2)	IT281FP	Mini Project		2		4	15	35	50
Minor (2+2)	IT291MN	Cryptography & Network Security OR Automation tools for cloud Deployment	2		2		15	35	50
	IT292MNP	Practical Based on IT291MN		2		4	15	35	50
GE/OE * (2)	OE251IT OE252IT OE253IT OE254IT	E commerce II/ Web Design II/ Digital Marketing II / AI for everyone - II	2		2		15	35	50
SEC (2)	SEC251IT	Linux Operating System	2		2		15	35	50
AEC(2)	AEC251-T	Course from University Basket	2		2		15	35	50
CC(2)	CC251-T	Course from University Basket	2		2		15	35	50
<b>TOTAL</b>			16	06	16	12			550

\* These subjects are offered to *other faculty students* under GE/OE. The students of B.Sc. (Information Technology) will opt the subjects offered by other faculty given in University Basket.

**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

<p style="text-align: center;"><b>Savitribai Phule Pune University</b>  <b>S.Y.B.Sc. (Information Technology)</b>  <b>Subject Code : IT201MJ</b>  <b>Title : Object Oriented Programming using Python</b></p>		
Teaching Scheme 2 hours/week	No. of Credits 2	Examination Scheme CE:15 marks EE:35 marks
<b>Prerequisites</b>		
1. Fundamental concepts of Python		
<b>Course Objectives:-</b>		
<ul style="list-style-type: none"> <li>• To understand the principles of Object-Oriented Programming (OOP).</li> <li>• To apply OOP concepts using Python.</li> <li>• To implement real-world problems using Python classes and objects.</li> <li>• To understand inheritance, polymorphism, encapsulation, and abstraction.</li> <li>• To explore exception handling in Python.</li> </ul>		
<b>Course Outcomes:-</b>		
<b>After completing the course, students will be able to:</b>		
CO1 : Understand and apply OOP concepts in Python.		
CO2 : Design and develop applications using Python classes and objects.		
CO3 : Implement encapsulation, inheritance, and polymorphism effectively.		
CO4 : Utilize file handling and exception handling for robust programming.		
<b>Course Contents</b>		
<b>Chapter 1</b>	<b>Introduction to OOP &amp; Classes in Python</b>	<b>5 hours</b>
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 <code>self</code> Parameter, Class Attributes vs. Instance Attribute		
1.4 Constructor ( <code>__init__()</code> method) and Destructor		
<b>Chapter 2</b>	<b>Encapsulation &amp; Data Hiding</b>	<b>5 hours</b>
2.1 Data Hiding and Access Modifiers – Public, Private, and Protected Members		
2.2 Getters and Setters – Using Property Decorators ( <code>@property</code> )		
2.3 Name mangling in Python		
<b>Chapter 3</b>	<b>OOP with Modules and Packages</b>	<b>8 hours</b>
3.1 Introduction to Modules, Standard Python Modules Overview of commonly used built-in modules: <code>math</code> , <code>random</code> , <code>datetime</code> , <code>os</code> , <code>sys</code> , <code>time</code>		
3.2 Creating User-Defined Modules Writing your own <code>.py</code> files as modules		
3.3 Introduction to Packages Using <code>__init__.py</code> & its role, Importing from packages		

<b>Chapter 4</b>	<b>Error Handling in OOP</b>	<b>4 hours</b>
4.1 Try-except in modular code 4.2 Raising and handling custom exceptions 4.3 Creating a custom exception class in a module		
<b>Chapter 5</b>	<b>GUI and Object-Oriented Programming</b>	<b>8 hours</b>
5.1 Review of GUI Basics Recap of Tkinter basics (widgets, layout managers, events) 5.2 Advanced Widgets and Controls Treeview widget (displaying tables) Notebook (Tabbed interfaces) Spinbox, Scale, Progressbar Widget customization (fonts, styles, colors) 5.3 File Dialogs and Data Integration Using filedialog for file I/O messagebox and simpledialog Reading/writing files from GUI (text, CSV, JSON)		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. <b>Kenneth A. Lambert</b>, The Fundamentals of Python: First Programs, Cengage Learning, ISBN: 978-1111822705</li> <li>2. <b>R. G. Dromey</b>, How to Solve it by Computer, Pearson Education India, ISBN-13: 978-8131705629</li> <li>3. <b>Taneja Sheetal and Kumar Naveen</b>, Python Programming: A Modular Approach, Pearson India, ISBN: 978-9332585348</li> <li>4. <b>Mark Lutz</b>, Programming Python, O'Reilly Media, ISBN: 978-0596158101</li> <li>5. <b>Erich Gamma et al.</b>, Design Patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley, ISBN: 978-0201633610</li> </ol>		
<b>E-Books and Online Learning Material</b>		
<ol style="list-style-type: none"> <li>1. <a href="#">W3Schools Python OOP</a></li> <li>2. <a href="#">NPTEL – The Joy of Computing using Python</a></li> <li>3. <a href="#">Programming, Data Structures, and Algorithms using Python</a></li> </ol>		

<p style="text-align: center;"><b>Savitribai Phule Pune University</b>  <b>S.Y.B.Sc. (Information Technology)</b>  <b>Subject Code : IT202MJ</b>  <b>Title: Relational Database Management System</b></p>		
Teaching Scheme 2 hours / week	No. of Credits 2	Examination Scheme CE: 15 marks EE: 35 marks
<b>Prerequisites :</b> Basic Knowledge of DBMS, Knowledge of SQL Queries		
<b>Course Objectives: -</b> <ul style="list-style-type: none"> <li>• To perform Programs</li> <li>• To study concurrency control</li> <li>• To understand crash recovery techniques</li> </ul>		
<b>Course Outcomes: - Student will be able to: -</b> On completion of the course, student will be able to– CO1 : Perform Database operations using PL/PostgreSQL. CO2 : To understand Transaction Concepts CO3 : Compare and contrast different concurrency control and recovery techniques. CO4 : Apply mechanisms for Crash and Recovery		
Course Contents		
<b>Chapter 1</b>	<b>Introduction to PL/PGSQL</b>	<b>8 hours</b>
1.1 Introduction 1.2 Data Types 1.3 Language structure 1.4 Controlling the program flow: conditional statements, loops 1.5 Functions 1.6 Handling errors and exceptions 1.7 Cursors 1.8 Triggers		
<b>Chapter 2</b>	<b>Transaction Concepts</b>	<b>8 hours</b>
2.1 Transaction 2.2 Properties of transaction 2.3 States of transactions 2.4 Schedules 2.5 Types of schedules 2.6 Concept of serializability 2.7 Precedence graph for serializability		
<b>Chapter 3</b>	<b>Concurrency Control</b>	<b>9 hours</b>
3.1 Locks, Types of Locks 3.2 Ensuring serializability by locks, 3.3 Lock Based Protocols - 2PL, 2PL and its variations. 3.4 Multiple Granularity locking protocol 3.5 Basic Timestamp method for concurrency, 3.6 Thomas Write Rule 3.7 Deadlock 3.8 Deadlock Detection and Recovery (Wait for graph). 3.9 Deadlock Prevention Algorithms (Wound-wait, Wait-die)		

<b>Chapter 4</b>	Crash and recovery	<b>5 hours</b>
4.1 Concepts of failure, Failure Classification 4.2 Recovery concepts 4.3 Log base recovery techniques (Deferred and Immediate update) 4.4 Checkpoints 4.5 Recovery with concurrent transactions 4.6 Database backup and recovery from catastrophic failures		
<b>Reference Books:</b>		
1. Henry F. Korth, Abraham Silberschatz, S. Sudarshan, “Database System Concepts”, Tata McGraw-Hill Education 2. Raghuram Ramakrishnan and Johannes Gehrke, “Database Management Systems”, McGraw-Hill 3. Fundamentals of Database Systems- Ramez Elmasri, Shamkant B. Navathe, 6 <sup>th</sup> edition– Pearson. 4. Introduction to Database Management System- Bipin Desai, 3 <sup>rd</sup> edition, Galgotia Publication 5. An Introduction to Database Systems - C.J. Date, 7 <sup>th</sup> edition, Addison-Wesley 6. Practical PostgreSQL- Joshua D. Drake, John C Worsley, O’Reilly Publications		
<b>E-Books and Online Learning Material</b>		
<a href="http://www.postgresql.org/docs/9.3/static/tutorial.html">http://www.postgresql.org/docs/9.3/static/tutorial.html</a> <a href="http://www.w3schools.com/html/html5_intro.asp">http://www.w3schools.com/html/html5_intro.asp</a>		

<b>Savitribai Phule Pune University</b> <b>S.Y.B.Sc.(Information Technology)</b> <b>Subject Code: IT203MJP</b> <b>Title: Practical Based on Object Oriented Programming using Python (IT201MJ) and</b> <b>Relational Database Management System (IT202MJ)</b>		
Teaching Scheme 4 hours / week	No. of Credits 2	Examination Scheme CE : 15 marks EE : 35 marks
<b>Prerequisites :</b> <ul style="list-style-type: none"> <li>• Basic understanding of Python programming</li> <li>• Knowledge of fundamental programming concepts</li> <li>• Knowledge of SQL Queries</li> </ul>		
<b>Course Objectives:-</b> <ul style="list-style-type: none"> <li>• To understand the principles of Object-Oriented Programming (OOP).</li> <li>• To apply OOP concepts using Python.</li> <li>• To develop problem-solving skills using class-based programming.</li> <li>• To implement, test, debug, and execute Python programs based on OOP.</li> <li>• To become familiar with stored Functions in PL/Postgre SQL</li> <li>• To write Cursors and Triggers.</li> </ul>		
<b>Course Outcomes:-</b> <b>After completing this course, students will be able to:</b> 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. CO4 : Write Conditional Statements, Loops, CO5 : Write Functions, cursors using PL/Postgre SQL CO6 : Execute Triggers. CO7 : Design a database using database normalization technique		
<b>Practical Assignments</b>		
<b>Object Oriented Programming using Python :</b>		
<b>Assignment 1: Introduction to OOP</b>		
<ol style="list-style-type: none"> <li>1. Explain the difference between procedural and object-oriented programming with examples in Python.</li> <li>2. Write a Python program to define a class <code>Student</code> with instance variables and methods to display student details.</li> </ol>		
<b>Assignment 2: Classes and Objects</b>		
<ol style="list-style-type: none"> <li>1. Create a class <code>Book</code> with attributes like title, author, and price. Create objects of this class and display their attributes.</li> <li>2. Implement a constructor method to initialize the class attributes.</li> </ol>		

### **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

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## **Relational Database Management System**

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### **Assignment 1:**

Write Program on conditional statements, loops

### **Assignment 2:**

Write program on Stored Functions.

### **Assignment 3:**

Write program on Cursor.

### **Assignment 4:**

Write Program on Error and Exception handling

- Raise Notice
- Raise Exception

### **Assignment 5:**

1. Write Program on Triggers
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<p style="text-align: center;"><b>Savitribai Phule Pune University</b>  <b>S.Y.B.Sc. (Information Technology)</b>  <b>Subject Code : IT221VSC</b>  <b>Title: E-Commerce</b></p>		
Teaching Scheme 2 hours / week	No. of Credits 2	Examination Scheme CE: 15 marks EE: 35 marks
<p><b>Course Objectives: -</b></p> <ul style="list-style-type: none"> <li>• To understand the concepts, technologies, and tools used in e-commerce.</li> <li>• To learn core business models and marketing strategies in e-commerce.</li> <li>• To develop skills to analyze e-commerce business models and online strategies.</li> <li>• To learn the legal, social, and ethical considerations in e-commerce.</li> </ul>		
<p><b>Course Outcomes: -</b>  <b>After completing the course, students will be able to-</b>            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.</p>		
<b>Course Contents</b>		
<b>Chapter 1</b>	<b>Introduction to E Commerce</b>	<b>6 hours</b>
1.1 <b>Introduction To Electronic Commerce</b> : Definition, Features of E-Commerce, Need to study e-commerce, Scope of e-commerce 1.2 Unique features of E-Commerce 1.3 <b>History and Evolution of E-commerce</b> : History and Evolution of E-commerce, Importance of E-Commerce in the Modern Business Environment, Difference between E-Commerce and E-Business 1.4 <b>E-Commerce Architecture Types</b> : Client-Server Architecture, Two-Tier Architecture, Three-Tier Architecture 1.5 <b>Types of E-Commerce Models</b> : B2C, B2B, C2C, C2B, P2P, B2G 1.6 Advantages and Limitations of E-Commerce 1.7 Uses of E-Commerce		
<b>Chapter 2</b>	<b>Internet Service Provider</b>	<b>4 hours</b>
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 <b>Basic Concepts of Internet</b> : 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		
<b>Chapter 3</b>	<b>Electronic Payment Systems</b>	<b>6 hours</b>
3.1 Electronic Payment System : Introduction, Types of Electronic Payment Systems, Traditional Payment System vs Electronics Payment System 3.2 <b>E-Commerce Platforms</b> : Overview of major platforms like Amazon, eBay, Shopify, etc. 3.3 Social networks and online communities, Online auctions, E-commerce portals		

3.4 <b>E-Commerce Payment Systems:</b> 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		
<b>Chapter 4</b>	<b>Legal, Ethical, and Security Issues in E-Commerce</b>	<b>7 hours</b>
4.1 <b>Legal Aspects:</b> Consumer protection, digital contracts, data privacy, and intellectual property		
4.2 <b>Cybersecurity in E-Commerce:</b> Secure online payments, fraud prevention, and safe data handling		
4.3 <b>Ethical Issues:</b> Privacy concerns, online transparency, and responsible marketing		
4.4 <b>Security Issues :</b> 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.		
<b>Chapter 5</b>	<b>Digital Marketing Concepts &amp; Optimizing E-Commerce System</b>	<b>7 hours</b>
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		
<b>Reference Books:</b>		
1. <b>E-Commerce 2025: Business. Technology. Society</b> by Kenneth C. Laudon and Carol Guercio Traver		
2. <b>E-Commerce: Business, Technology, Society</b> by Kenneth C. Laudon and Carol Guercio Traver		
3. <b>Digital Marketing for Dummies</b> by Ryan Deiss and Russ Henneberry		
4. <b>Introduction to E-Commerce</b> by Jeffrey F. Rayport and Bernard J. Jaworski		
5. <b>Electronic Commerce</b> , by Elias. M. Awad, Prentice-Hall of India Pvt Ltd.		
6. <b>Electronic Commerce-A Manager's guide</b> , 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  
4 hours / week

No. of Credits  
2

Examination Scheme  
CE: 15 marks  
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 : IT241MN**  
**Title : Wireless Networking**

Teaching Scheme  
2 hours / week

No. of Credits  
2

Examination Scheme  
CE: 15 marks  
EE: 35 marks

**Prerequisites**

- Principle of Communication,
- 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

<b>Chapter 3</b>	<b>Wireless Network Type</b>	<b>8 hours</b>
3.1 Infrastructure-based Wireless Networks 3.2 Ad-hoc wireless networks 3.3 Wireless Sensor Networks (WSN) 3.4 Wireless Mesh Network (WMN) 3.5 Cellular Network Architecture 3.6 Software-Defined Wireless Networks (SDWN)		
<b>Chapter 4</b>	<b>Wireless Network Security</b>	<b>5 hours</b>
4.1 Wireless Network Security Threats 4.2 Types of Wireless Security Encryption ( WEP,WPA,WPA2,WPA3) 4.3 Intrusion Detection Systems (IDS) in wireless environments 4.4 Best practices for securing wireless network		
<b>Chapter 5</b>	<b>Emerging Trends in Wireless Networking</b>	<b>5 hours</b>
5.1 Role of wireless networking in IoT 5.2 Communication between <b>IoT devices using MQTT, CoAP</b> <b>5.3 Case studies:</b> Wireless Sensor Networks in Smart cities , Helathcare, Agriculture, Automation. 5.4 Future trends: AI in Wireless Networks		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. Wireless Communications- Principles &amp; Practice, Theodore S. Rappaport, Prentice Hall Series. ISBN: 0130422320.</li> <li>2. Wireless Communications and Networks", William Stallings, Pearson / Prentice Hall. ISBN: 9780131967908</li> <li>3. Wireless Networks, Nicopolitidia, M S Obaidat, GI Papadimitriou, Wiley India (Student Edition, 2010). ISBN : 8126522208</li> <li>4. Wireless Networking Complete by Pei Zheng, Larry L. Peterson, Bruce S. Davie, Adrian Farrel. ISBN: 9780123785701</li> </ol>		
<b>E-Books and Online Learning Material</b>		
<ol style="list-style-type: none"> <li>4. <a href="http://ebooks.lpude.in/computer_application/mca/term_6/DCAP311_DCAP607_WIRELESS_NETWORKS.pdf">http://ebooks.lpude.in/computer_application/mca/term_6/DCAP311_DCAP607_WIRELESS_NETWORKS.pdf</a></li> <li>5. <a href="https://doi.org/10.3390/books978-3-03842-780-3">https://doi.org/10.3390/books978-3-03842-780-3</a></li> <li>6. <a href="https://web.stanford.edu/~dntse/wireless_book.html">https://web.stanford.edu/~dntse/wireless_book.html</a></li> <li>7. <a href="https://archive.nptel.ac.in/courses/117/102/117102062">https://archive.nptel.ac.in/courses/117/102/117102062</a></li> <li>8. <a href="https://archive.nptel.ac.in/courses/106/105/106105160">https://archive.nptel.ac.in/courses/106/105/106105160</a></li> </ol>		

<p style="text-align: center;"><b>Savitribai Phule Pune University</b>  <b>S.Y.B.Sc. (Information Technology)</b>  <b>Subject Code : IT241MN</b>  <b>Title : Public Cloud –Google, AWS, Azure</b></p>		
<b>Teaching Scheme</b> 2 hours / week	<b>No. of Credits</b> 2	<b>Examination Scheme</b> CE: 15 marks EE: 35 marks
<p><b>Prerequisites:</b></p> <ol style="list-style-type: none"> <li>1) Understanding cloud computing fundamentals, service models (IaaS, PaaS, SaaS), and deployment models (Public, Private, Hybrid).</li> <li>2) Knowledge of key cloud components such as compute, storage, and networking, along with familiarity with major cloud providers (AWS, Azure, GCP).</li> <li>3) Ability to apply cloud services for application deployment, manage resources efficiently, and utilize automation tools for scalability.</li> <li>4) Understanding performance tuning, cost optimization, security best practices, and compliance requirements for cloud-based applications.</li> </ol>		
<ul style="list-style-type: none"> <li>• <b>Course Objectives:</b></li> <li>• Overview of the basic concepts, services, and components of public cloud platforms.</li> <li>• Understand the functionality and applications of public cloud services.</li> <li>• How to apply cloud service models (IaaS, PaaS, SaaS) for deployment.</li> <li>• How to utilize key cloud services (compute, storage, and networking) to build and manage cloud-based applications.</li> <li>• How to design and deploy basic cloud applications using public cloud services.</li> <li>• How to optimize cloud applications for performance, cost efficiency, and security compliance.</li> </ul>		
<p><b>Course Outcomes:</b></p> <p><b>After completing this course, students will be able to:</b></p> <p>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.</p>		
<b>Course Contents</b>		
<b>Chapter 1</b>	<b>Introduction to Public Cloud Platforms</b>	<b>6 hours</b>
<ol style="list-style-type: none"> <li>1.1 Introduction to Cloud Computing</li> <li>1.2 Overview of Public Cloud Providers</li> <li>1.3 Cloud Service Models-IaaS (Infrastructure as a Service), PaaS (Platform as a Service), SaaS (Software as a Service)</li> <li>1.4 Cloud Deployment Models: Public, Private, and Hybrid Cloud., Multi-cloud environments.</li> <li>1.5 Introduction to Google Cloud Platform (GCP), AWS, and Azure.</li> <li>1.6 Comparative Analysis of Features, Pricing, and Use Cases.</li> <li>1.7 Core Cloud Services (Compute, Storage, Networking)</li> <li>1.8 Cloud Market Trends and Adoption in Enterprises</li> </ol>		

<b>Chapter 2</b>	<b>Google Cloud Platform (GCP)</b>	<b>5 hours</b>
<p>2.1 Introduction to Google Cloud Platform</p> <p>2.2 Key GCP Services: Compute Engine, Cloud Storage, Cloud SQL, BigQuer, Data analytics platform.</p> <p>2.3 GCP Pricing and Billing</p> <p>2.4 Deploying Applications on GCP</p>		
<b>Chapter 3</b>	<b>Amazon Web Services (AWS): Compute and Storage Services</b>	<b>8 hours</b>
<p>3.1 Introduction to AWS</p> <p>3.2 Key AWS Services: EC2 (Elastic Compute Cloud), S3 (Simple Storage Service), RDS (Relational Database Service), Server less Computing with AWS Lambda,</p> <p>3.3 Compute Engine: Virtual Machines and Auto-Scaling</p> <p>3.4 AWS Pricing and Billing</p> <p>3.5 Deploying Applications on AWS</p> <p>3.6 Hands-on Lab: Launch and manage VMs in each platform</p> <p>3.7 Kubernetes Engine (GKE) and Containerization.</p> <p>3.8 Virtual Private Cloud (VPC), Firewalls, Load Balancers</p> <p>3.9 BigQuery for Data Analytics</p> <p>3.10 AI &amp; Machine Learning Services in GCP</p>		
<b>Chapter 4</b>	<b>Microsoft Azure: Compute and Storage Services</b>	<b>6 hours</b>
<p>4.1 Introduction to Microsoft Azure Architecture</p> <p>4.2 Key Azure Services: Virtual Machines (VM), Azure Functions, App Services</p> <p>4.3 Storage &amp; Database Services: Azure Blob Storage, Azure SQL Database, Cosmos DB</p> <p>4.4 Block &amp; File Storage: EBS, File store, Azure Disk/File 4.4</p> <p>4.5 Networking &amp; Security in Azure</p> <p>4.6 Data Encryption &amp; Security Best Practices.</p> <p>4.7 Azure Pricing and Billing</p> <p>4.8 Deploying Applications on Azure</p> <p>4.9 Hands-on Lab: Upload, retrieve and manage data in each platform</p>		
<b>Chapter 5</b>	<b>Deploying Applications in cloud computing</b>	<b>5 hours</b>
<p>5.1 Introduction</p> <p>5.2 Cloud Migration</p> <p>5.3 Challenges and Benefits of cloud Migration</p> <p>5.4 Moving Applications to Cloud</p> <p>5.5 Application Hosting in Azure</p> <p>5.6 Google Cloud Applications</p>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. "Cloud Computing: From Beginning to End" by Ray J. Rafaels</li> <li>2. "Cloud Computing: Concepts, Technology &amp; Architecture" by Thomas Erl</li> <li>3. "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)" by Michael J. Kavis</li> <li>4. "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" by George Reese</li> <li>5. "The Basics of Cloud Computing: Understanding the Fundamentals of Cloud Computing in Theory and Practice" by Derrick Rountree and Ileana Castrillo</li> </ol>		

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](#)
  - o AWS Training and Certification: *Link:* [AWS Training and Certification](#)
  - o 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 Wireless Networking (IT241MN)**

Teaching Scheme  
4 hours / week

No. of Credits  
2

Examination Scheme  
CE: 15 marks  
EE: 35 marks

**Prerequisites**

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

**Course Objectives:-**

- 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:-Student will be able to:-**

- CO1: Understand wireless networking fundamentals and key protocols.
- CO2: Configure and analyze Wi-Fi and Bluetooth networks using simulation tools
- CO3: Design and simulate wireless architectures like WSN, MANET.
- CO4: Evaluate wireless security mechanisms like WPA2

**Practical Assignments**

**Assignment1:**

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

**Assignment2:**

- Study of TDMA /FDMA /CDMA Using MATLAB

**Assignment3:**

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

**Assignment4:**

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

**Assignment5:**

- To simulate a wireless sensor network using MATLAB
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**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: IT242MNP**

**Title: Practical Based on Public Cloud –Google, AWS, Azure (IT241MN)**

Teaching Scheme  
4 hours / week

No. of Credits  
2

Examination Scheme  
CE: 15 marks  
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.

**Savitribai Phule Pune University**  
**S.Y.B.Sc.(Information Technology)**  
**Subject Code: OE201IT**  
**Title: E-Commerce I**

Teaching Scheme  
2 hours /week

No. of Credits 2

Examination Scheme  
CE: 15 marks  
EE: 35 marks

**Prerequisites**

- Basic Computer and Internet Knowledge
- Fundamentals of Business, Commerce and Digital Marketing Basics
- Financial and Payment Systems

**Course Objectives**

- To understand basic concepts about e-Commerce.
- To understand the applications of e-Commerce.
- To learn Business model knowledge.
- To enable knowledge about E-payment system.
- To get a general idea of M-commerce

**Course Outcomes**

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

CO1: Learn and implement basic concepts and applications of e-Commerce.

CO2: Understand operations of electronic payment system.

CO3: Compare and analyze various business models.

CO4: Understand regulatory framework for E-Commerce.

**Course Contents**

<b>Chapter1</b>	<b>E- Commerce and Business Model Concepts</b>	<b>7 Hours</b>
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- 1.1. Introduction to E Commerce: Definition, Goals, Technical Components, Functions, Status, Prospects, Significance, Advantages, Disadvantages E-Commerce
- 1.2. Business Models: Major Business to Consumer (B2C) Business Model Portal, E-tailor, Major Business to Business (B2B) Business Mode, E Distributor, E-Procurement, Exchanges
- 1.3 Business models in Emerging E-Commerce Areas - C2C, P2P, and B2G.,case studies.

<b>Chapter2</b>	<b>E-Marketing and E- Commerce Application</b>	<b>7 Hours</b>
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- 2.1. Introduction, Identifying Goals, Definition
- 2.2. Browsing Behavior Model
- 2.3. Online Marketing
  - 2.3.1 e-Commerce and retailing
  - 2.3.2 e-Commerce and banking,
- 2.4. E-Advertising –Introduction, Purpose, Goals, advantages, disadvantages.

2.5. Internet Marketing Trends 2.6. Target Markets 2.7. E-Branding 2.8. Marketing Strategies 2.9. Consumer Online: The Internet Audience and Consumer Behaviors 2.10. E-cycle of Internet Marketing		
<b>Chapter 3</b>	<b>E-commerce Payment Method</b>	<b>6 Hours</b>
3.1. The requirements of an electronic payment system 3.2. Traditional payment system, Electronic payment technology. 3.3. Electronic payment gateways. 3.4. B2B electronic payments. 3.5. Third-party payment processing, electronic or digital currency, characteristics, operation. 3.6. Online credit card payments and smart cards.		
<b>Chapter 4</b>	<b>E-Commerce Laws &amp; Regulations</b>	<b>5 Hours</b>
4.1. Introduction to E-Commerce Laws 4.2. Information Technology (IT) Act, 2000 (India). 4.3. GDPR (General Data Protection Regulation) – EU. 4.4. Other Global E-Commerce Laws.		
<b>Chapter 5</b>	<b>Future Trends in E-Commerce</b>	<b>5 Hours</b>
5.1. AI & Chatbots in E-Commerce. 5.2. AR/VR Shopping Experiences. 5.3. Personalization & Data Analytics. 5.4. The Role of IoT in E-Commerce.		
<b>Reference Books:</b>		
1. Kenneth C. Laudon, E-Commerce: Business, Technology, Society, 4th Edition, Pearson 2. S. J. Joseph, E-Commerce: An Indian perspective, PHI 3. E-Commerce Law: National and Transnational Topics– Alan Davidson 4. Artificial Intelligence in E-Commerce– Richard Boire		

**Savitribai Phule Pune University**  
**S.Y.B.Sc.(Information Technology)**  
**Subject Code: OE202IT**  
**Title :Web Design-I**

Teaching Scheme 2 hours / week	No. of Credits 2	Examination Scheme CE: 15 marks EE: 35 marks
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**Prerequisites**

- Basic computer knowledge and the ability to work with files.
- Knowledge and understanding of Internet.

**Course Objectives**

- To learn HTML tags and programming concepts and techniques.
- To develop the ability to logically plan and develop web pages.
- To learn writing and debugging HTML code.
- To learn to design table, frames etc.

**Course Outcomes**

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

- Learn and use the HTML Tags.
- Understand and resolves errors in HTML codes.
- Design and develop the page using HTML codes.
- Implement and develop Web pages

**Course Contents**

<b>Chapter 1</b>	<b>Introduction to Web Design</b>	<b>8 hours</b>
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- 1.1 Introduction
- 1.2 Working of the Internet.
- 1.3 Role of Web Servers, Clients(Communication)
- 1.4 Web Browsers
- 1.5 Working of the Internet, Intranet and WWW
- 1.6 E-Mail Servers and Protocols
- 1.7 E-mail Clients and Web Based Mail Access using Browser
- 1.8 Messenger Services and Clients(Chat)
- 1.9 Advantages and Disadvantages of Internet
- 1.10 Concept of effective Web Design (Web site, classification of website, Advantages and Disadvantages. Of website)
- 1.11 Fundamental Principles of Web page design and issues

<b>Chapter 2</b>	<b>Getting Started with HTML</b>	<b>6 hours</b>
2.1	Introduction to scripting Languages	
2.2	HTML Editing Tools	
2.3	WYSISYG Authoring Tools	
2.3.1	HTML Script	
2.3.2	Basic HTML Document Structure	
2.3.3	Common HTML Tags and its attributes	
2.3.4	Design HTML Tags	
2.3.5	Text Formatting and Styles	
2.3.6	Images and Graphics	
2.3.7	Button, Formatting and Style	
2.3.8	Lists	
2.3.9	Hyperlinks	
2.4	Multimedia	
2.5	Frames	
2.6	HTML Forms	
2.7	Linking Web pages	
2.8	Publishing Web Pages	
<b>Chapter 3</b>	<b>Tables</b>	<b>6 hours</b>
3.1	Table Structure	
3.2	Table tags	
3.3	Affecting table appearance	
3.4	Table troubleshooting	
3.5	Tips and tricks	
3.6	Standard table templates	
3.7	Multipart images in tables	
<b>Chapter 4</b>	<b>Frame / Forms</b>	<b>6 hours</b>
4.1.	Introduction to frames	
4.2.	Basic frameset structure	
4.3.	The frame function, appearance and Targeting frames.	
4.4.	The Inline (Floating) frames and Frame design tips and tricks	
4.5.	Forms: FORM elements, FORM attributes, Unconventional use of FORM elements	
4.8.	Demystifying CGI	
4.9.	Retrieving parameter value using getParameter () method	

<b>Case Studies</b>	<b>4 hours</b>
<b>Case study 1:</b> Creation of forms, small case study to create HTML pages using all the above learnt techniques.	
<b>Case study 2:</b> Creation of Forms layout designing by using div element with CSS property	
<b>Case study 3:</b> Create Multiple Web pages link them to publish a small website.	
<b>Reference Books:</b>	
<ol style="list-style-type: none"><li>1. Computer Programming For Beginners:Learn The Basics Of HTML5-Joseph Connor</li><li>2. The Complete Reference HTML &amp; CSS-Fifth Edition-Thomas A.Powell</li><li>3. Learning Web Design: A beginner's Guide to HTML, CSS, Javascript, and Web Graphics - Jennifer Robbins</li><li>4. HTML5: The Missing Manual - Matthew MacDonald.</li></ol>	

**Savitribai Phule Pune University**  
**S.Y.B.Sc.(Information Technology)**  
**Subject Code: OE203IT**  
**Title: Digital Marketing I**

Teaching Scheme 2 hours / week	No. of Credits 2	Examination Scheme CE: 15 marks EE: 35 marks
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<p><b>Prerequisites</b></p> <ul style="list-style-type: none"> <li>• Creative &amp; Logical thinking ability,</li> <li>• Digital devices operational skills and Knowledge</li> </ul>
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<p><b>Course Objectives</b></p> <ul style="list-style-type: none"> <li>• To understand Digital Marketing as the most powerful marketing tool.</li> <li>• Learn to create digital marketing artworks.</li> <li>• Learn how to use email campaigns, blogging to produce worthwhile, pertinent material that draws in and engages a target audience.</li> </ul>
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<p><b>Course Outcomes</b></p> <p>On completion of the course, student will be able to–</p> <p>CO1: Learn and visualize power to explore new ideas.</p> <p>CO2: Analyze and develop their Marketing skills.</p> <p>CO3: Analyze and understand facts with corporate objectives and produce quantifiable outcomes from e-payment mechanisms.</p> <p>CO4: Identify and apply target demographics and company objectives, increasing brand awareness and boosting conversions.</p>
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**Course Contents**

<b>Chapter1</b>	<b>History of Digital Marketing</b>	<b>8 Hours</b>
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<p>1.1. Introduction</p> <p>1.2. Offline digital marketing - Electronic billboards, Radio marketing, T.V. marketing, Phone marketing</p> <p>1.3. Online marketing - Search Engine Optimization (SEO), Social media marketing, E-mail marketing</p> <p>1.4. Difference between conventional marketing and online marketing.</p>
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<b>Chapter2</b>	<b>Internet Marketing</b>	<b>8 Hours</b>
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<p>2.1. Structure of Website - Team</p> <p>2.2. Types of website - Static Website, Dynamic website, Personal, Commercial, Governmental, Non-profit organization</p> <p>2.3. Web Portals - Type of Portals</p>
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<b>Chapter3</b>	<b>Classification of e-Commerce</b>	<b>8 Hours</b>
3.1. Business to Business (B2B) Model 3.2. Business to Consumer(B2C) Model 3.3. Consumer to Consumer(C2C) Model 3.4. Consumer to Business (B2B) Model		
<b>Case Study</b>		<b>6 Hours</b>
Case Study 1: Digital Platform like subscription-based streaming service that offers a vast library of TV shows, movies, documentaries, and original content. (eg. Prime Video, Netflix etc ) Case Study 2: Any Private sector bank in India–Digital Transformation and Customer Engagement, Retail banking, corporate banking, credit cards, loans, digital banking, etc. Case Study 3: Multispecialty Hospital in 2- Tier city -Cardiology and Orthopedic Departments Case Study 4: Content Marketing - like HupSpots Content Marketing creates valuable content like blog posts, e-books and infographics that address their target audience and establishing themselves as though leaders and attracting potential customers. Case Study 5: Any Newspaper like The New York Times – Digital Subscription Growth- Transition from print to digital revenue through subscriptions		
<b>Reference Books:</b>		
1 SEO 2025: Learn Search Engine Optimization with Smart Internet Marketing Strategies" by Adam Clarke 2 Digital Marketing: Nitin Kamat, Chinmay Kamat (Himalaya Publishing House)"Made to Stick: Why Some Ideas Survive and Others Die" by Chip Heath and Dan Heath 3 "Digital Marketing: Strategy, Implementation, and Practice" by Dave Chaffey and Fiona Ellis-Chadwick		

**Savitribai Phule Pune University**  
**S.Y.B.Sc.(Information Technology)**  
**Subject Code: OE204IT**  
**Title: AI for Everyone - I**

Teaching Scheme:  
2 hours / week

No. of Credits:  
**2**

Examination Scheme:  
CE: 15 marks  
EE: 35 marks

**Course Objectives: -**

1. Understand the basics of artificial intelligence and its subfields.
2. Explore real-world applications of AI across different industries.
3. Gain insights into the ethical, social, and economic implications of AI.
4. Develop an appreciation for the potential of AI to drive innovation and transformation.

**Course Outcomes: -**On completion of the course, student will be able to–

CO1: Learn and analyse the fundamental concepts and subfields of AI.

CO2: Understand the potential of AI to drive innovation and transformation in different domains.

CO3: Identify and apply AI tools across various industries.

CO4: Analyse and apply the ethical, social, and economic implications of AI.

**Course Contents**

**Unit 1**

**Introduction to Artificial Intelligence**

**8 hours**

- 1.1 Definition and scope of AI
- 1.2 Historical overview and key milestones
- 1.3 Differentiating AI from human intelligence
- 1.4 Types of AI tools: Text, image, audio, video, coding, and automation.
- 1.5 Where to find free AI tools? (Google AI, Open AI, Hugging Face, etc.)

**Unit2**

**AI Subfields**

**6 hours**

- 2.1 Machine learning: Supervised, unsupervised, and reinforcement learning
- 2.2 Deep learning and neural networks
- 2.3 Natural language processing (NLP) and computer vision

**Unit3**

**Applications of AI**

**8 hours**

- 3.1 AI in healthcare: Diagnosis, treatment, and medical imaging
- 3.2 AI in finance: Fraud detection, algorithmic trading, and risk assessment
- 3.3 AI in transportation: Autonomous vehicles and traffic optimization
- 3.4 AI in customer service and chatbots
- 3.5 AI in education: Personalized learning and intelligent tutoring systems

<b>Unit4</b>	<b>Ethical and Social Implications of AI</b>	<b>8 hours</b>
4.1	Bias and fairness in AI systems.	
4.2	Privacy and data protection concerns	
4.3	Impact of AI on employment and the workforce	
4.4	AI and social inequality	
<b>Reference Books:</b>		
1.	Artificial Intelligence: A Guide for Thinking Humans" – Melanie Mitchell	
2.	The AI Revolution in Medicine: GPT-4 and Beyond" – Peter Lee, Carey Goldberg, Isaac Kohane	
3.	AI 2041: Ten Visions for Our Future" – Kai-Fu Lee, Chen Qiufan	
4.	The Business of AI: AI Technologies and How to Leverage Them for Business Success" – Anirudh Koul	
5.	AI-Powered Marketing: Harness the Future of Marketing with AI" – Peter Gentsch	
6.	The AI Marketing Handbook" – Ryan McKenzie	

**Savitribai Phule Pune University**  
**S.Y.B.Sc. (Information Technology)**  
**Subject Code: IT201IKS**

**Title : Indian Knowledge System in Computing**

Teaching Scheme 2 hours /Week	No. of Credits 2	Examination Scheme CE : 15 marks EE: 35 marks
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**Course Objective:**

1. To introduce Vedic mathematical techniques and their relevance to modern computational methods.
2. To understand Nyaya's logical framework and its application in reasoning and AI.
3. To explore the algorithmic structure of Panini's grammar and Chandasastra's binary system in computational linguistics and mathematics.
4. To explore real-world applications of IKS concepts in computational sciences

**Course Outcomes :**

**On Completion of this course, student will be able to –**

CO1: Understand the computational foundations of Indian Knowledge Systems by applying Vedic mathematical techniques in problem-solving.

CO2: Use Nyaya's logical reasoning in AI and decision-making.

CO3: Explore the connection between Panini's grammar and NLP technologies. CO4: Recognize the applications of IKS in modern computing fields

**Course Contents**

<b>Chapter 1</b>	<b>Vedic Mathematics &amp; Computational Thinking</b>	<b>8 hours</b>
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- 1.1 Introduction to Vedic Mathematics: Origins and importance in ancient India, Sutras and their logical foundation
- 1.2 Basic Arithmetic using Vedic Methods: Addition, subtraction, multiplication, and division tricks
- 1.3 Algebraic Applications of Vedic Mathematics: Squaring, square roots, cube roots, and factorization

<b>Chapter 2</b>	<b>Introduction to Nyaya (Indian Logic)</b>	<b>8 hours</b>
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- 2.1 Introduction to Nyaya Philosophy: Introduction to Nyaya (Indian Logic), Overview of Indian philosophical schools, Importance of Nyaya in logical reasoning, Types of reasoning (Anumana, Pramana, etc.)
- 2.2 Nyaya's Four Sources of Knowledge (Pramana): Perception, inference, comparison, verbal Testimony
- 2.3 Types of Argumentations in Nyaya Vada (truth-based), Jalpa (debate-focused), Vitanda (criticism) Applications in AI & Machine Learning: Logical reasoning models, expert systems, and rule-based AI

<b>Chapter 3</b>	<b>Panini's Astadhyayi &amp; Chandasāstra</b>	<b>8 hours</b>
3.1	Introduction to Panini's Astadhyayi: Historical background and linguistic importance	
3.2	Rule-Based System of Sanskrit Grammar: Sutras, meta-rules, recursion, and transformations	
3.3	Chandasāstra's Binary logic and combinatorial techniques	
<b>Chapter 4</b>	<b>Applications of IKS in Computer Science</b>	<b>6 hours</b>
4.1	Mind and cognition in Samkhya and Yoga: AI insights	
4.2	Machine Learning and Indian philosophies: Understanding of human cognition in Indian philosophical schools (Advaita, Samkhya and Yoga)	
4.3	Cryptography and Security: Ancient cryptographic methods in Kautilya's Arthashastra, protecting information: analogies from Indian traditions	
<b>Reference Books</b>		
1.	Vedic Mathematics, Jagadguru Swami Bharati Krishna Tirtha, Motilal Banarsidass Publishing House, New Delhi.	
2.	"The Power of Vedic Maths" – Atul Gupta, JAICO publishing	
3.	Nyaya Theory of Knowledge" – S.C. Vidyabhusana	
4.	"A Primer of Indian Logic" – Kuppuswami Sastri, Hassell Street Press.2021	
5.	"Indian Logic: A Reader" – Jonardon Ganeri	
6.	"Aṣṭādhyāyī of Pāṇini" (Volumes 1 & 2) – Rama Nath Sharma, Munshirm Manoharlal publication	
7.	"Panini: His Work and Its Traditions" – George Cardona, Motilal Banarsidass Publishing House	
8.	"The Mathematics of Metre" – Satyanarayana Das	
9.	"Samkhya and Science" – Debabrata Sen Sharma	
10.	Explores the cognitive science aspects of Samkhya and Yoga in AI research.	
11.	"AI and Indian Philosophy" – Sangeet Kedia	
12.	"Kautilya's Arthashastra" – R. Shamasastri (Translation)	
13.	"History of Indian Cryptography" – Subhash Kak	
14.	Discusses coded messages, steganography, and security concepts in ancient India.	
15.	Saubhagya Vardhan, AI in Land of Vedas, Notion Press, 2023	

# Semester-IV

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

**Title : Python Ecosystem: A Practical Approach with Libraries and Frameworks**

Teaching Scheme 2 hours/week	No. of Credits 2	Examination Scheme CE:15marks EE:35marks
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**Prerequisites**

1. Fundamental concepts of Python

**Course Objectives:-**

- To understand the Foundation of Python Ecosystem
- To apply basic concepts Web Development using Python.
- To implement real-world problems using Python libraries and Frameworks.
- To understand Data Handling and Analysis Libraries.
- To explore Visualization and Reporting in Python.

**Course Outcomes:-**

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

CO 1: Understand the structure and components of the Python ecosystem including package management tools.

CO 2: Apply data analysis libraries like NumPy, Pandas, and visualization tools to handle and interpret data.

CO 3 : Develop command-line, GUI, and web applications using Python frameworks such as Flask and Tkinter.

CO 4: Automate real-world tasks, perform testing, and deploy Python applications using modern tools.

**Course Contents**

<b>Chapter 1</b>	<b>Foundations of Python Ecosystem</b>	<b>5 hours</b>
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1.5 Introduction to Python Ecosystem, Setting up Python environments (Anaconda, Virtualenv, venv)

1.6 Package management with `pip` and `conda`

1.7 Introduction to Jupyter Notebooks and IDEs (VS Code, PyCharm)

<b>Chapter 2</b>	<b>Data Handling and Analysis Libraries</b>	<b>5 hours</b>
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2.1 Working with `NumPy` for numerical computations,

2.2 Data manipulation with `Pandas`

2.3 Working with `DateTime` and Missing Data

<b>Chapter 3</b>	<b>Application and Web Development Frameworks</b>	<b>7 hours</b>
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3.1 Building command-line apps with `argparse` and `Click`

3.2 GUI Development using `Tkinter` or `PyQt`

3.3 Web Development with `Flask` and introduction to `FastAPI`

<b>Chapter 4:</b>	<b>Visualization and Reporting</b>	<b>4 hours</b>
3.1 Introduction to Data Visualization, Matplotlib – Basic Plotting, Seaborn – Statistical Plots 3.2 Creating Summary Reports using <code>pandas-profiling</code> . 3.3 Exporting Reports (PDF, Excel)		
<b>Chapter 5</b>	<b>Automation, Utilities, and Applied Libraries</b>	<b>8 hours</b>
4.1 File I/O and OS Operations ( <code>os</code> , <code>shutil</code> , <code>pathlib</code> ), Working with <code>csv</code> , <code>json</code> , and <code>xml</code> files 4.2 Email and Notification Automation ( <code>smtplib</code> , <code>email</code> ) 4.3 Working with PDFs and Excel ( <code>PyPDF2</code> , <code>openpyxl</code> , <code>xlsxwriter</code> ) 4.4 Introduction to Scheduling with <code>schedule</code> and <code>time</code>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. <b>Wes McKinney</b>, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, O’Reilly Media, ISBN: 978-1491957660</li> <li>2. <b>Jake VanderPlas</b>, Python Data Science Handbook: Essential Tools for Working with Data, O’Reilly Media, ISBN: 978-1491912058</li> <li>3. <b>Joel Grus</b>, Data Science from Scratch: First Principles with Python, O’Reilly Media, ISBN: 978-1492041139</li> <li>4. <b>Erich Gamma et al.</b>, Design Patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley, ISBN: 978-0201633610</li> <li>5. <b>R.G.Dromey</b>, How to Solve it by Computer, Pearson Education India ISBN-13: 978-8131705629</li> </ol>		
<b>E-Books and Online Learning Material</b>		
<ol style="list-style-type: none"> <li>1. <a href="https://jakevdp.github.io/PythonDataScienceHandbook/">https://jakevdp.github.io/PythonDataScienceHandbook/</a></li> <li>2. <a href="#">NPTEL – The Joy of Computing using Python</a></li> <li>3. <a href="https://greenteapress.com/wp/think-python-2e/">https://greenteapress.com/wp/think-python-2e/</a></li> <li>4. <b>Anaconda Tutorial:</b> <a href="https://docs.anaconda.com/anaconda/">https://docs.anaconda.com/anaconda/</a></li> </ol>		

**Savitribai Phule Pune University**  
**S.Y.B.Sc. (Information Technology)**  
**Subject Code : IT252MJ**  
**Title : Exploratory Data Analysis**

Teaching Scheme 2 hours/week	No. of Credits 2	Examination Scheme CE: 15 marks EE: 35 marks
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**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**

<b>Chapter 1</b>	<b>Fundamentals of EDA</b>	<b>4 hours</b>
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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.

<b>Chapter 2</b>	<b>Understanding Data Analysis</b>	<b>8 hours</b>
<p>5.2 Significance of EDA – Making sense of data.</p> <p>5.3 Types of data qualitative and quantitative data;</p> <p>5.4 Measurement scales-Comparing EDA with classical and Bayesian analysis.</p> <p>5.5 Python libraries : Python libraries numpy, pandas, scipy. Data preprocessing: Steps involved in data preprocessing.</p> <p>5.6 Data transformation techniques/Data Wrangling: functionalities of data Wrangling, Combining and Merging Datasets, filtering dataset, removing duplication, Reshaping and Pivoting.</p>		
<b>Chapter 3</b>	<b>Graphical Exploratory Data Analysis</b>	<b>8 hours</b>
<p>3.1 Python libraries for visualization : matplotlib and seaborn, Difference between seaborn and matplotlib libraries.</p> <p>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.</p>		
<b>Chapter 4</b>	<b>EDA Methods and Techniques</b>	<b>6 hours</b>
<p>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).</p> <p>4.2 Types of analysis : Univariate, Bivariate and Multivariate analysis, Multivariate analysis using Titanic dataset.</p> <p>4.3 Grouping dataset: Understanding groupby(), groupby mechanics, cross tabulation.</p>		
<b>Chapter 5</b>	<b>Descriptive Statistics and Inferential Statistics</b>	<b>4 hours</b>
<p>5.1 Understanding statistics</p> <p>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</p> <p>5.3 Regression Analysis, Types of regression (simple, multiple, polynomial, logistic).</p> <p>5.4 Advanced data visualization tool: Tableau-Connecting to data, Creating Sheets and Dashboards.</p>		

**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: IT253MJP**

**Title:** Practical Based on Python Ecosystem : A Practical Approach with Libraries and Framework (IT251MJ) and Exploratory Data Analysis (IT252MJ)

Teaching Scheme  
4 hours / week

No. of Credits  
2

Examination Scheme  
CE: 15 marks  
EE: 35 marks

**Prerequisites:**

- Basic understanding of libraries in Python programming
- Knowledge of Advanced programming concepts
- Exploratory Data Analysis,
- Python

**Course Objectives:-**

1. To understand the Foundation of Python Ecosystem
2. To apply basic concepts Web Development using Python.
3. To develop problem-solving skills using libraries-based programming.
4. To execute Python programs based on GUI applications
5. To understand the fundamental concepts of exploratory data analysis using Python.
6. To find missing values in data and identify the correlation between different variables.
7. To understand and interpret results obtained from graphical analysis.
8. To understand how to create a dashboard.

**Course Outcomes:-**

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

- CO1: Demonstrate the ability to set up and manage Python environments using Anaconda, venv, pip, and Jupyter Notebooks.
- CO2: Apply NumPy and Pandas to perform efficient data manipulation, analysis, and handling of missing or temporal data.
- CO3: Develop command-line tools, GUI applications such as argparse, Tkinter, Flask, and FastAPI.
- CO4 : Understand the fundamentals of EDA
- CO5: Implement the data visualization using matplotlib and seaborn library.
- CO6: Understanding basics of python for performing data analysis.
- CO7: Understand the hypothesis testing.
- CO8 : Identify and transform erroneous data using different data Wrangling techniques for Analyzing.
- CO9: Import, clean, and explore data to perform preliminary analysis.
- CO10: Understand Advance data visualization using tableau.

## Practical Assignments

### Python Ecosystem : A Practical Approach with Libraries and Framework

#### Assignment 1: Foundations of Python Ecosystem

3. Create a Python virtual environment using `venv` and install packages like `numpy`, `pandas`, and `matplotlib` using `pip`. Show commands and output.
4. Setup a Jupyter Notebook using Anaconda and demonstrate importing and using packages. Document the setup steps.

#### Assignment 2: NumPy – Numerical Computation

1. Create a NumPy array and perform vectorized operations (addition, multiplication, mean, standard deviation).
2. Use NumPy to solve a matrix multiplication problem and find eigenvalues of a 2x2 matrix.

#### Assignment 3: Data Manipulation with Pandas

1. Load a CSV file into a Data Frame, perform cleaning (drop NA, fill missing values, filter rows).
2. Group data by category and calculate aggregate statistics(mean, sum, count)using `groupby()`

#### Assignment 4: DateTime and Missing Data Handling

1. Create a command-line tool using `argparse` to calculate factorial and square root from user input.
2. Design a simple GUI calculator using Tkinter or PyQt with addition and subtraction buttons.

#### Assignment 5: Web Development Using Flask and FastAPI

1. Create a Flask app with two routes: home and contact. Accept form input and return a thank-you message.
2. Create a FastAPI endpoint that returns a JSON response with student data.

#### Assignment 6: Data Visualization with Matplotlib and Seaborn

1. Plot bar chart, pie chart, and histogram for a dataset using `matplotlib`.
2. Use `seaborn` to plot boxplot, heatmap, and pairplot for a dataset like `iris`.

#### Assignment 7: 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 8: Reporting with Pandas-Profiling**

1. Generate a summary report using `pandas-profiling` for a sample dataset and save it as an HTML file.
2. Export a cleaned dataset to Excel and PDF using `to_excel()` and `reportlab` or `pdfkit`.

### **Assignment 9: File I/O, JSON, XML, and OS Utilities**

1. Read and write data from a CSV, JSON, and XML file. Parse and display contents.
2. Perform file organization using `os`, `shutil`, and `pathlib`: move all `.txt` files into a new folder.

### **Assignment 10: Automation – Email, PDFs, Excel, and Scheduling**

1. Automate sending a basic email using `smtplib` with an attachment (PDF or image).
2. Schedule a Python script to run every 2 minutes using the `schedule` library that writes the current time to a log file.

### **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`.

**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.
3. **Wes McKinney**, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, O’Reilly Media, ISBN: 978-1491957660.
4. **R.G.Dromey**, How to Solve it by Computer, Pearson Education India ISBN-13: 978-8131705629

**Online Resources:**

- <https://www.tableau.com/learn/tutorials/on-demand/getting-started>
- <https://www.w3schools.com/python/>
- <https://jakevdp.github.io/PythonDataScienceHandbook/>
- [NPTEL – The Joy of Computing using Python](#)

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

Teaching Scheme  
2 hours / week

No. of Credits  
2

Examination Scheme  
CE: 15 marks  
EE: 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

<b>Chapter 3</b>	<b>Requirement Engineering</b>	<b>7 Lectures</b>
3.1 Introduction 3.2 Requirement Engineering Tasks <ul style="list-style-type: none"> <li>3.2.1 Inception</li> <li>3.2.2 Elicitation</li> <li>3.2.3 Elaboration</li> <li>3.2.4 Negotiation</li> <li>3.2.5 Specification</li> <li>3.2.6 Validation</li> </ul> 3.3 Software Requirement Specification (SRS) <ul style="list-style-type: none"> <li>3.3.1 Developing Use Cases (UML)</li> </ul> 3.4 Feasibility Study		
<b>Chapter 4</b>	<b>Analysis and Design Engineering</b>	<b>6 Lecture</b>
4.1 Introduction to DFD 4.2 Basic Notations 4.3 Context Level DFD 4.4 1 <sup>st</sup> Level DFD 4.5 2 <sup>nd</sup> Level DFD 4.6 Input and Output Screen Design 4.7 Cover at least three case studies on above topics		
<b>Chapter 5</b>	<b>Agile Development</b>	<b>4 Lectures</b>
5.1 What is Agility? 5.2 Agile Process <ul style="list-style-type: none"> <li>5.2.1 Agility Principles</li> <li>5.2.2 The Politics of Agile Development</li> </ul> 5.3 Extreme Programming (XP)		
<b>Reference Books :</b> <ol style="list-style-type: none"> <li>1. Software Engineering : A Practitioner’s Approach (Seventh Edition) by Roger S. Pressman, McGraw Hill International Edition</li> <li>2. System Analysis, Design and Introduction to Software Engineering (SADSE) - S. Parthasarthy, B.W. Khalkar</li> <li>3. System Analysis and Design (Second Edition) by Elias M. Awad, Galgotia Publications Pvt. Ltd.</li> <li>4. A Concise Introduction to Software Engineering – Pankaj Jalote , Springer ISBN: 978-1-84800-301-9</li> </ol>		

**Savitribai Phule Pune University**  
**S.Y.B.Sc. (Information Technology)**  
**Subject Code : IT281FP**  
**Title : Mini Project**

Teaching Scheme 4 hours /week	No. of Credits 2	Examination Scheme CE: 15 marks EE: 35 marks
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**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**  
**Subject : Cryptography & Network Security**

<b>Teaching Scheme</b> 2 hours / week	<b>No. of Credits</b> 2	<b>Examination Scheme</b> CE: 15 marks EE: 35 marks
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**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 know various cryptographic techniques using Symmetric Key Cryptographic Algorithms using Substitution Technique
3. To know about various Symmetric Key Cryptographic Algorithms using Transposition Techniques
4. To get acquainted with Asymmetric Cryptographic Algorithms.
5. Understand Key Management and Digital Certificates
6. To understand different Hash functions and their role in cryptography

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

1. Understand the concept of OSI Reference Model and the components of the Network Security
2. Summarize the encryption, decryption and intrusion detection techniques and its solutions to overcome the attacks using Substitution techniques
3. Understand cryptographic algorithms to design secure applications using different transposition techniques
4. Develop attitude to apply appropriate asymmetric cryptographic algorithms
5. Understand top down approach of data communication from one user to another user
6. Develop attitude to apply appropriate encryption technique for the problem.

**Course Contents**

<b>Unit 1</b>	<b>Computer Security Essentials</b>	<b>3 hours</b>
<ol style="list-style-type: none"> <li>1.1 Computer and Network Security – an Introduction</li> <li>1.2 Need for Security</li> <li>1.3 Security Approaches and Principles</li> <li>1.4 OSI Security Architecture</li> <li>1.5 Security Services and Mechanisms</li> <li>1.6 Network Security Model</li> <li>1.7 Email Security (Domain Key Identified Mail (DKIM))</li> </ol>		
<b>Unit 2</b>	<b>Symmetric Key Cryptographic Algorithms- Substitution Techniques</b>	<b>5 hours</b>

	<p>2.1 Introduction, Algorithm Types and Modes</p> <p>2.2 Symmetric Cipher Model (Plain Text and Cipher Text, Cryptography, Cryptanalysis, Brute-Force Attack)</p> <p>2.3 Encryption and Decryption</p> <p>2.4 Substitution Techniques (Caesar Cipher, Monoalphabetic Ciphers, Playfair Cipher, Hill Cipher, Polyalphabetic Ciphers, One-Time Pad)</p> <p>2.5 Types of security Attacks (General view and Technical view, Active and Passive attacks)</p> <p>2.6 Possible Types of Attacks on substitution technique</p>	
<b>Unit 3</b>	<b>Symmetric Key Cryptographic Algorithms- Transposition Techniques</b>	<b>10 hours</b>
	<p>3.1 Transposition Techniques (Single Columnar, Double Columnar) - Rail Fence technique, Simple Columnar transposition Technique</p> <p>3.2 Possible Types of Attacks on transposition technique</p> <p>3.3 Key Range and Key Size</p> <p>3.4 Block Cipher Principles and modes of operations</p> <p>3.5 Introduction to Data Encryption Standard (DES), Advanced Encryption Standard (AES)</p> <p>3.6 Stream Ciphers</p> <p>3.7 RC4 , RC5 , Blowfish</p> <p>3.8 Steganography (Applications, Limitations)</p>	
<b>Unit 4</b>	<b>Asymmetric Key Cryptographic Algorithms</b>	<b>4 hours</b>
	<p>4.1 Asymmetric Key Cryptography – Introduction, History and Outline</p> <p>4.2 Principles of Public Key Cryptosystems</p> <p>4.3 RSA Algorithm with example</p> <p>4.4 Diffie Hellman Key Exchange algorithm with example</p> <p>4.5 Knapsack Algorithm</p>	
<b>Unit 5</b>	<b>Public Key Infrastructure</b>	<b>4 hours</b>
	<p>5.1 Introduction</p> <p>5.2 Digital Certificates, Creation of Digital Certificates</p> <p>5.3 Digital Signatures-Direct Digital Signature, Digital Signature Standard (DSS)</p> <p>5.4 Private Key Management (PKI and PKIX Model)</p> <p>5.5 Public Key Cryptographic Standards (PKCS), PKI and XML Security</p> <p>5.6 Public key – distribution of secret keys, elliptic curve cryptography</p>	
<b>Unit 6</b>	<b>Cryptographic Hash Functions</b>	<b>4 hours</b>
	<p>6.1 Introduction and Applications</p> <p>6.2 Simple Hash Functions (XOR and rotated XOR, XOR with Cipher Block Chaining (CBC) mode)</p> <p>6.3 Requirements and Security 6</p> <p>6.4 Hash Functions based on Cipher Block Chaining</p> <p>6.5 Secure Hash Algorithms (SHA), SHA-3, SHA-256</p>	
<b>Reference Books:</b>		

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. Atul Kahate, Cryptography and Network Security, TMH, 2019.
6. V.K. Pachghare, Cryptography and Information Security, PHI Learning, Private Limited.
7. Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, Hand-book of Applied Cryptography, Taylor & Francis Excl. Spl Reprint, 2018.
8. Margaret Cozzens, Steven J Miller, The Mathematics of Encryption, American Mathematical Society, 2017.
9. Bruce Schneier, Applied Cryptography, John Wiley and Sons, 2012.
10. S. Bose, Cryptography And Network Security, Pearson Education India, 2016.
11. 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>

<b>Savitribai Phule Pune University</b> <b>S.Y.B.Sc. (Information Technology)</b> <b>Subject Code : IT291MN</b> <b>Title : Automation Tools for Cloud Deployment</b>		
<b>Teaching Scheme</b> 2 hours / week	<b>No. of Credits</b> 2	<b>Examination Scheme</b> CE: 15 marks EE: 35 marks
<b>Prerequisites:</b> To successfully achieve the Course Outcomes (COs), students should have: <ul style="list-style-type: none"> <li>• Basic Knowledge of Cloud Computing</li> <li>• Familiarity with IT Infrastructure</li> <li>• Foundational Programming &amp; Scripting Skills</li> <li>• Understanding of DevOps &amp; CI/CD Concepts</li> </ul>		
<b>Course Objectives: -</b> <ul style="list-style-type: none"> <li>• Understand the fundamentals of cloud computing and the need for automation in deployment.</li> <li>• Apply Infrastructure as Code (IaC) tools for automated cloud infrastructure management.</li> <li>• Implement configuration management and CI/CD pipelines to automate cloud deployments.</li> <li>• How to evaluate cloud automation tools and apply best practices for efficient and secure deployment.</li> <li>• How to design and develop cloud automation scripts using industry-standard tools and techniques.</li> <li>• How to optimize and enhance cloud automation strategies by integrating advanced cloud technologies and security best practices.</li> </ul>		
<b>Course Outcomes:</b> <b>After completing the course, students will be able to:</b> 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.		
<b>Course Contents</b>		
<b>Chapter 1</b>	<b>Introduction to Cloud Computing and Automation</b>	<b>7 hours</b>

<p><b>1.1 Introduction to Cloud Computing:</b> Definition and characteristics, Cloud service models: IaaS, PaaS, And SaaS. Cloud deployment models: Public, Private, Hybrid. Benefits and challenges of cloud deployment,</p> <p><b>1.2 Need for Automation in Cloud Deployment:</b> Benefits of automation, Speed, efficiency, consistency, Challenges of manual deployment, Use cases of automation in cloud environments.</p> <p><b>1.3 Automation Concepts in Cloud:</b> Infrastructure as Code (IaC), Configuration management basics, Continuous Integration and Continuous Deployment (CI/CD).</p> <p><b>1.4 Overview of Cloud Platforms:</b> AWS, Azure, and Google Cloud Platform (GCP), Native automation tools: Cloud Formation, Azure Resource Manager, GCP Deployment Manager.</p>		
<b>Chapter 2</b>	<b>Infrastructure as Code (IaC) Tools</b>	<b>6 hours</b>
<p>2.1 Introduction to Infrastructure as Code (IaC)</p> <p>2.2 Terraform</p> <p>2.3 AWS CloudFormation</p> <p>2.4 Comparison of IaC Tools</p>		
<b>Chapter 3</b>	<b>Configuration Management and CI/CD Tools</b>	<b>8 hours</b>
<p><b>3.1 Configuration Management:</b> Definition and significance, Tools: Ansible, Chef, Puppet, Automating cloud configuration with Ansible, Managing cloud instances with Ansible playbooks.</p> <p><b>3.2 Continuous Integration and Continuous Deployment (CI/CD):</b> CI/CD concepts and benefits, Tools: Jenkins, GitLab CI/CD, GitHub Actions. Automating deployment processes in cloud environments.</p> <p><b>3.3 CI/CD Pipeline Deployment:</b> Creating CI/CD pipelines, Automating testing and deployment, Integrating Docker and Kubernetes with CI/CD pipelines.</p>		
<b>Chapter 4</b>	<b>Cloud Automation Best Practices and Security</b>	<b>9 hours</b>
<p><b>4.1 Best Practices for Cloud Automation:</b> Automation principles Error handling and logging. Monitoring and scaling automated services.</p> <p><b>4.2 Security and Compliance in Cloud Automation:</b> Security risks in cloud automation, Automating security enforcement, Secure IaC practices, Automating compliance checks.</p> <p><b>4.3 Cloud Automation Case Studies:</b> Real-world cloud automation projects, Examples from AWS, Azure, and GCP.</p> <p><b>4.4 Emerging Trends in Cloud Automation:</b> AI-driven cloud automation, Serverless frameworks, Cloud-native DevOps and GitOps. Future of automation in cloud deployment.</p>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>"Cloud Computing: From Beginning to End" by Ray J. Rafaels</li> <li>"Cloud Computing: Concepts, Technology &amp; Architecture" by Thomas Erl</li> <li>"Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)" by Michael J. Kavis</li> </ol>		

4. "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" by George Reese
2. "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 Cryptography & Network Security (IT291MN)

Teaching Scheme 4 hours / week	No. of Credits 2	Examination Scheme CE: 15 marks EE:35marks
<b>Prerequisites</b> <ol style="list-style-type: none"> <li>1. Strong foundation in mathematics.</li> <li>2. Algorithmic and problem-solving skills.</li> <li>3. Intermediate Level Skills of Python Programming.</li> </ol>		
<b>Course Objectives:-</b> <ul style="list-style-type: none"> <li>• To enable students learn different encryption technique</li> <li>• To enable students learn symmetric and asymmetric algorithms</li> </ul>		
<b>Course Outcomes:-Student will be able to:-</b> <ul style="list-style-type: none"> <li>• Implement cryptographic algorithms.</li> <li>• Develop understanding of substitution and transposition techniques</li> <li>• Develop understanding of Symmetric and Asymmetric algorithm</li> <li>• Design secure applications.</li> <li>• Develop attitude to apply appropriate encryption technique for the problem.</li> </ul>		
<b>Practical Assignments</b>		
<b>Assignment 1</b>	<b>Substitution Technique</b>	
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.		
<b>Assignment 2</b>	<b>Transposition Technique</b>	
Write a Program to implement Transposition techniques in Python. ( Any Two)		
<b>Assignment 3</b>	<b>AES Algorithm</b>	
Write a Program to implement AES Algorithm		
<b>Assignment 4</b>	<b>RSA Algorithm</b>	
Write a Program to implement RSA Algorithm		
<b>Assignment 5</b>	<b>Diffie Hellman Key Exchange Algorithm</b>	
Write a Program to implement Diffie Hellman Key Exchange Algorithm		
<b>Assignment 6</b>	<b>Knapsack Algorithm</b>	
Write a Program to implement Knapsack algorithm.		
<b>Assignment 6</b>	<b>SHA Algorithm</b>	
Write a Program to implement SHA Algorithm		

**Savitribai Phule Pune University**  
**S.Y.B.Sc.(Information Technology)**  
**Subject Code: IT292MNP**

**Title: Practical Based on Automation Tools for Cloud Deployment (IT291MN)**

Teaching Scheme  
4 hours / week

No. of Credits  
2

Examination Scheme  
CE:15 marks  
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: OE251IT**  
**Title: E-Commerce II**

Teaching Scheme 2 hours / week	No. of Credits 2	ExaminationScheme CE:15 marks EE:35 marks
<b>Prerequisites</b> <ul style="list-style-type: none"> <li>• Knowledge of basic e-commerce concepts, business models and payment systems.</li> <li>• Understanding of digital marketing, financial systems, and internet technologies</li> </ul>		
<b>Course Objectives</b> <ul style="list-style-type: none"> <li>• To understand the technical and security aspects of e-commerce.</li> <li>• To explore data-driven decision-making and analytics in e-commerce.</li> <li>• To study supply chain and logistics management in e-commerce.</li> <li>• To gain insights into global e-commerce trends and challenges.</li> <li>• To learn about the integration of AI, Blockchain, and Cloud Computing in e-commerce.</li> </ul>		
<b>Course Outcomes</b> On completion of the course, student will be able to– CO1: Implement secure e-commerce transactions and protect user data. CO2: Apply analytics tools to track and enhance e-commerce performance. CO3: Manage e-commerce logistics and understand global trends. CO4: Use emerging technologies such as AI, Blockchain, and Cloud for e-commerce applications.		
<b>Course Contents</b>		
<b>Chapter1</b>	<b>E-Commerce Logistics and Supply Chain Management</b>	<b>6 Hours</b>
1.1. E-Commerce Supply Chain Overview 1.2. Inventory Management in E-Commerce 1.3. Role of Warehousing and Fulfillment Centers 1.4. Last-Mile Delivery Challenges 1.5. Reverse Logistics and Return Policies 1.6. Green and Sustainable Supply Chains		
<b>Chapter2</b>	<b>Data Analytics and Consumer Behavior in E-Commerce</b>	<b>7 Hours</b>

2.1. Importance of Data Analytics in E-Commerce 2.2. Key Performance Indicators (KPIs) and Metrics 2.3. Web Analytics (Google Analytics, Heatmaps, A/B Testing) 2.4. Predictive Analytics & Customer Insights 2.5. Recommendation Engines & Personalization 2.6. Conversion Rate Optimization (CRO) 2.7. Fraud Detection Using AI in E-Commerce		
<b>Chapter3</b>	<b>E-Commerce Security and Privacy</b>	<b>6 Hours</b>
3.1. Importance of Security in E-Commerce 3.2. Threats to E-Commerce (Phishing, Fraud, Cyber Attacks) 3.3. Cryptography & Secure Transactions (SSL/TLS, Encryption) 3.4. Digital Signatures & Certificates 3.5. Firewalls & Intrusion Detection Systems		
<b>Chapter4</b>	<b>Advanced E-Commerce Technologies</b>	<b>5 Hours</b>
4.1. Machine Learning for Product Recommendations 4.2. Block chain for Secure Transactions and Smart Contracts 4.3. Cloud Computing and SaaS Platforms for E-Commerce 4.4. The Role of 5G in E-Commerce Growth		
<b>Chapter5</b>	<b>Global Trends of E-Commerce</b>	<b>6 Hours</b>
5.1. Cross-Border E-Commerce and Global Expansion 5.2. Mobile Commerce (M-Commerce) Innovations 5.3. Subscription-Based E-Commerce Models 5.4. Social Commerce (Instagram, Facebook Shops, TikTok Commerce) 5.5. Ethical and Sustainable E-Commerce Practices 5.6. Future Challenges in E-Commerce		
<b>Reference Books:</b>		
1. E-Commerce Analytics: Analyze and Improve the Impact of Your Digital Strategy, Judah Phillips, Pearson 2. Cloud Computing: Principles and Paradigms, RajkumarBuyya, James Broberg, Andrzej Goscinski, Wiley 3. Global E-Commerce: Theory and Case Studies, Jie Lin, Fei Gao, Springer 4. Logistics and Supply Chain Management, Martin Christopher, Pearson		

**Savitribai Phule Pune University**  
**S.Y.B.Sc.(Information Technology)**

**Subject Code: OE252IT**

**Title :Web Design II**

Teaching Scheme 2 hours / week	No. of Credits 2	Examination Scheme CE:15 marks EE:35 marks
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**Prerequisites**

- Knowledge and understanding of HTML is essential for structuring web pages.
- Basic design principles can enhance your web design abilities.
- Knowledge of programming concepts like variables, loops, and functions can be helpful when learning JavaScript.

**Course Objectives**

- To learn to define the structure and content of XML documents using XML.
- To know and learning how to use the DOM to access and manipulate XML data within applications.
- To prepare the learners with the fundamentals of CSS programming and scripting languages.
- Learners should know how to create and interact with web pages effectively, develop static and dynamic websites, and understand how they work together.

**Course Outcomes**

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

- Learn and use the CSS to design Webpages.
- Understand Linking and publishing of Web pages.
- Plan, design and implement webpages.
- Develop a dynamic web pages using JavaScript (client side programming).

**Course Contents**

<b>Chapter 1</b>	<b>CSS(Cascading Style Sheet)</b>	<b>8 Hours</b>
1.1. Introduction of CSS and its Syntax 1.2. Ways to Insert CSS and Background image handling 1.3. Background colour management using CSS 1.4. Text and Font management using CSS 1.5. Managing Hyperlinks and List using CSS 1.6. Designing Borders and Outline 1.7. Setting Page Margin using CSS		
<b>Chapter 2</b>	<b>XML(Extensible Markup Language)</b>	<b>8 Hours</b>

2.1. XML Namespaces and Infoset and Document Type 2.2. Definitions (DTDs) 2.3. XML Schemas and XML-Parser 2.4. Data Modeling, Document and Object Model (DOM) 2.5. Displaying XML with XSLT		
<b>Chapter 3</b>	<b>Introduction to JavaScript</b>	<b>8 Hours</b>
3.1. Concept of Script, Types of Scripts, Scripting Languages 3.2. Introduction to JavaScript. 3.3. Variables, identifier and Operator, Control structure. 3.4. Examples on JavaScript Operators. 3.5. Functions 3.6. Event Handling in JavaScript with examples.		
<b>Case Study</b>		<b>6 Hours</b>
<b>Case study 1:</b> Creation of forms, small case study to create HTML pages using all the above learnt techniques. <b>Case study 2:</b> Redesigning the Website of a Small Business. <b>Case study 3:</b> Create a Styled Web Page for a Coffee Shop.		
<b>Reference Books:</b>		
1. Learning Web Design: A beginner's Guide to HTML, CSS, Javascript, and Web Graphics - Jennifer Robbins 2. HTML5: The Missing Manual - Matthew MacDonald 3. HTML and JavaScript – Ivan Bayross 4. Mastering HTML, CSS & Javascript Web Publishing		

<b>Savitribai Phule Pune University</b> <b>S.Y.B.Sc.(Information Technology)</b> <b>Subject Code: OE253IT</b> <b>Title: Digital Marketing II</b>		
Teaching Scheme 2 hours / week	No. of Credits 2	ExaminationScheme CE:15 marks EE:35 marks
<b>Prerequisites</b> <ul style="list-style-type: none"> <li>Digital marketing requires creativity and problem-solving abilities.</li> <li>Experience with social media platforms (Facebook, Instagram, Twitter, LinkedIn, etc.) is beneficial, as digital marketing</li> </ul>		
<b>Course Objectives</b> <ul style="list-style-type: none"> <li>To understand Digital Marketing as the most powerful marketing tool.</li> <li>To Learn to create digital marketing artworks.</li> <li>To use social media sites like Facebook, Instagram, Twitter, LinkedIn, and others to raise sales, engage customers, and establish your brand.</li> </ul>		
<b>Course Outcomes</b> On completion of the course, student will be able to– CO1: Understand and learn marketing strategies and results effectively to stakeholders. CO2: Assess and enhance digital marketing campaigns' return on Investment. CO3: Analyze and implement practical experience with industry-standard digital marketing tools. CO4: Analyze and use variety of social media channels to create and interact with communities, raise awareness of a brand.		
<b>Course Contents</b>		
<b>Chapter1</b>	<b>Online Consumer Behavior Analysis</b>	<b>8 Hours</b>
1.1 Consumer Behavior 1.2 Segmentation and Targeting online customers 1.3 Psychological Responses 1.4 Social Trends		
<b>Chapter2</b>	<b>Social Media Marketing</b>	<b>8 Hours</b>
2.1. Social Media Sites 2.2. - Influence of Social Media Marketing 2.3. Power of Social Media 2.4. Monetization through Social Media		

<b>Chapter3</b>	<b>Future of Digital Marketing</b>	<b>8 Hours</b>
3.1. Use of Artificial Intelligence (AI) in Digital Marketing. 3.2. Common use of household gadgets for online marketing. 3.3. Digital Marketing strategies.		
<b>Case Study</b>		<b>6 Hours</b>
Case Study 1 Experiential Learning: Creating a website. Case Study 2 Online Consumer Behavior Analysis for an E-Commerce Fashion Brand		
<b>Reference Books:</b>		
1	Digital Marketing: Nitin Kamat, Chinmay Kamat (Himalaya Publishing House)	
2	"Digital Marketing for Dummies" by Ryan Deiss and Russ Henneberry	
3	"Influence: The Psychology of Persuasion" by Robert B. Cialdini	
4	"Social Media Marketing Workbook: How to Use Social Media for Business" by Jason McDonald	

**Savitribai Phule Pune University**  
**S.Y.B.Sc.(Information Technology)**

**Subject Code: OE254IT**

**Course Title: AI for Everyone II**

Teaching Scheme:  
2 hours / week

No. of Credits:  
**2**

Examination Scheme:  
CE:15 marks  
EE:35 marks

**Course Objectives: -**

- 1 Understand the basics of artificial intelligence and its subfields.
- 2 Explore real-world applications of AI across different industries.
- 3 Gain insights into the ethical, social, and economic implications of AI.
- 4 Develop an appreciation for the potential of AI to drive innovation and transformation.

**Course Outcomes: -**On completion of the course, student will be able to–

- CO1: Understand different types of AI Models  
CO2: Learn and use content optimization using AI.  
CO3: Compare and implement Animations and motions in AI  
CO4: Understand and analyse AI tools.

**Course Contents**

<b>Chapter 1</b>	<b>Advanced AI Fundamentals</b>	<b>6 Hours</b>
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- 1.1 Deep Dive into AI, Machine Learning & Deep Learning
- 1.2 Types of AI Models: Generative AI, NLP, Computer Vision, Reinforcement Learning
- 1.3 Latest AI Trends: AGI, Large Language Models (LLMs), and multimodal AI
- 1.4 Exploring AI Frameworks & APIs: Open AI, Hugging Face, Google AI

<b>Chapter 2</b>	<b>AI for Advanced Text &amp; Content Creation</b>	<b>8 Hours</b>
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- 2.1 AI for Long-form Writing & Reports
- 2.2 Automating Research & Citation Management
- 2.3 AI for SEO & Content Optimization
- 2.4 Using AI for Professional Emails & Business Writing

<b>Chapter 3</b>	<b>Advanced AI for Image &amp; Video Processing</b>	<b>8 Hours</b>
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- 3.1 AI Image Generation Beyond Basics
- 3.2 Deepfake Technology & Ethical Concerns
- 3.3 AI Video Editing & Creation
- 3.4 AI Animation & Motion Capture

<b>Chapter 4</b>	<b>AI Tools</b>	<b>8 Hours</b>
4.1	Chat GPT (Open AI)	
4.2	Google Gemini (Bard AI)	
4.3	Canva, Beautiful. AI, Gamma, Slides AI	
4.4	Rytr, Grammarly	
<b>References:</b>		
1.	Artificial Intelligence: A Modern Approach – Stuart Russell & Peter Norvig.	
2.	Practical AI for Business Leaders – Anand S. Rao	
3.	AI-Powered Automation Handbook – Will Kelly	
4.	AI for Content Creators: How to Use AI Tools for Writing and Marketing – Rob Lennon	
5.	Human Compatible: Artificial Intelligence and the Problem of Control – Stuart Russell	
6.	<a href="https://www.grammarly.com/ai/ai-writing-tools/article-writer">https://www.grammarly.com/ai/ai-writing-tools/article-writer</a>	

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

Teaching Scheme  
2 hours / week

No. of Credits  
2

Examination Scheme  
CE: 15 marks  
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**

<b>Chapter 1</b>	<b>Introduction to Linux Operating System</b>	<b>6 hours</b>
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- 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

<b>Chapter 2</b>	<b>General Purpose Utilities</b>	<b>6 hours</b>
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- 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.

<b>Chapter 3</b>	<b>Linux File Management and Command Line Basics</b>	<b>6 hours</b>
<p>3.1 Concept of Directories: Home directory, Directory handling commands: cd, mkdir, rmdir, pwd</p> <p>3.2 File Concept: File types, File system tree</p> <p>3.3 File Handling Commands: ls, cat, cp, mv, rm, wc, more, cmp, diff</p> <p>3.4 Basic File Attributes: Viewing and changing file attributes (e.g., permissions, ownership), chmod: Changing file or directory permissions</p> <p>3.5 File Filters: cut, paste, sort, uniq, head, tail, grep</p> <p>3.6 Command Linking: Using Pipe ( ) Operator, Command Substitution (e.g., \$(command))</p>		
<b>Chapter 4</b>	<b>The vi Editor</b>	<b>6 hours</b>
<p>4.1 The vi Editor Overview: Introduction to vi, The vi Interface.</p> <p>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).</p> <p>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.)</p> <p>4.4 vi Input Mode Operations: Switching to Input Mode, Inserting and replacing text</p> <p>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</p> <p>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)</p>		
<b>Chapter 5</b>	<b>Shell Scripting Fundamentals</b>	<b>6 hours</b>
<p>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.</p> <p>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.</p> <p>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).</p> <p>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).</p> <p>5.5 Loops in Shell Scripting-for Loop, while Loop, until Loop, Breaking and Continuing in Loops</p> <p>5.6 Input and Output in Shell Scripts-Reading User Input, Displaying Output, Redirecting Output</p>		

**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, 2<sup>nd</sup> 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:**

1. Online Linux Compiler: [https://www.onlinegdb.com/online\\_bash\\_shell](https://www.onlinegdb.com/online_bash_shell)
2. Shell Scripts and Programs : <https://www.shellscript.sh/>
3. Linux Basic Commands: <https://maker.pro/linux/tutorial/basic-linux-commands-for-beginners>
4. Linux Basic Commands: <https://www.guru99.com/must-know-linux-commands.html>