Savitribai Phule Pune University, Pune

Faculty of Commerce and Management

Bachelor of Computer Application (BCA)

Revised Curriculum (2024 Pattern as per NEP-2020)

w.e.f. Academic Year: 2025-2026

SYBCA Semester IV								
Course Type	Course	Course Code	Paper Title	Credits		Hours / Week	Marks	
				Theory	Practical		Int.	Ext.
Major Mandatory	Major Mandatory (Theory)	CA-251-MJ	Database Management Systems	4	-	4	30	70
	Major Mandatory (Practical)	CA-251-MJP	Lab course on CA - 251 - MJ	-	2	4	15	35
Minor	Minor (Theory)	CA-251-MN	Communication Networks	2	-	2	15	35
	Minor (Practical)	CA-251-MNP	Lab course on CA - 251 - MN		2	4	15	35
Open Elective (OE)	Open Elective		To be selected from the OE basket of Faculty of Commerce and Management, Faculty of Humanities and Faculty of Interdisciplinary Studies	2	-	2	15	35
Ability Enhancement Course (AEC)	Ability Enhancement Course (AEC)	AEC-201-MAR/AEC-201-HIN'	Modern Indian Languages 1– Marathi/Hindi	2	-	2	15	35
Ability Enhancement Course (AEC)	Ability Enhancement Course (AEC)	AEC-251-MAR/AEC-251-HIN	Modern Indian Languages 2– Marathi/Hindi	2	-	2	15	35
Community Engagement and Service	Project	CA-251-CEP	Community Engagement through Social Awareness	-	2	4	50	-
Co-Curricular Courses (CC)	Co-Curricular Courses (CC)	CA-201-CC	NSS/NCC/Yoga Education/Health and Wellness/Fine Arts - 1	-	2	2	50	-
Co-Curricular Courses (CC)	Co-Curricular Courses (CC)	CA-251-CC	NSS/NCC/Yoga Education/Health and Wellness/Fine Arts- 2	-	2	2	50	-
			Sub-Total	**12**	**10**		**270**	**280**
			Total	**22**			**550**	

Savitribai Phule Pune University

Second Year Bachelor of Computer Applications

Course Code: CA- 251-MJ

Course Name : Database Management Systems

Teaching Scheme: Theory: 04 Hrs./Week	Credits 4	Examination Scheme: Continuous Evaluation: 30 Marks End- Semester: 70 Marks

Course Objectives:

1. To introduce fundamental concepts of database management.
2. To develop understanding of the relational model, relational algebra, and SQL.
3. To enable students to design databases using ER modeling and convert ER diagrams into relational schemas.
4. To impart knowledge of normalization techniques for effective and optimized database design.
5. To explain transaction management, concurrency control, database security, backup, and recovery mechanisms.

Course Outcomes: After successful completion of this course, learner will be able to

CO1: Understand the basic concepts of DBMS.

CO2: Apply relational algebra operations and SQL queries.

CO3: Design Entity-Relationship (ER) diagrams and convert them into relational schemas.

CO4: Apply normalization techniques (1NF, 2NF, 3NF, BCNF).

CO5: Demonstrate understanding of transaction processing, concurrency control, security issues, and backup–recovery strategies in DBMS.

Sr.No.	Topic Details	No. of Sessions	Weightage
Unit I	**Introduction to Database**	**6**	**10 %**
1	1.1 Data, Information, Metadata 1.2 File Processing System vs DBMS 1.3 Need for DBMS 1.4 Database, Types of Databases: Hierarchical, Network, Relational, NoSQL (overview) 1.5 DBMS Architecture: 1-Tier, 2-Tier, 3-Tier,Structure of DBMS 1.6 Components of DBMS: Users, Hardware, Software Database applications in real world (banking, e-		

	commerce, social media)		
Unit II	**Relational Algebra**	**10**	**15%**
2	2.1 Codd's Rule 2.2 Introduction a. Need for relational algebra b. Procedural query language concept 2.3 Basic Relational Algebra Operations a. Selection (σ) b. Projection (π) c. Union (∪) d. Set Difference (−) e. Cartesian Product (×) f. Rename (ρ) g. Joins (⋈) 2.4 Relational database language 2.5 Data definition in SQL, Views 2.6 Queries in SQL, Specifying constraints and Indexes in SQL, Specifying constraints management systems (Extra Reading: Relational Calculus)		
Unit III	**Relational Model Design – ER Diagram**	**9**	**15%**
3	3.1 ER Diagram: Representation of Entities, Attributes, Relationships and their Types, Cardinality, Generalization, Specialization, Aggregation - Case Studies 3.2 Database Design – ER to Relational 3.3 E-R to Relational Tables Conversion		
Unit IV	**Relational Model Design – Normalization**	**9**	**18%**
4	4.1 Database design using Normalization – Normal forms - 1NF, 2NF, 3NF, BCNF 4.2 Case Studies		
Unit V	**Transaction Management, Concurrency Control & Data Security**	**6**	**12%**
5	5.1 Definition of Transaction, state of transactions 5.2 Introduction of schedules 5.3 Introduction to Concurrency control techniques a) locking		

	and b) Deadlock 5.4 Overview of security, backup and Recovery		

References:

1. Silberschatz, Korth, and Sudarshan, "Database System Concepts", 6 th Edition, McGraw- Hill, 2011
2. Database Management System by Raghu Ramakrishnan / Johannes Gherke
3. Database system practical approach to design, implementation & management by Connoly & Begg
4. Desai Bipin "Introduction to Database Management System", 1st Edition Galgotia Publication,2008.
5. Singh, S. K., "Database Systems: Concepts, Design and Application", 2nd Edition, Pearson, 2011

Textbooks:

1. Database system concept Korth, TMH,5th Ed.
2. Introduction to database systems C.J.Date, Pearson
3. Fundamentals of Database Systems Elmasri Navathe, Pearson,5th ed

Web links:

1. https://www.geeksforgeeks.org/dbms/dbms/ GeeksforGeeks
2. https://www.scaler.com/topics/course/dbms/ Scaler
3. https://www.learnvern.com/course/database-management-tutorial-hindi LearnVern
4. https://www.guru99.com/dbms-tutorial-pdf.html guru99.com
5. https://usemynotes.com/dbms/

MOOC Courses

1. Data Base Management System : Prof. Partha Pratim Das & Prof. Samiran Chattopadhyay, IIT Kharagpur
2. Fundamentals of Database Systems: Dr. Arnab Bhattacharya, IIT Kanpur
3. Introduction to Database Systems: Prof. P. Sreenivasa Kumar, IIT Madras
4. Relational Databases — BITS Pilani, on Coursera

Savitribai Phule Pune University

Second Year Bachelor of Computer Applications

CA – 252 - MJP: Lab course on CA - 251 - MJ

Teaching Scheme: Practical: 04 Hrs./Week/ Batch	Credits 02	Examination Scheme: Continuous Evaluation: 15 Marks End-Semester: 35 Marks

1. **Course Objectives:**
2. To understand fundamental concepts of DBMS including data, metadata, architectures, and types of databases.
3. To develop the ability to write and execute SQL queries using DDL, DML, joins, constraints, indexing, and views.
4. To design ER diagrams for real-world applications and convert them into relational schemas with appropriate keys.
5. To enhance database design skills through normalization, identification of functional dependencies, and schema decomposition.
6. To understand and implement concepts of transaction management, concurrency control, database security, backup, and recovery techniques.

Course Outcomes: After successful completion of this course, learner will be able to

CO1: Explain fundamental DBMS concepts including data, metadata, architectures, database types, relational algebra, and normalization.

CO2: Implement SQL operations such as DDL, DML, joins, constraints, indexing, grouping, and views on relational databases.

CO3: Analyze real-world problem statements to design ER diagrams and convert them into relational schemas with proper keys and cardinalities.

CO4: Perform database design and refinement through normalization up to BCNF, identifying functional dependencies and performing decomposition.

CO5: Demonstrate transaction management, concurrency control, and database security techniques including ACID properties, locking, backup, and recovery.

Guidelines for Instructor's Manual

The instructor shall prepare instructor’s manual consisting of university syllabus, conduction and Assessment guidelines.

Guidelines for Student Journal

The student shall perform each laboratory assignment and submit the same in the form of a journal. Journal shall have a Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Program Outputs, software and Hardware requirements, Date of Completion, Assessment grade/marks and signature of the instructor).

Guidelines for Assessment

The instructor shall carry out internal evaluation of laboratory assignments of 15 marks on a continuous basis throughout the semester. For each lab assignment, the instructor shall assign grade/marks based on parameters with appropriate weightage. Suggested parameters include-timely completion, performance, innovation, efficient codes, code documentation, punctuality and neatness of the write-up etc.

A pair of examiners shall conduct end semester examination of 35 marks in the form of practical examination based on journal assignments. Examiners shall ask questions about journal assignments and / or problem statement provided during practical examination to judge understanding of concepts by the students.

Lab Journal Format (for each practical)

Practical No. & Title
Objective
Theory / Concept
Tools / Software Used
Procedure
Screenshots / Output
Result / Conclusion

Assignment No.	List of Assignments
1.	**Assignment 1: DBMS Fundamentals** a. Define Data, Information, Metadata with real-life examples. b. Compare File Processing System vs DBMS (any 5 differences). c. Explain the need for a DBMS in modern industries such as banking, e-commerce, education, or healthcare.
2.	**Assignment 2: DBMS Architecture & Components** a. Explain 1-tier, 2-tier, and 3-tier DBMS architecture with neat diagrams. b. Write a note on DBMS components: hardware, software, users (DBA, end users, designers). c. Identify 5 real-world DBMS applications and explain how DBMS is used in each. d. Explain Hierarchical, Network, Relational, and NoSQL databases with examples.

3.	**Assignment 3: Relational Algebra Operations** Given a sample database: **STUDENT (RollNo, Name, Dept, Marks)** **DEPARTMENT (Dept, HOD)** Perform the following relational algebra operations: a. σ Marks > 70 (STUDENT) b. π Name, Dept (STUDENT) c. STUDENT ⋈ DEPARTMENT d. STUDENT − {students from 'CS' department} e. Rename STUDENT as STUD
4.	**Assignment 4: SQL DDL, DML, Constraints** Create a database for a college: Tables: **Student**, **Course**, **Enrollment** Tasks: a. Write SQL queries for CREATE TABLE with constraints (PK, FK, CHECK, UNIQUE). b. Insert 5 sample records in each table. c. Write queries for: • Update • Delete • Select with WHERE, ORDER BY, LIKE • Create a VIEW on Student table
5.	**Assignment 5: SQL Joins & Indexes** Using the above tables: a. Write SQL queries using: • INNER JOIN • LEFT JOIN • RIGHT JOIN • FULL JOIN b. Create an index on Student (RollNo). c. Write queries containing: • GROUP BY • HAVING • Aggregate functions (SUM, AVG, COUNT)

6.	**Assignment 6: ER Diagram Creation** Draw an ER diagram for **Online Food Delivery System**. Include: • Entities • Attributes • Cardinalities • Relationship types (1:1, 1:M, M:N) • Weak entities (if any)
7.	**Assignment 7: ER to Relational Conversion** Convert your ER diagram (Assignment 7) to relational tables. Include: • Primary keys • Composite keys • Foreign keys • Cardinality mapping
8.	**Assignment 8: Case Study on ER Modeling** Choose ANY one: 1. Hospital Management System 2. Library Management System 3. College Admission System Tasks: a. Identify all entities & relationships. b. Draw a fully labeled ER diagram. c. Convert it into a relational schema.
9.	**Assignment 9: Normalization Concepts** a. Explain 1NF, 2NF, 3NF, and BCNF with examples. b. Give a real-time example of data redundancy & anomalies. c. Why normalization is required? State advantages.
10.	**Assignment 10: Normalization Problem Solving** Given the un-normalized table: **SALES (InvNo, Date, CustomerName, CustomerPhone, ItemCode, ItemName, Qty, Price, SupplierName, SupplierPhone)** Tasks: a. Convert this table into **1NF, 2NF, 3NF, BCNF**. b. Identify functional dependencies clearly.

	c. Show step-by-step decomposition.
11.	**Assignment 11: Transaction Management** a. Define transaction and explain ACID properties with examples. b. Write states of a transaction using diagrams. c. Give examples of: • Successful transaction • Failed transaction • Rollback scenario
12.	**Assignment 12: DB Security, Backup & Recovery** a. Explain DB security threats and protection techniques. b. Write short notes on: • Authentication • Authorization • Encryption c. Explain backup types (full, differential, log) with examples. d. Write a real-life case study of database failure & recovery.

References Books:

1. Database Management Systems: A Practical Approach — Dr. Rajiv Chopra (S Chand)
2. Fundamentals of Database Systems — Ramez Elmasri & Shamkant Navathe
3. Database System Concepts — A. Silberschatz, H.F. Korth & S. Sudarshan
4. Database Systems: The Complete Book — H. Garcia-Molina, J. D. Ullman & J. Widom
5. Database Management Systems — (by Indian authors / Indian publication, e.g. Textbooks tailored BCA/B.Sc)

Certifications:

1. Data Base Management System --- NPTEL
2. Introduction to Database Systems ----- NPTEL
3. Fundamentals of Database Systems --- NPTEL
4. Introduction to DBMS --- NPTEL

Savitribai Phule Pune University Second Year

Bachelor of Computer Applications

CA – 271 - CEP: Community Services Project

Teaching Scheme: **Practical: 04 Hrs./ Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester: 35 Marks**

Course Objectives:

1. To provide exposure to the students and sensitize them for community issues/problems
2. To know levels of community engagements (Informative, participative and decision- making participations)

Course Outcomes: After successful completion of this course, the learners will be able to

CO1: Identify and define community engagement service to address community problem

CO2: Analyze and propose possible solutions to solve community problems.

Guidelines for the faculty

- A faculty shall be assigned as a guide for each group of 2-3 students.
- Assist the group in choosing a suitable community project topic and defining clear objectives and expected outcomes.
- Guide students in planning surveys, questionnaires, data collection methods, and using the necessary tools and resources.
- Provide advice on possible solutions and approaches to address the community issues effectively.
- Monitor the students' progress throughout the semester and hold regular meetings to guide them and answer questions.
- Help them prepare the project report, ensuring all sections and supporting evidence like photos or charts are included.
- Evaluate their work, participation, and diary, and give constructive feedback to help them improve.

Guidelines for Students

- Students shall work in groups of 2-3 members and select a community engagement topic or area in consultation with their assigned faculty mentor.
- Each group shall plan objectives, expected outcomes, activities, methodology (e.g., surveys, data collection, analysis tools) and get the plan approved by the mentor.
- Groups will be associated with a government official, village authority, NGO, or designated organization during the project.
- Activities are to be carried out during free slots, before/after college hours, Sundays, or holidays, ensuring ethical and respectful engagement.
- Each student must maintain an Activity Book / Field Diary recording tasks, observations, and learnings, which must be countersigned by the mentor/HoD.
- The Community Engagement Project should be distinct from NSS/NCC programs.

The project report should include: Title, Abstract, Rationale, Problem Definition, Objectives, Outcomes, Methodology, Activities, Analysis, Findings, Proposed Solution (paper design/prototype/app), Conclusions, along with Geo-tagged photographs or audio-video evidence.

The suggested timelines for the project is:

Week 1: Form groups (2-3 students) and meet your mentor

Week 2: Select topic/area for community engagement

Week 3: Plan objectives, outcomes, activities, and methodology; get approval from mentor

Week 4-7: Conduct activities: surveys, awareness programs, interviews, discussions, and meetings

Week 8-9: Prepare project report with findings, proposed solution, and supporting evidence

Week 10: Present the project and submit the report

Suggestive list of topics under Community Engagement Project (BCA) The below lists are not exhaustive and open for HoD's or mentors to add, delete or modify. The focus should be on bridging the digital divide and using logical skills to help the community.

1. **Digital Banking & Financial Inclusion:** Teaching shopkeepers/elderly how to use UPI (GPay/PhonePe) safely.

2. **Cyber Security Awareness:** Seminars for school children on safe internet usage.
3. **E-Waste Awareness:** Surveying and educating locals on disposing of old mobiles/batteries.
4. **Assisting in E-Governance:** Helping villagers apply for Aadhaar updates, PAN cards, or Ration cards online.
5. **Fake News & Social Media Ethics:** Workshop on verifying news sources for local youth.
6. **Digitization of Records:** Converting manual registers of a local library, clinic, or Anganwadi into Excel/Digital formats.
7. **Village Asset Mapping:** Using Google Maps/GPS to tag important locations (Water sources, Schools) in a village.
8. **Website/Blog Creation:** Making a basic online presence for a local Self-Help Group (SHG) or small business.
9. **Computer Basics Workshop:** Teaching MS Office (Word/Paint) to underprivileged children.
10. **Online Education Assistance:** Teaching parents how to use Zoom/Google Meet for their children's schooling.
11. **Health Data Analysis:** Conducting a survey on local health issues (e.g., dengue awareness) and presenting data graphs to the Gram Panchayat.
12. **Career Guidance:** Counseling 10th/12th students on career paths (Arts/Commerce/Science streams).
13. **Women Safety Apps:** Educating women on using safety features and apps on their phones.
14. **Plastic-Free Campaign:** Promoting digital posters and social media campaigns against single-use plastic.
15. **Smart Farming Awareness:** Showing farmers YouTube videos or apps related to modern organic farming techniques.
16. **Voter Registration Awareness:** Helping youth register on the National Voters Service Portal (NVSP).
17. **Blood Donor Database:** Creating a simple contact list/database of blood donors in a specific ward/area.
18. **Accessible Technology:** Teaching visually impaired persons to use Voice Assistants (Google Assistant/Siri).
19. **River Pollution Mapping:** Go to a local riverbank, find where dirty water (sewage) is entering the river, and mark the spot on a Google Map to show the authorities.
20. **Single-Use Plastic Survey:** Visit a vegetable market and count how many people are using plastic bags versus cloth bags to understand the plastic waste problem.

Learning Resources Text Books:

1. Waterman, A. *Service-Learning: A Guide to Planning, Implementing, and Assessing Student Projects.* Routledge, 1997.
2. *Digital India Guidebook* (Ministry of Electronics and Information Technology, Govt of India).
3. *Cyber Security Awareness Guidelines* (CERT-In).
4. Dostilio, L. D., et al. *The Community Engagement Professional's Guidebook.* Stylus Publishing, 2017.

MOOC / NPTEL / YouTube Links:

1. NPTEL Course: *Management of Field Operations*
2. Swayam Course: *Digital Literacy & Cyber Security*
3. Government Schemes: https://www.digitalindia.gov.in/

Savitribai Phule Pune University

Second Year Bachelor of Computer Applications

Course Code: CA - 251 - MN

Course Name: Communication Networks

Teaching Scheme: **Theory: 02 Hrs./Week**	**Credits** **2 credits**	**Examination Scheme:** **Continuous Evaluation: 15** **Marks End-Semester: 35** **Marks**

Course Objectives:

1. To understand the basic ideas, structure, and hardware used in different computer networks.

2. To study the TCP/IP protocol suite including its layer models, addressing schemes.

3. To study how Windows systems work and understand the basics of network security and firewalls.

Course Outcomes: After successful completion of this course, learner will be able to

CO1: Understand the principles of the OSI and TCP/IP models

CO2: Apply network protocol fundamentals to configure IPv4 and IPv6 addressing

CO3: Understand the Windows Server features & network security fundamentals

Sr.No.	**Topic Details**	**No. of Sessions**	**Weightage**
Unit I	**Fundamentals of Networking layers**	**8**	**30%**
1	1.1 Introduction to Communication Network 1.2 Key components 1.3 Need for layering 1.4 ISO-OSI 7 Layer Model 1.5 TCP/IP model 1.6 OSI Model vs TCP/IP model 1.7 Data Encapsulation 1.8 PDU Formation 1.9 Data Link Standards		
Unit II	**Network Protocols Concepts and Applications**	**10**	**30 %**
	2.1 Core Protocol Suites and Addressing TCP/IP 2.2. IPv4 addressing 2.2.1. Basic sub netting concepts with numerical 2.3. Fundamentals of IPv6		

2	2.3.1. Advantages of IPv6 2.3.2. Addressing scheme 2.4. Private Networks (VPNs) Tunneling Protocols 2.4.1. PPTP 2.4.2. L2TP 2.4.3. IPsec framework for secure communication. 2.5. HTTP and HTTPS 2.6. FTP for file transfer TELNET 2.7. Electronic Mail Protocols		
Unit III	**Windows Server & Network Security**	**12**	**40 %**
3	3.1.Fundamentals of Windows 3.1.1Windows 11 Client Operating System 3.1.2 Key features 3.1.3 Applications 3.2 Windows Server 2022 3.2.1. Key features 3.2.2 Editions 3.4 Network Security 3.4.1 Introduction and need for Network Security 3.4.2 CIA Triangle(Confidentiality , Integrity , Availability) 3.4.3 Common Threats 3.4.4 Active and Passive attacks 3.4.5. Cryptography (Symmetric and Asymmetric) 3.5. Firewall 3.5.1 Functions 3.5.2 Types 3.5.3 Architecture 3.5.4 Limitations 3.5.5 Security		

References:

1. Mastering Windows Server 2022; by Mark Minasi, et al.

2. Learn Windows Server Administration by Shivendra Kumar
3. Windows Server 2022 Networking by Craig Zacker
4. Windows Server 2022 for Beginners: A Comprehensive Guide to Install, Configure, and Manage Your Server by J. L. Chandler

Text books:

1. Computer Networks by Andrew S. Tanenbaum- latest edition.
2. Data Communications and Networking by Behrouz A. Forouzan
3. Computer Networks: A Systems Approach by Peterson & Davie

Web links:

1. https://www.geeksforgeeks.org/
2. https://learn.microsoft.com/en-us/windows-server/
3. https://www.tutorialspoint.com/index.htm
4. https://networklessons.com/
5. https://www.freecodecamp.org/

MOOC Courses:

1. Communication Networks By Prof. Goutam Das, IIT Kharagpur on SWAYAM NPTEL
2. The Bits and Bytes of Computer Networking on Coursera
3. Basics of Computer Networking on Great Learning

Savitribai Phule Pune University

Second Year Bachelor of Computer Applications

CA - 251 - MNP: Lab course on CA -291 –MN

Teaching Scheme:	Credits	Examination Scheme:
Practical: 04 Hrs./Week/ Batch	02	Continuous Evaluation: 15 Marks End-Semester: 35 Marks

Course Objectives:

1. To understand the basic ideas, structure, and hardware used in different computer networks.
2. To study the TCP/IP protocol suite including its layer models, addressing schemes.
3. To study how Windows systems work and understand the basics of network security and firewalls.

Course Outcomes: After successful completion of this course, learner will be able to

CO1: Understand the principles of the OSI and TCP/IP models

CO2: Apply network protocol fundamentals to configure IPv4 and IPv6 addressing

CO3: Understand the Windows Server features & network security fundamentals

Guidelines for Instructor's Manual

The instructor shall prepare an instructor's manual consisting of university syllabus, conduction and Assessment guidelines.

Instructors can use mentioned tools for the demonstration, almost all tools are available for free:- PC/Laptop, Notepad, Internet browser, optional OSI simulator Wireshark, Internet connection, PC, CMD, Online subnet calculator, PC with Internet Outlook/Thunderbird email client, Windows Server 2022, Server Manager.

Guidelines for Student Journal

The student shall perform each laboratory assignment and submit the same in the form of a journal. Journal shall have a Certificate, table of contents, and **handwritten write-up** of each assignment (Title, Objectives, Problem Statement, Program Outputs, software and Hardware requirements, Date of Completion, Assessment grade/marks and signature of the instructor).

Guidelines for Assessment

The instructor shall carry out internal evaluation of laboratory assignments of 15 marks on a continuous basis throughout the semester. For each lab assignment, the instructor shall assign grade/marks based on parameters with appropriate weightage. Suggested parameters include-timely completion, performance, innovation, efficient codes, code documentation, punctuality and neatness of the write-up etc.

A pair of examiners shall conduct an end semester examination of 35 marks in the form of practical examination based on journal assignments. Examiners shall ask questions about journal assignments and / or problem statements provided during practical examination to judge understanding of concepts by the students.

Lab Journal Format (for each practical)

Practical No. & Title
Objective
Theory / Concept
Tools / Software Used
Procedure
Screenshots / Output
Result / Conclusion

Assignment No's	List of Assignments
1	Demonstrate how data is transmitted step-by-step through different network layers and justify the need for layering. Objective: To simulate layered communication and observe its importance. Expected Output: Understanding of structured communication using network layers.
2	Capture and analyze network packets using Wireshark tool and identify how each protocol corresponds to the OSI 7-layer model. Objective: To analyze network packets mapped to OSI layers. Expected Output: Identification of protocols across all OSI layers.
3	Use ip config and Wireshark to analyze real network traffic and identify information related to each layer of the TCP/IP model. Objective: To observe TCP/IP layer information from real network traffic. Expected Output: Real-time understanding of TCP/IP functioning.
4	Use Wireshark to capture network traffic and analyze how data is encapsulated into Protocol Data Units (PDUs) with headers added at each layer. Objective: To observe encapsulation with headers and PDUs.

	Expected Output: Visibility of frames, packets, segments, and data PDUs.
5	Identify the Ethernet (IEEE 802.3) and Wireless (IEEE 802.11) standards supported by your system using network adapter properties and system tools. Objective: To find supported 802.3 and 802.11 standards in a system. Expected Output: List of supported Ethernet and Wi-Fi standards.
6	Identify listening and established connections on a system using netstat and explain their significance. Objective: To analyze active network protocols and ports. Expected Output: Active TCP, UDP, HTTP, HTTPS connections identified.
7	Calculate subnets using an IPv4 subnet calculator and analyze network ranges for different subnet masks. Objective: To calculate subnets and observe network ranges. Expected Output: Subnet tables with network ID, broadcast ID, and hosts.
8	Analyze the IPv6 address assigned to your computer using CMD and classify it as link-local, global, or unique local. Objective: To analyze IPv6 structure assigned to a system. Expected Output: IPv6 address, prefix length, and interface ID identified.
9	Configure a VPN connection (PPTP/L2TP/IPsec) on a Windows system and explain how the tunneling protocol establishes a secure connection. Objective: To understand VPN tunneling protocols and configuration. Expected Output: VPN profile successfully created and settings observed.
10	Observe and compare HTTP and HTTPS traffic using a web browser and Wireshark, and identify how encryption (SSL/TLS) protects data. Objective: To check encrypted (SSL/TLS) and non-encrypted web traffic. Expected Output: Certificate details displayed; difference between HTTP & HTTPS identified.
11	Demonstrate email sending using SMTP and email retrieval using POP3/IMAP, and analyze the differences between these protocols. Objective: To observe email sending and receiving protocol configuration. Expected Output: SMTP/IMAP/POP3 server settings viewed and explained.
12	Explore Windows 11 client settings and Windows Server 2022 roles to understand system management and network security features. Objective: To understand Server Manager, roles, and security features. Expected Output: List of roles & security features identified (AD DS, DNS, Firewall, etc.).

References:

1. Mastering Windows Server 2022" by Mark Minasi, et al.
2. Learn Windows Server Administration by Shivendra Kumar
3. Windows Server 2022 Networking by Craig Zacker
4. Windows Server 2022 for Beginners: A Comprehensive Guide to Install, Configure, and Manage Your Server by J. L. Chandler

Certifications:

1. Communication Networks By Prof. Goutam Das, IIT Kharagpur on SWAYAM NPTEL
2. The Bits and Bytes of Computer Networking on Coursera
3. Basics of Computer Networking on Great Learning

Savitribai Phule Pune University Second Year Bachelor of Computer Applications Course Code: CA - 251 - CEP Course Name: Community Engagement Program through Social Awareness		
Teaching Scheme: Theory: 04 Hrs./Week	Credits 2 credits	Examination Scheme: Continuous Evaluation: 00 Marks End-Semester: 50 Marks

This will be of 60 Hrs. Duration and to be conducted on field in collaboration with any NGO. Detail guidelines will be shared soon.