Savitribai Phule Pune University, Pune

Faculty of Commerce and Management

Second Year Bachelor of Computer Application (SYBCA)

Revised Curriculum (2024 Pattern as per NEP-2020)

w.e.f. Academic Year: 2026-2027

SYBCA Semester III								
Course Type	Course	Course Code	Paper Title	Credits		Hours / Week	Marks	
				Theory	Practical		Int.	Ext.
Major Mandatory	Major Mandatory (Theory)	CA-201-MJ	Data Structures	2	-	2	20	30
	Major Mandatory (Practical)	CA-202-MJP	Lab course on CA - 201 - MJ	-	2	4	20	30
Vocational Education Course	Vocational Education Course	CA-221-VSC	C++ Programming	2	-	2	20	30
	Major Mandatory (Practical)	CA-222-VSC	Lab course on CA - 221 - VSC	-	2	4	20	30
Field Project	Field Work	CA-231-FP	Field Work based on Major Mandatory	-	2	4	50	-
Minor	Minor (Theory)	ELS-241-MN	Data Communication (Networking)	2	-	2	20	30
	Minor (Practical)	ELS-242-MNP	Lab course on CA - 241 - MN	-	2	4	20	30
IKS	IKS -Domain Specific	CA-200-IKS	Indian Knowledge System for Computing	2	-	2	50	-
Open Elective (OE)	Open Elective	To be selected from the OE basket of Faculty of Science and Technology, Faculty of Humanities and Faculty of Interdisciplinary Studies		2			20	30
Ability Enhancement Course (AEC)	Ability Enhancement Course (AEC)	AEC-201-MAR/AEC-201-HIN	Modern Indian Languages 1– Marathi/Hindi	2	-	2	20	30
Co-Curricular Courses (CC)	Co-Curricular Courses (CC)	To be Selected from CC Basket		2		2	50	-
			Sub-Total	**14**	**8**		**310**	**240**
			Total	**22**			**550**	

Savitribai Phule Pune University
Second Year Bachelor of Computer Applications
CA – 201 - MJ: Data Structures

Teaching Scheme: Theory: 02 Hrs./Week	Credits 02	Examination Scheme: Continuous Evaluation: 20 Marks End-Semester: 30 Marks

Course Objectives:

1. To study various data structures
2. To learn analysis of algorithms
3. To understand real-world applications of data structures.

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

CO1: Define various data structures and notations for algorithm analysis
CO2: Design algorithms using suitable data structure(s)
CO3: Compare various representations of a stack, queue, tree and graph
CO4: List real world applications of stacks, queues, trees and graphs
CO5: Apply appropriate data structure(s) to solve a given problem
CO6: Evaluate the time and space complexity of the given algorithm/program

Course Contents

Unit I	Introduction to Data Structure	02 Hrs.

1.1 Introduction, Basic concepts, Data types and data objects.
1.2 Abstract Data Types (ADT)
1.3 Types of Data Structures: Linear and non -linear
1.4 Algorithm analysis: Frequency counts, Space and Time complexity, Asymptotic notation: Big O, Omega (Ω) (With examples)

Unit II	Arrays	08 Hrs.

2.1 Introduction
2.2 Matrix representation using arrays: Row and column major, operations on matrices, Sparse Matrix
2.3 Sorting techniques with time complexity: Bubble sort, Insertion sort, Merge sort, Quick sort
2.4 Searching techniques with time Complexity: Linear search and Binary search

Unit III	Linked Lists	10 Hrs.

3.1 Introduction
3.2 Representation
3.3 Types of linked lists: Singly, Doubly, Circular (Singly, Doubly)
3.4 Operations on link list: Create, Display, Insert, Delete, Reverse, Search, Sort, Concatenation, Merge
3.5 Real world applications of Link list : Polynomial Representation, Addition of two polynomials

Unit IV	Stacks and Queues	10 Hrs.

4.1 Introduction
4.2 Representation of Stack: Using arrays and Linked Lists
4.3 Operations on stack: push, pop
4.4 Applications of Stack: Recursion, Expressions: Infix to postfix, postfix to infix
4.5 Representation of Queues: Static (Array) and Dynamic (Linked List)
4.6 Operations on queue: insert, delete
4.7 Types of queues: Circular queue and Priority queue
4.8 Real world Applications of queue (Implementation not expected)

Books

1. Horowitz, Ellis and Sahani Sartaj, "Fundamentals of Data Structures",1st Edition, Galgotia,1984
2. Kamthane, Ashok N., "Introduction to Data Structures using C",1st Edition, Pearson,2004
3. Bandopadhya, S. K. and Dey, K. S. "Data Structures using C", 1st Edition, Pearson, 2004
4. Srivastava, S. K. and Srivastava, D., "Data Structures using C",1st Edition, BPB Publication, 2004
5. Gilberg, Richard F. and Forouzan, Behrouz A., "Data Structures: A Pseudocode approach with C", 2nd Edition, Cengage Learning, 2007
6. Steven S. S, "The Algorithm Design Manual", 2nd Edition, Springer, 2008

Savitribai Phule Pune University

Second Year Bachelor of Computer Applications

CA - 202 - MJP: Lab course on CA – 201 - MJ

Teaching Scheme: Practical: 04 Hrs./Week/ Batch	Credits 02	Examination Scheme: Continuous Evaluation: 20 Marks End-Semester: 30 Marks

Course Objectives:

1. To understand algorithms and analysis of algorithms
2. To learn static and dynamic data structures.

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

CO1: Apply appropriate data structures to solve the given problem **CO2:**
Design an efficient algorithm for the given problem and implement **CO3:**
Determine the time and space complexity of a given algorithm

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.

Assignment Nos	List of Assignments	Number of Hrs.
1	Non-Recursive Sorting Techniques • Bubble Sort • Insertion Sort	8
2	Recursive Sorting Techniques • Quick Sort • Merge Sort	12
3	Searching Techniques • Linear search • Binary search	4
4	Linked List • Implementation of Linked List, Singly Circular Linked List, Doubly Linked List, Doubly Circular Linked List, operations	18
5	Stacks and Queues • Static Stack Implementation and operations • Dynamic Stack Implementation • Applications of Stack -Expression Conversions • Static Queue Implementation and operations • Dynamic Queue Implementation	18

Savitribai Phule Pune University Second Year Bachelor of Computer Applications

CA - 221 - VSC: C++ Programing

Teaching Scheme: Practical: 02 Hrs./ Week / Batch	Credits 02	Examination Scheme: Continuous Evaluation: 20 Marks End-Semester: 30 Marks

Course Objectives:

1. **To understand the difference** between **procedural and object-oriented programming paradigms**.
2. **To introduce the fundamentals** of **object-oriented programming (OOP)** such as classes, objects, constructors, and destructors.
3. **To demonstrate advanced OOP features** like **function overloading**, **operator overloading**, **inheritance**, **polymorphism**, and **virtual functions**.
4. **To implement robust programs** using **exception handling mechanisms**.
5. **To apply OOP principles** by developing C++ programs that demonstrate real-world problem-solving.

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

CO1	Compare and contrast **procedural** and **object-oriented** programming paradigms.
CO2	Use **classes**, **objects**, **constructors**, and **destructors** to create modular C++ programs.
CO3	Illustrate the use of **function overloading**, **operator overloading**, **inheritance**, **virtual functions**, and **polymorphism** in C++.
CO4	Apply **exception handling** mechanisms to manage run-time errors effectively.
CO5	Demonstrate the use of **object-oriented programming concepts** in solving real-life problems through practical implementations in C++.

Course Contents

Unit I	**Introduction to CPP**	**2 Hrs.**

1.1 Basic concepts, advantages and applications of OOP
1.2 Introduction, applications of C++
1.3 Input and Output operator in C++
1.4 Elementary C++ program

Unit II	**Beginning with CPP**	**5 Hrs.**

2.1 Data type and Keywords
2.2 Declaration of variables, dynamic initialization of variables, reference variable
2.3 Operators: Scope resolution operator, Memory management operators
2.4 Manipulators
2.5 Functions: Function prototyping, call by reference and return by reference, Inline functions

Unit III	**Classes and Objects**	**6 Hrs.**

3.1 Class, Object and its structure
3.2 Access specifiers, defining data member
3.3 Defining member functions
3.4 C++ program using class
3.5 Memory allocation
3.6 Static data members and static member functions
3.7 Array of objects

3.8 Friend function and Friend class

Unit IV	Constructors & Destructors	5 Hrs.

4.1 Constructors and its types
4.2 Multiple constructors in a class and with default argument
4.3 Dynamic constructor
4.4 Destructor

Unit V	Inheritance	4 Hrs.

5.1 Introduction: Defining Base class and Derived class
5.2 Types of Inheritance
5.3 Virtual base class and abstract class

Unit VI	Polymorphism	4 Hrs.

6.1 Compile Time Polymorphism: Introduction, rules for overloading operators, Function overloading, Operator Overloading, String manipulation using operator overloading
6.2 Runtime Polymorphism: Virtual functions and pure virtual functions

Unit VII	Managing console, I/O operations	4 Hrs.

7.1 C++ streams and C++stream classes
7.2 Formatted and Unformatted I/O operations
7.3 File Handling: Stream Classes for File operations, File operations -Opening, Closing and updating, File updating with random access. Error handling during File operations

Books

1. Balagurusamy, E., "Object-Oriented Programming with C++", 8th Edition, McGraw Hill Education, 2020.
2. Stroustrup, Bjarne, "The C++ Programming Language", 4th Edition, Addison-Wesley Professional, 2013.
3. Lippman, Stanley B., Lajoie, Josée, and Moo, Barbara E., "C++ Primer", 5th Edition, Addison-Wesley Professional, 2012.
4. Stroustrup, Bjarne, "Programming: Principles and Practice Using C++", 2nd Edition, Addison-Wesley Professional, 2014.
5. Schildt, Herbert, "The Complete Reference C++", 4th Edition, McGraw Hill Education, 2003.
6. Lafore, Robert, "Object Oriented Programming in C++", 4th Edition, Sams Publishing, 2002.

Savitribai Phule Pune University

Second Year Bachelor of Computer Applications

CA - 221 - VSC: C++ Programing

Teaching Scheme: Practical: 04 Hrs./ Week / Batch	Credits 02	Examination Scheme: Continuous Evaluation: 20 Marks End-Semester: 30 Marks

Course Objectives:

6. To understand Object Oriented Programming concepts using the C++.
7. To study principles of data abstraction, inheritance and polymorphism.
8. To learn Virtual functions and polymorphism.
9. To know Formatted I/O and unformatted I/O.

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

CO1: Compare the procedural and object-oriented paradigms

CO2: Use Classes, Objects, constructors, destructors etc.

CO3: Illustrate the concept of function overloading, operator overloading, inheritance, virtual functions and polymorphism.

CO4: Apply exception handling

CO5: Demonstrate use of various OOPs concepts with the help of programs

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 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.

List of Assignments

The instructor shall cover necessary theoretical concepts in object-oriented programming such as objects, classes, data abstraction, encapsulation, data members, methods, access specifiers, inheritance, polymorphism, operator and function overloading, abstract classes, virtual function, file and exception handling etc.

Topic Name	Object Oriented Programming and functions in C++	20 Hrs.
Assignment No 1: Creation of classes, objects, methods, access specifiers, input-output Assignment No 2: Scope resolution operator, static members, call by reference Assignment No 3: Inline function, friend class and function.		
Topic Name	**Inheritance and Polymorphism**	**20 Hrs.**
Assignment No 4: Constructor and destructor Assignment No 5: Single inheritance and multiple inheritance Assignment No 6: Multilevel inheritance and Hierarchical Inheritance, Hybrid inheritance Assignment No 7: Polymorphism (Function overloading) Assignment No 8: Polymorphism (Operator overloading)		
Topic Name	**File Handing and Exception Handling**	**20 Hrs.**
Assignment No. 9: Operations on files (Read, Write, Open, Close), Random Access file functions Assignment No 10: Exception handling Assignment No.11: Hash tables and Dictionaries		

Books

1. B. Stroutstrup, "The C++ Programming Language", 3rd Edition, Pearson Education, 2000.
2. T. Gaddis, J. Walters and G. Muganda, "OOP in C++", 7th Edition, Pearson Education, 2010.
3. R. Lafore, "Object Oriented Programming in C++", 3rd Edition, Galgotia Publications Pvt. Ltd, 2004.
4. Herbert Schildt, "The Complete Reference C++", 4th Edition, Tata McGraw Hill, 2014.
5. Walter Savitch, "Problem solving with C++: The Object of Programming, 4th Edition, Pearson Education, 2002.

Savitribai Phule Pune University
Second Year Bachelor of Computer Applications
CA - 231 - FP: Field work

Teaching Scheme: Practical: 04 Hrs./ Week	Credits 02	Examination Scheme: Continuous Evaluation: 50 Marks

Course Objectives:

1. To provide exposure to the students and sensitize them to field issues/problems
2. To understand methodology used to perform field work

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

CO1: Apply methodology to perform field work

CO2: Identify and define real-world issues or problems

CO3: Analyze the data collected and propose solution to solve real-world problem

Guidelines for the faculty

A faculty shall be assigned as a guide for each group of 3 / 4 students.

The guide assigned for each group shall assist the assigned student group(s) for identifying topic/area (topic list is provided below for reference) for the field work, objectives and outcomes, preparation of questionnaire, resources/tools needed and guide the students for possible solutions and report preparation

The guide assigned for each group shall monitor, track and assess the progress of work carried out by students throughout the semester

Guidelines for Students

The student shall work in a group of 3 or 4 students. Each group shall select topic/area for the fieldwork to be undertaken by them in consultation with their assigned guide.

The group shall discuss and decide objectives, outcomes, overall plan for fieldwork, methodology to be adopted, such as preparation of a questionnaire for conduction of survey or methods for data gathering, tools to be used for analysis etc. and get the plan approved from their guide.

Each group shall carry out fieldwork during their free slots, or before/after college hours or on Sundays or holidays.

The students shall maintain a diary giving details of tasks performed by them, observations/study notes etc.

The suggested timelines for the field work are

- Formation of group – 1 week
- Selection of topic for field study – 2 Week
- Discussions and finalization of objectives, outcomes and methodology to be used – 3 Weeks
- Field work and visits, SWOT/SWOC analysis, group discussions and meeting with guide – Conduction of survey / gathering data etc. – 4Weeks
- Preparation of report and presentation – 2 weeks

Each group shall submit a report at the end of the semester consisting of Title, Abstract, Rational of the study, problem definition, objectives, outcomes, methodology used, details of field work performed (Field Visits, Interviews, discussions etc.), analysis, SWOT/SWOC, findings, details of proposed solution (Paper design/prototype/mobile App etc.) and conclusions. Students should also submit geo-tagged photographs, audio-video clips etc.

Guidelines for Assessment

The instructor shall carry out internal evaluation of fieldwork for 15 marks throughout the semester based on timely completion of the work, analysis, findings and neatness of the report etc.

The end semester examination of 35 marks shall be based on Group presentation and the reports of fieldwork submitted in the journal.

List of suggested topics/areas for Field work (but not limited to)

1. Healthcare (Civil and private hospitals) – HIMS, Telemedicine etc.
2. Schools, colleges, Universities - e-Learning Platforms, MOOCs, ERP, IT Infrastructure and Security systems etc.
3. Agriculture - Use of IoT Devices, drones in Agriculture, Management of Water Distribution, etc.
4. Old age homes and organizations working of differently abled people - Assistive Technologies for Divyanga Personnel, Support for Senior Citizens etc.
5. Organizations/NGOs working on food habits, nutrition, adulterations
6. Urban Region - Smart Cities, Traffic Management, Renewable energy and Solar Systems, Waste collection and disposal, studying water quality and water supply system of the city etc.
7. Rural Region - Smart Villages, Agriculture Product Distribution Systems etc.
8. Government offices and offices of Local Bodies (Corporation/Municipal Corporation/ Grampanchayat - ERP, IT Infrastructure and Security etc.
9. Pollution control boards – study / develop a system to monitor City environmental parameters - Air/Sound/Water pollutions
10. Department of disaster Management – Study /develop response system for allocating resources during natural disasters.
11. Governance - e-Governance Portals, Online Payment Systems etc.
12. Industries (IT/Manufacturing/Telecomm) involved in development of solutions to solve social issues

BOOKS

1. Waterman, A. Service-Learning: A Guide to Planning, Implementing, and Assessing Student Projects. Routledge, 1997.
2. Beckman, M., and Long, J. F. Community-Based Research: Teaching for Community Impact. Stylus Publishing, 2016.
3. Design Thinking for Social Innovation. IDEO Press, 2015.
4. Dostilio, L. D., et al. The Community Engagement Professional's Guidebook: A Companion to The Community Engagement Professional in Higher Education. Stylus Publishing, 2017

Savitribai Phule Pune University
Second Year Bachelor of Computer Applications
ELS- 241-MN: Data Communication

Teaching Scheme: Theory: 02 Hrs./Week	Credits 02	Examination Scheme: Continuous Evaluation: 20 Marks End-Semester: 30 Marks

Course Objectives:

1. To understand various computer networks and technologies behind networks
2. To study TCP/IP protocol suite, IP addressing schemes and link layer communication
3. To study routing concept along with Routing protocols
4. To study application layer protocols
5. To understand basics of cryptography and socket programming

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

CO1: Understand the basic concepts of Computer Network, and principle of layering (Understand)
CO2: Apply the error detection and correction techniques used in data transmission (Apply)
CO3: Apply IP addressing schemes and sub netting (Apply)
CO4: Understand the concept of routing protocols, Application layer protocols and Network Security (Understand)
CO5: Apply the socket programming basics to create a simple chat application (Apply)

Course Contents

Unit I	**Introduction to Data Communication**	**5 Hrs.**

1.1 Definition and components of data communication
1.2 Data representation (text, numbers, audio, video)
1.3 Communication models: Sender, Receiver, Medium, Message, Protocol
1.4 Types of data transmission: Analog vs Digital
1.5 Data flow directions: Simplex, Half-duplex, Full-duplex
1.6 Networks and their categories (LAN, WAN, MAN)
1.7Protocols and standards

Unit II	**Transmission Media**	**5 Hrs.**

2.1 Guided Media: Twisted pair, Coaxial cable, Optical fiber
2.1 Unguided Media: Radio waves, Microwaves, Infrared
2.2 Comparison of media types (speed, cost, distance, security)
2.3 Transmission impairments: Attenuation, Noise, Distortion

Unit III	**Data Encoding and Transmission**	**5 Hrs.**

3.1 Digital-to-Digital Encoding (NRZ, Manchester, etc.)
3.2 Analog-to-Digital Conversion (Sampling, Quantization, PCM, Delta Modulation)
3.3 Digital-to-Analog (ASK, FSK, PSK, QAM)
3.4 Analog-to-Analog (AM, FM, PM)
3.5 Bandwidth and Bitrate
3.6 Transmission Modes: Synchronous & Asynchronous

Unit IV	Network Devices and Topologies	5 Hrs.
4.1 Devices: Hub, Switch, Router, Bridge, Gateway, Modem 4.2 Network Topologies: Bus, Ring, Star, Mesh, Hybrid 4.3 Comparison and Applications of each topology		
Unit V	**Emerging Trends in Data Communication**	**5 Hrs.**
5.1 Mobile communication (4G/5G overview) 5.2 Wireless networks (Wi-Fi, Bluetooth, Zigbee) 5.3 Satellite Communication 5.4 IoT (Internet of Things) basics 5.5 Network virtualisation & cloud-based networking		

Books

1. *Data Communications and Networking* – Behrouz A. Forouzan – McGraw-Hill Education
2. *Data and Computer Communications* – William Stallings – Pearson Education
3. *Computer Networks* – Andrew S. Tanenbaum, David J. Wetherall – Pearson Education
4. *Computer Networks* – Atul Kahate – McGraw-Hill Education
5. *Data Communications and Computer Networks* – Prakash C. Gupta – PHI Learning
6. *Computer Networking: A Top-Down Approach* – James F. Kurose, Keith W. Ross – Pearson Education
7. *Data Communication and Networking* – Satish Jain – BPB Publications
8. *Fundamentals of Data Communication and Computer Networks* – D.L. Varshney – S.K. Kataria & Sons
9. *Data Communication & Networks* – Achyut S. Godbole – Tata McGraw-Hill
10. *Understanding Data Communications and Networks* – William A. Shay – Brooks/Cole
11. *Introduction to Data Communications and Networking* – Wayne Tomasi – Pearson Education

Savitribai Phule Pune University

Second Year Bachelor of Computer Applications

ELS- 242- MNP: Lab course on ELS – 241 - MN

Teaching Scheme: Practical: 04 Hrs./Week/ Batch	Credits 02	Examination Scheme: Continuous Evaluation: 20 Marks End-Semester: 30 Marks

Course Objectives:

1. Understand the fundamental concepts of data communication systems and signal flow mechanisms.
2. Compare different types of transmission media used in guided and unguided communication.
3. Simulate and implement encoding and modulation techniques used in data transmission.
4. Identify, configure, and analyze the role of network devices and common network topologies.
5. Explore and demonstrate real-world applications of modern communication technologies like IoT, Wi-Fi, and 5G.

Course Outcomes: After suc cessful con pletion of this course, learner will be able to

	Bloom's Level	Description
CO1	Understand	Demonstrate understanding of basic data communication concepts
CO2	Analyze	Compare performance of different transmission media
CO3	Apply	Apply encoding techniques using code/simulation
CO4	Apply & Analyze	Configure networks and analyze device functionality
CO5	Evaluate	Explore and evaluate modern communication technologies

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Guidelines for Student Journal

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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 Nos	List of Assignments
1	**Simulate Data Flow Types (Simplex, Half-Duplex, Full-Duplex)** ➢ Objective: Understand the direction of data flow using Python or diagram tools. ➢ Tools: Python/C or Packet Tracer animation ➢ Output: Directional flow simulation between sender and receiver
2	**Identify and Document Real-life Examples of Communication Systems** • Objective: Classify systems as analog/digital and simplex/full-duplex. • Task: Fill a table based on TV broadcast, telephone, chat, etc.
3	**Practical 3: Comparative Analysis of Transmission Media** • Objective: Create a table comparing Twisted Pair, Coaxial, Fiber Optic, Microwave, Infrared. • Parameters: Bandwidth, Cost, Distance, Interference, Use Cases
4	**Visual Demonstration of Guided vs Unguided Media** • Tools: Packet Tracer or physical lab hardware • Task: Draw or simulate connections using different media types
5	**Implement Digital Encoding Schemes** • Objective: Write a Python/C program to simulate NRZ, Manchester encoding • Output: Bit pattern visualization with timing diagram
6	**Simulate Analog Modulation Techniques (ASK/FSK/PSK)** • Tool: MATLAB / Python / Simulation tools • Objective: Show how digital bits modulate analog signals
7	**Bit Rate and Baud Rate Calculation** • **Write a small tool or calculator in Python that takes input and shows bit rate vs baud rate**
8	**Identify and Compare Networking Devices** • Devices: Hub, Switch, Router, Modem, Gateway, Bridge • Task: Physical or simulated demo + table of functionalities
9	**Create and Simulate Network Topologies in Packet Tracer** • Topologies: Star, Bus, Ring, Mesh • Task: Connect PCs, assign IPs, test ping
10	**Troubleshoot Network with Commands** • Commands: ping, ipconfig, tracert, arp, netstat • Tools: CMD/Terminal • Task: Interpret outputs and explain

Savitribai Phule Pune University
Second Year Bachelor of Computer Applications
CA – 200 – IKS: Indian Knowledge System for Computing

Teaching Scheme: Theory: 02 Hrs./Week	Credits 02	Examination Scheme: Continuous Evaluation: 50 Marks

Course Objectives:

1. To study contributions of Indian scholars to computation and logic.
2. To understand Indian methods for Number representations
3. To know use of Sanskrit in Natural language processing
4. To learn ancient cryptography techniques

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

CO1: List India's contributions to Computing
CO2: Apply Ancient Indian Mathematical concepts in Computing
CO3: Utilize Linguistic and Computational aspects of Sanskrit from IKS in Modern Computing
CO4: Describe Cryptographic techniques from IKS
CO5: Make use of Cybersecurity techniques from IKS
CO6: Illustrate the Role of IKS in Emerging Technologies

Course Contents

Unit I	Introduction to Indian Knowledge Systems (IKS)	05Hrs.

1.1 Introduction IKS
1.2 Defining Indian Knowledge System (IKS) and its components,
1.3 Contribution of Aryabhata and Brahmagupta, Buddhist logico-epistemology
1.4 The knowledge triangle
1.5 Prameya -A vaiśeṣikan approach to physical reality
1.6 Dravyas -the constituents of the physical reality
1.7 Attributes -the properties of substances and Action -the driver of conjunction and disjunction
1.8 sāmānya, viśēṣa, samavāya
1.9 Pramāṇa -the means of valid knowledge
1.10 Samsaya-ambiguities in existing knowledge.

Unit II	Number Systems and Units of Measurement	12 Hrs.

2.1 Number systems in India -Historical evidence
2.2 Salient Features of the Indian Numeral System
  2.2.1 Concept of zero and its importance,
  2.2.2 Large numbers and their representation
  2.2.3 Place Value of Numerals
  2.2.4 Decimal System
2.3 Unique approaches to represent Numbers
  2.3.1 Bhūta-Saṃkhyā system

2.3.2 Śūnyabindu System
2.3.3. Piṅgala and the Binary system
2.4. Measurements for time, distance, and weight in ancient India

Unit III	Linguistics	08 Hrs.

3.1 Introduction to Linguistics
3.2 Aṣṭādhyāyī
3.3 Phonetics
3.4 Word generation
3.5 Computational aspects
3.6 Mnemonics
3.7 Recursive operations -Introduction to use of Kaprekar Constant 6174 in recursion
3.8 Rule based operations
3.9 Sentence formation
3.10 Verbs and prefixes
3.11 Role of Sanskrit in natural language processing

Unit IV	Ancient Cryptography and Security Systems	05 Hrs.

4.1 The Evolution of India's Intelligence Culture-Kautilya's Discourse on Secret Intelligence in the Arthashastra
4.2 Kaṭapayādi system
4.3 Steganography in Kautilya's Arthashastra
4.4 Cryptographic methods in ancient Indian texts
4.5 Relevance to modern-day cybersecurity and encryption
4.6 Introduction to use of Kaprekar Constant (6174) in cryptography

Books

1. B. Mahadevan, Vinayak Rajat Bhat, and R.N. Nagendra Pavana, "Introduction to Indian Knowledge System: Concepts and Applications", PHI Learning, 2022.
2. Dee Hetvik, "Ancient Indian encryption: KaTaPaYadi system", Kindle Edition
3. https://www.geeksforgeeks.org/kaprekar-constant/