Savitribai Phule Pune University

(Formerly University of Pune)

Four Year Degree Program
B.Sc.(Computer Science)

With

Major: Computer Science

(Faculty of Science and Technology)

Syllabi for
F.Y.B.Sc. (Computer Science)

(For Colleges Affiliated to Savitribai Phule Pune University)

Choice Based Credit System (CBCS) Syllabus
Under National Education Policy (NEP)
To be implemented from Academic Year 2024-2025

Title of the Course: B.Sc.(Computer Science)

Preamble:

The B. Sc. (Computer Science) and B. Sc. (Computer Science) (Honors) and (Research) course is a systematically designed program with Computer Science as a major subject under the faculty of Science and Technology. The objective of the course is to prepare students to undertake careers involving problem solving using computer science and technologies, or to pursue advanced studies and research in computer science. The syllabus which comprises of Computer Science (Major) subject along with that of the three allied subjects (Mathematics, Electronics and Statistics) (Minor) covers the foundational aspects of computing sciences and also develops the requisite professional skills and problem solving abilities using computing sciences.

Introduction:

At the first year of under-graduation, the basic foundations of two important skills required for software development are laid. A course in problem solving and programming along with a course in database fundamentals forms the preliminary skill set for solving computational problems. The practical courses are designed to supplement the theoretical training in the year. Along with Computer Science (Major), VSC and SEC courses help in building a strong technical foundation. Another aspect of this course is IKS which tells about the rich heritage and advancement of India in the field of computation.

In the second year of under-graduation, computational problem solving skills are further strengthened by a course in Data structures, C++ and python programming. Software engineering concepts that are required for project design are also introduced. Essential concepts of computer networking are also introduced this year. The practical course included in both semesters complements the theory courses. Field projects/ OJT are introduced so that students can implement the concept they have learnt in first year.

In Second Year, the "Subject 1 : Computer Science" will be the 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

At the third year of under-graduation, all the subjects are designed to fulfill core Computer Science requirements as well as meet the needs of the software industry. Theory courses are adequately supplemented by hands-on practical courses. Major elective courses are taking care of recent advancement in the field of computer science. Minor and Skill Enhancement courses enable the students to acquire additional skills.

At the fourth year (honors) and (research) of under-graduation, all the subjects are designed to fulfill core Computer Science requirements as well as meet the needs of the software industry. Practical courses and field projects enable students to get hands-on training. Various learning tracks are open through Major elective courses. Research methodology course will create interest among the students to carry research in the field of computer science.

Objectives:
- To develop problem solving abilities using a computer.
- To build the necessary skill set and analytical abilities for developing computer based solutions for real life problems.
- To train students in professional skills related to the Software Industry.
- To prepare the necessary knowledge base for research and development in Computer Science.
- To help students build-up a successful career in Computer Science and to produce entrepreneurs who can innovate and develop software products.

Eligibility
a) H.S.C.(10 + 2) Science stream with Mathematics.
b) Three years diploma course after S.S.C.(10th std.) of Board of Technical Education conducted by Government of Maharashtra or its equivalent.

Programme Out comes:

PO No	Outcomes
PO1	Develop creative skills, critical thinking, analytical skills and research to address the real world problems using computational skills
PO2	Understand and apply mathematical foundation, computing and domain knowledge and develop computing models for defined problems
PO3	Understand software project management and computing principles with computing knowledge to manage projects in multidisciplinary environments
PO4	Illustrate the concepts of systems fundamentals, including architectures and organization, operating systems, networking and communication
PO5	Understand and apply the concepts of Digital Electronics, Computer Architecture, IoT etc.
PO6	Recognize the need for and develop the ability to engage in continuous learning as a Computing professional
PO7	Apply modern computing tools, skills and techniques necessary for innovative software solutions
PO8	Communicate effectively with the computing community as well as society by being able to comprehend effective documentations and presentations
PO9	Gain Self Discipline and commit Professional Ethics in global economic environment
PO10	Individual & Team Work: Ability to work as a member or leader in diverse teams in multidisciplinary environment
PO11	Identify opportunities, entrepreneurship vision and use innovative ideas to create value and wealth for the betterment of the individual and society

Savitribai Phule Pune University
Structure of UG Program as per NEP-2020
Name of Program :- B.Sc. (Computer Science)
Major Course:- Computer Science

Level:- 4.5 (First Year)   Sem:-I

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Subject 1	CS-101-T	Problem Solving using 'C' Programming	2		2		15	35	50
	CS-102-P	Lab Course based on CS-101-T		2		4	15	35	50
Subject 2	MTC-101-T	Matrix Algebra	2		2		15	35	50
	MTC-102-P	Mathematics Practical I		2		4	15	35	50
Subject 3	ELC-101-T	Principles of Analog Electronics	2		2		15	35	50
	ELC-102-P	Electronics Practical Course I		2		4	15	35	50
IKS(2)	IKS-100-T	Generic IKS	2		2		15	35	50
GE/OE* (2)	OE-101-CS -T/ OE-102-CS -T/ OE-103-CS-T / OE-104-CS-T	Office Automation I / Introduction to Computers and Basics of Internet / Introduction to Google Apps I / Fundamentals of Computers I	2		2		15	35	50
SEC (2)	SEC-101-CS	Statistical Methods for Computer Science I		2		4	15	35	50
AEC(2)	AEC-101-ENG	English	2		2		15	35	50
VEC(2)	VEC-101-ENV	EVS-I	2		2		15	35	50
Total			14	08	14	16			550

* The subjects offered to other faculty students under OE vertical are OE-101-CS -P/ OE-102-CS -T/OE-103-CS-P / OE-104-CS-T. The students of B.Sc. (Computer Science) will opt the subjects offered by other faculty given in University Basket.

Level:- 4.5 (First Year)   Sem:-II

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Subject 1	CS-151-T	Advanced C Programming	2		2		15	35	50
	CS-152-P	Lab Course Based on CS-151-T		2		4	15	35	50
Subject 2	MTC-151-T	Graph Theory	2		2		15	35	50
	MTC-152-P	Mathematics Practical II		2		4	15	35	50
Subject 3	ELC-151-T	Principles of Digital Electronics	2		2		15	35	50

Course Type	Course Code	Course Title							
	ELC-152-P	Electronics Practical Course II		2		4	15	35	50
GE/OE* (2)	OE-151-CS-T / OE-152-CS-T / OE-153-CS-T OE-154-CS-T OE-155-CS-T	Office Automation II / Computer Fundamentals / Introduction to Google Apps II/ Fundamentals of Computers II / AI Tools for Business		2		4	15	35	50
SEC(2)	SEC-151-CS-P	Statistical Methods for Computer Science II		2		4	15	35	50
AEC(2)	AEC-151-ENG	English	2		2		15	35	50
VEC(2)	VEC-151-ENV	EVS-II	2		2		15	35	50
CC(2)	CC-151-T	From University Basket	2		2		15	35	50
Total			12	10	12	20			550

The subjects offered to other faculty students under OE vertical are OE-151-CS -P/ OE-152-CS -T/OE-153-CS-P / OE-154-CS-T. The students of B.Sc. (Computer Science) will opt the subjects offered by other faculty given in University Basket.

Exit option: *Award of UG Certificate in Major with 44 credits and an additional 4 credits core as per university guidelines OR Continue with Major and Minor*
Continue option: Student will select one subject among the (subject 2 and subject 3) as minor and subject 1 will be major subject

In Second Year, the "Subject 1 : Computer Science" 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	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core (4+2)	CS-201-MJ-T	Data Structure -I	2		2		15	35	50
	CS-202-MJ-T	Database Management System I	2		2		15	35	50
	CS-203-MJ-P	Lab Course based on CS-201-MJ-T & CS-202-MJ-T		2		4	15	35	50
VSC(2)	CS-221-VSC-T	Software Engineering	2		2		15	35	50
IKS	IKS-200-T	Computations in Ancient India	2		2		15	35	50
FP/OJT/ CEP(2)	CS-231-FP	Mini Project		2		4	15	35	50
Minor (2+2)	CS-241-MN-T	Mathematics or Electronics	2		2		15	35	50
	CS-242-MN-P	Mathematics or Electronics		2		4	15	35	50
GE/OE(2)	OE-201-CS-T OE -202-CS-P OE-203-CS-T	E commerce / Web Design / Digital Marketing	2		2		15	35	50

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
AEC(2)	AEC-201-T	From University Basket	2		2		15	35	50
CC(2)	CC-201-T	From University Basket	2		2		15	35	50
Total			16	06	16	12			550

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

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core (4+2)	CS-251-MJ-T	Data Structure - II	2		2		15	35	50
	CS-252-MJ-T	Database Management System II	2		2		15	35	50
	CS-253-MJ-P	Lab Course based on CS-251-MJ-T & CS-252-MJ-T		2		4	15	35	50
VSC(2)	CS-221-VSC-P	Advanced Python Programming		2		4	15	35	50
FP/OJT/ CEP(2)	CS-281-FP	Mini Project		2		4	15	35	50
Minor (2+2)	CS-291-MN-T	Mathematics or Electronics	2		2		15	35	50
	CS-292-MN-P	Mathematics or Electronics		2		4	15	35	50
GE/OE(2)	OE-251-CS-T / OE-252-CS-P / OE-253-CS-T	E commerce / Web Design / Digital Marketing		2		4	15	35	50
SEC(2)	SEC-251-CS-P / SEC-252-CS-P	Computer Networks / Statistical Analysis using R Software		2		4	15	35	50
AEC(2)	AEC251	From University Basket	2		2		15	35	50
CC(2)	CC-251-T	From University Basket	2		2		15	35	50
Total			10	12	10	24			550

Exit option: Award of UG Diploma in Major and Minor with 88 credits and an additional 4 credits core as per university guidelines OR Continue with Major and Minor

Level:- 5.5 (Third Year)   Sem:-V

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core (8+4)	CS-301-MJ-T	Core Java	2		2		15	35	50
	CS-302-MJ-T	Operating Systems	2		2		15	35	50
	CS-303-MJ-T	Web Technology-I	2		2		15	35	50
	CS-304-MJ-T	Theory of Computer Science	2		2		15	35	50

Course Type	Course Code	Course Title	TH	PR	TH	PR	CE	EE	Total
	CS-305-MJ-P	Lab Course based on CS-302-MJ-T		2		4	15	35	50
	CS-306-MJ-P	Lab Course based on CS-301-MJ-T & CS-303-MJ-T		2		4	15	35	50
Major Elective (2+2)	CS-307-MJ-T	Data Science	2		2		15	35	50
	CS-308-MJ-P	Lab Course based on CS-307-MJ-T		2		4	15	35	50
	OR								
	CS-309-MJ-T	Database Technologies	2		2		15	35	50
	CS-3010-MJ-P	Lab Course on CS-309-MJ-T		2		4	15	35	50
	OR								
	CS-3011-MJ-T	Embedded Systems	2		2		15	35	50
	CS-3012-MJ-P	Lab Course on CS-3011-MJ-T		2		4	15	35	50
VSC(2)	CS-321-VSC-P	Advanced Python Programming		2		4	15	35	50
FP/OJT/ CEP(2)	CS-331-FP	Project		2		4	15	35	50
Minor (2)	CS-341-MN-T	Mathematics or Electronics	2		2		15	35	50
Total			12	10	12	20			550

Level:- 5.5 (Third Year)   Sem:-VI

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core (8+4)	CS-351-MJ-T	Advanced Java	2		2		15	35	50
	CS-352-MJ-T	Design Framework	2		2		15	35	50
	CS-353-MJ-T	Web Technology-II	2		2		15	35	50
	CS-354-MJ-T	Compiler Construction	2		2		15	35	50
	CS-355-MJ-P	Lab Course based on CS-352-MJ-T		2		4	15	35	50
	CS-356-MJ-P	Lab Course based on CS-351-MJ-T & CS-353-MJ-T		2		4	15	35	50
Major Elective (2+2)	CS-357-MJ-T	Android Programming	2		2		15	35	50
	CS-358-MJ-P	Lab Course based on CS-357-MJ-T		2		4	15	35	50
	OR								
	CS-359-MJ-T	Software Testing Tools	2		2		15	35	50
	CS-3510-MJ-P	Lab Course based on CS-359-MJ-T		2		4	15	35	50
	OE								
	CS-3511-MJ-T	Internet of Things							
	CS-3512-MJ-P	Lab Course based on CS-3511-MJ-T							
VSC(2)	CS-321-VSC-P	Agile Processes		2		4	15	35	50
FP/OJT/ CEP(4)	CS-381-OJT	OJT		4		8	30	70	100

Total			10	12	10	24			550

Level:- 6.0 (Fourth Year)   Sem:-VII (Research)

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core (6+4)	CS-401-MJ-T	Advanced Operating System	2		2		15	35	50
	CS-402-MJ-T	Artificial Intelligence	2		2		15	35	50
	CS-403-MJ-T	Principles of Programming Language	2		2		15	35	50
	CS-404-MJ-P	Lab Course based on CS-401-MJ-T		2		4	15	35	50
	CS-405-MJ-P	Lab Course based on CS-402-MJ-T		2		4	15	35	50
Major Elective (2+2)	CS-406-MJ-T	Advance Databases and Web Technologies	2		2		15	35	50
	CS-407-MJ-P	Lab Course on CS-406-MJ-T		2		4	15	35	50
	OR								
	CS-408-MJ-T	Cloud Computing	2		2		15	35	50
	CS-409-MJ-P	Lab Course on CS-408-MJ-T		2		4	15	35	50
	OR								
	CS-410-MJ-T	C# .NET Programming	2		2		15	35	50
	CS-411-MJ-P	Lab Course on CS-410-MJ-T		2		4	15	35	50
FP/OJT/ CEP/RP(4)	CS-431-RP	Research Project		4		8	30	70	100
	CS-451-MN	Research Methodology	4		4		30	70	100
Total			12	10	12	20			550

Level:- 6.0 (Fourth Year)   Sem:-VIII (Research)

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core (6+4)	CS-451-MJ-T	Design and Analysis of Algorithms	2		2		15	35	50
	CS-452-MJ-T	Mobile App Development Technologies	2		2		15	35	50

	CS-453-MJ-T	Software Project Management	2		2		15	35	50
	CS-454-MJ-P	Lab Course based on CS-451-MJ-T		2		4	15	35	50
	CS-455-MJ-P	Lab Course based on CS-452-MJ-T		2		4	15	35	50
Major Elective (2+2)	CS-456-MJ-T	Full Stack Development I	2		2		15	35	50
	CS-457-MJ-P	Lab Course based on CS-456-MJ-T		2		4	15	35	50
	OR								
	CS-458-MJ-T	Web Services	2		2		15	35	50
	CS-459MJ-P	Lab Course based on CS-458-MJ-T		2		4	15	35	50
	OR								
	CS-460-MJ-T	ASP DOT Net Programming	2		2		15	35	50
	CS-461-MJ-P	Lab Course based on CS-460-MJ-T		2		4	15	35	50
FP/OJT/ CEP(8)	CS-481-FP	Research Project		8		16	60	140	200
Total			08	14	08	28			550

Level:- 6.0 (Fourth Year)   Sem:-VII (Honors)

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core (10+4)	CS-401-MJ-T	Advanced Operating System	2		2		15	35	50
	CS-402-MJ-T	Artificial Intelligence	2		2		15	35	50
	CS403MJ-T	Principles of Programming Language	2		2		15	35	50
	CS-404-MJ-P	Lab Course based on CS401MJ		2		4	15	35	50
	CS-405-MJ-P	Lab Course based on CS402MJ		2		4	15	35	50
	CS-406-MJ-T	Advanced Networking	2		2		15	35	50
	CS-407-MJ-T	Digital Marketing	2		2		15	35	50
Major Elective (2+2)	CS-408-MJ-T	Advance Databases and Web Technologies	2		2		15	35	50
	CS-409-MJ-P	Lab Course on CS-408-MJ-T		2		4	15	35	50
	OR								
	CS-410-MJ-T	Cloud Computing	2		2		15	35	50
	CS-411-MJP-T	Lab Course on CS-410-MJ-T		2		4	15	35	50
	OR								
	CS-412-MJ-T	C# .NET Programming	2		2		15	35	50
	CS-413-MJ-P	Lab Course on CS-412-MJ-T		2		4	15	35	50
	CS-441-MN-T	Research Methodology	4		4		30	70	100
Total			16	06	16	12			

Level:- 6.0 (Fourth Year)   Sem:-VIII (Honors)

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core (10+4)	CS-451-MJ-T	Design and Analysis of Algorithms	2		2		15	35	50
	CS-452-MJ-T	Mobile App Development Technologies	2		2		15	35	50
	CS-453-MJ-T	Software Project Management	2		2		15	35	50
	CS-454-MJ-P	Lab Course based on CS-451-MJ-T		2		4	15	35	50
	CS-455-MJ-P	Lab Course based on CS-452-MJ-T		2		4	15	35	50
	CS-456-MJ-T	Crypto Currency Technologies	2		2		15	35	50
	CS-457-MJ-T	Cyber Security	2		2		15	35	50
Major Elective (2+2)	CS-458-MJ-T	Full Stack Development I	2		2		15	35	50
	CS-459-MJ-P	Lab Course based on CS-458-MJ-T		2		4	15	35	50
	OR								
	CS-460-MJ-T	Web Services	2		2		15	35	50
	CS-461-MJ-P	Lab Course based on CS-460-MJ-T		2		4	15	35	50
	OR								
	CS-462-MJ-T	ASP DOT Net Programming	2		2		15	35	50
	CS-463-MJ-P	Lab Course based on CS-462-MJ-T		2		4	15	35	50
FP/OJT/ CEP(4)	CS-481-OJT	OJT		4		8	30	70	100
Total			12	10	12	20			

Semester I

Savitribai Phule Pune University		
F.Y.B.Sc. (Computer Science) - Sem – I		
Course Type: Subject 1 Code : CS-101-T		
Course Title :Problem Solving Using C Programming		
Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks

Prerequisites
- Previous knowledge of any programming concepts is assumed.
- Knowledge of mathematical operators.
- Students think out of the box i.e. imagination power.

Course Objectives
- To introduce the foundations of computing, programming and problem- solving using computers.
- To develop the ability to analyze a problem and devise an algorithm to solve it.
- To formulate algorithms, pseudocodes and flowcharts for arithmetic and logical problems.
- To understand structured programming approaches.
- To implement algorithms in the 'C' language.
- To test, debug and execute programs.

Course Outcomes

On completion of the course, student will be able to :
- Explore algorithmic approaches to problem solving.
- Control the sequence of the program and give logical outputs.
- Understand and manage Input /Output operations in 'C' program
- Develop modular programs using control structures and arrays in 'C'.

Course Contents

Chapter 1	**Problem Solving Aspects**	**5 Hrs**

1.1. Introduction to problem solving using computers.
1.2. Problem solving steps.
1.3 Algorithms-definition, characteristics,examples, advantages and limitations.
1.4 Flowcharts - definition, notations, examples , advantages and limitations, Comparison with algorithms.
1.5 Programming Languages as tools, programming paradigms, types of languages

1.6 Compilation process (compilers, interpreters), linking and loading, syntax and semantic errors, testing a program

1.7 Good Programming Practices (naming conventions, documentation, indentation).

Chapter 2	'C' Fundamentals	6Hrs

2.1 History of 'C' language.

2.2 Application areas.

2.3 Structure of a 'C' program.

2.4 'C' Program development life cycle.

2.5 Function as building blocks.

2.6 'C' tokens

2.7 Character set, Keywords , Identifiers

2.8 Variables, Constants (character, integer, float, string, escape sequences, enumeration constant).

2.9 Data Types (Built-in and user defined data types).

2.10 Operators, Expressions, types of operators, Operator precedence and Order of evaluation.

2.11 Character input and output.

2.12 String input and output.

2.13 Formatted input and output.

Chapter 3	Control Structures	6 Hrs

3.1 Decision making structures:- if ,if-else, switch and conditional operator.

3.2 Loop control structures:- while ,do while, for.

3.3 Use of break and continue.

3.4 Nested structures.

3.5 Unconditional branching (goto statement).

Chapter 4	Functions	6Hrs

4.1 Concept of function, Advantages of Modular design.

4.2 Standard library functions.

4.3 User defined functions:- declaration , definition, function call, parameter passing (by value , by reference), return statement.

4.4 Recursive functions.

4.5 Scope of variables and Storage classes.

Chapter 5	Arrays	7Hrs

5.1 Concept of array.

5.2 Types of Arrays – One, Two and Multidimensional array.

5.3 Array Operations - declaration, initialization, accessing array elements.

5.4 Memory representation of two-dimensional array (row major and column major)

5.5 Passing arrays to function.

5.6 Array applications - Finding maximum and minimum, Counting occurrences, Linear search, Sorting an array (Simple exchange sort, bubble sort), Merging two sorted arrays, Matrix operations (trace of matrix, addition, transpose, multiplication, symmetric, upper/ lower triangular matrix)

Reference Books:

R1. How to Solve it by Computer, R.G. Dromey, Pearson Education.

R2. Problem Solving and Programming Concept, Maureen Sprankle,7th Edition, Pearson Publication.

R3. C: the Complete Reference, Schildt Herbert, 4th edition, McGraw Hill

R4. A Structured Programming Approach Using C, Behrouz A. Forouzan, Richard F. Gilberg, Cengage Learning India

R5. The 'C' programming language, Brian Kernighan, Dennis Ritchie, PHI

R6. Programming in C ,A Practical Approach, Ajay Mittal , Pearson

R7. Programming with C, B. Gottfried, 3rd edition, Schaum's outline Series, Tata McGraw Hill.

R8. Programming in ANSI C, E. Balagurusamy, 7th Edition, McGraw Hill.

Savitribai Phule Pune University F.Y.B.Sc. (Computer Science) - Sem – I Course Type: Subject 1 Code : CS-102-P Course Title :Lab Course based on CS-101-T		
Teaching Scheme 3 4 Hrs /Week	No. of Credits 2	Examination Scheme IE:15 Marks UE: 35 Marks

Prerequisites
- Previous knowledge of any programming concepts is assumed.
- Knowledge of mathematical operator.
- Student think the out of box ie imagination power.

Course Objectives.
- Explore and develop the algorithmic approaches to problem solving.
- Understand and implement modular programs using control structures and arrays in 'C'.
- Implement programming logic and also test, debug and execute programs.
- Implement Control the sequence of the program and give logical outputs.

Course Outcomes:-

On completion of this course, students will be able to:
- Explore and develop the algorithmic approaches to problem solving.
- Understand and implement modular programs using control structures and arrays in 'C'.
- Implement programming logic and also test, debug and execute programs.
- Implement Control the sequence of the program and give logical outputs.

Guidelines:

LabBook: The lab book is to be used as a hands-on resource, reference and record of assignment submission and completion by the student. The lab book contains the set of assignments which the student must complete as a part of this course.

Submission:

Problem Solving Assignments:

The problem solving assignments are to be submitted by the student in the form of a journalcontainingindividualassignmentsheets.EachassignmentincludestheAssignmentTitle, Problem statement, Date of submission, Assessment date, Assessment grade and instructors sign.

Programming Assignments:

Programs should be done individually by the student in the respective login. The codes should be uploaded on either the local server, Moodle, Github or any open source LMS. Print-outs of the programs and output may be taken but not mandatory for assessment.

Assessment:

Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes and good programming practices.

Operating Environment:

For 'C' Programming:

Operating system: Linux

Editor: Any linux based editor like vi, edit etc.

Compiler: cc or gcc

LAB Course Contents
A) C Programming

Assignment 1	**Problem Solving Aspects**
● Pseudo-code to programs. ● Compilation process (compilers , interpreters), linking and loading, syntax and semantic errors, testing a program ● Practices (naming conventions, documentation, indentation).	
Assignment 2	**'C' Fundamentals**
● 'C' tokens and Character set, Keywords , Identifiers ● character, integer, float, string, escape sequences, enumeration constant. ● Built-in and user defined data types and Operators, Expressions, types of operators, Operator precedence and Order of evaluation.	
Assignment 3	**Control Structures : Conditional Structures**

- Use of if ,if-else, and.
- Use of Switch case
- Use of conditional operator

Assignment 4	Control Structures : Loop Control Structures

- Use of While loop
- Use of Do While loop
- Use of for lo
- Use of break and continue.
- Nested structures and goto statement.

Assignment 5	Control Structures : Break continue and Nested Loop

- Use of break and continue.
- Nested structures and goto statement.

Assignment 6	Functions

- User defined functions:- declaration , definition, function call, parameter passing (by value), return statement.
-

Assignment 7	Recursive Functions

- Use of Recursive functions.

Assignment 8	Scope of variables

- Use of Scope of variables
- Use of Storage classes.

Assignment 9	One Dimensional Arrays

- One Dimensional Arrays (1D) Operations - declaration, initialization, accessing array elements.
-

Assignment 10	One Dimensional Arrays : passing array to function

- Assignment on Passing 1D arrays to function

Assignment 11	One Dimensional Arrays : Array Operations

- Finding maximum and minimum, Counting occurrences, Linear search,

Assignment 12	One Dimensional Arrays : Sorting and Searching

- Sorting an array (Simple exchange sort, bubble sort (ie arrange the data in ascending and descending order))

Assignment 13	Two Dimensional Arrays : Basic Operations

- Two and Multidimensional array(2D) Operations - declaration, initialization, accessing array.

Assignment 14	Two Dimensional Arrays : Passing 2D arrays to functions

- Passing 2D arrays to function.
- Merging two sorted arrays,

Assignment 15	Two Dimensional Arrays : matrix operations

- Matrix operations :

▪ Transpose
▪ Addition,
▪ Subtraction
▪ Multiplication
▪ Symmetric,
Diagonal/upper/ lower triangular matrix

Reference Books:
R1. How to Solve it by Computer, R.G. Dromey, Pearson Education.
R2. Problem Solving and Programming Concept, Maureen Sprankle,7th Edition, Pearson Publication.
R3. C: the Complete Reference, Schildt Herbert, 4th edition, McGraw Hill
R4. A Structured Programming Approach Using C, Behrouz A. Forouzan, Richard F. Gilberg, Cengage Learning India
R5. The 'C' programming language, Brian Kernighan, Dennis Ritchie, PHI
R6. Programming in C ,A Practical Approach, Ajay Mittal , Pearson
R7. Programming with C, B. Gottfried, 3rd edition, Schaum's outline Series, Tata McGraw Hill.
R8. Programming in ANSI C, E. Balagurusamy, 7th Edition, McGraw Hill.

Note: Lab Book be prepared for this course by BOS.

Savitribai Phule Pune University		
F.Y.B.Sc. (Computer Science) - Sem – I		
Course Type: Subject 2 Code : MTC-101-T		
Course Title :Matrix Algebra		
Teaching Scheme 02 Hrs / week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks

Aims :
- To give the students a sufficient knowledge fundamental principles ,methods and a clear perception of innumerous power of mathematical ideas and tools and know how to use them by modeling , solving and interpreting.
- Reflecting the broad nature of the subject and developing mathematical tools for continuing further study in various fields of science.
- Enhancing students' overall development and to equip them with mathematical modeling abilities, problem solving skills,
- Creative talent and power of communication necessary for various kinds of employment.
- Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study
- To test, debug and execute programs.

Course Objectives
- A student should be able to recall basic facts about mathematics and should be able to display knowledge of conventions such as notations , terminology and recognize basic geometrical figures and graphical displays, state important facts resulting from their studies.

- A student should get a relational understanding of mathematical concepts and concerned structures, and should be able to follow the patterns involved, mathematical reasoning .
- A student should get adequate exposure to global and local concerns that explore them many aspects of Mathematical

Course Outcomes

Upon successful completion of this course, the student will be able to:

- Work with graphs and identify certain parameters and properties of the given graphs.
- Perform certain algorithms, justify why these algorithms work, and give some estimates of the running times of these algorithms.
- Solve basic exercises of the type: given a graph with properties X, prove that the graph also has property Y.
- Develop an appreciation for the literature on the subject and be able to read and   present results from the literature.
- Write cohesive and comprehensive solutions to exercises and be able to defend their arguments.

Course Contents

Chapter 1	Matrices	10 Hrs
1.1	Matrix Operations	
1.2	Elementary Matrices, Elementary Row operations	
1.3	Row reduction and echelon forms	
1.4	LU factorization of a matrix	

Chapter 2	Determinants	5 Hrs
2.1 Introduction to determinants		
2.2 Properties of determinants		
2.3 Determinant by Row reduction		
2.4 Determinant by Cofactor expansion along any row or column		

Chapter 3	Invertible matrices	5 Hrs
3.1	3.1 The inverse of a matrix	
3.2	Characterization of invertible matrices	
3.3	To find inverse of a matrix by Row reduction	
	To find inverse of a matrix by Adjoint Method	

Chapter 4	Linear Equations	10 Hrs
3.1	System of Linear equations	
3.2	The matrix equation Ax=b	
3.3	Gauss Elimination Method	
3.4	Cramer's rule	
3.5	Application of LU decomposition to solve system Ax=b	

Books:

Text Book : Linear Algebra and its Applications (5th Edition)

David C Lay, Steven R. Lay, Judi J. MacDonald

Pearson Publication,2016

ISBN 978-0-321-98238-4

Unit 1: Sections 1.1, 1.2, 1.3.

Unit 2 : Sections 3.1, 3.2.

Unit 3 : Sections 2.1, 2.2, 2.3.

Unit 4: Sections 1.4, 1.5,1.6 , 3.3.

Reference Books :

1. Elementary Linear Algebra with supplemental Applications
   Author : Howard Anton and others
   Wiley Student Edition
2. Matrix and Linear Algebra (aided with MATLAB)
   Author :Kanti Bhushan Datta
   Eastern Economic Edition

Savitribai Phule Pune University
F.Y.B.Sc. (Computer Science) - Sem – I
Course Type: Subject 2   Code : MTC-101-P
Course Title :Mathematics Practical I

Teaching Scheme 3 4 Hrs /Week	No. of Credits 2	Examination Scheme IE:15 Marks UE: 35 Marks
Assignment 1	**Introduction to Python**	
- Installation of Python - Values and Types : int , float, str etc - Variables : assignment statements , printing variable values , types of variables - Boolean operators, Logical operators - Mathematical functions from math ,cmath,modules.		
Assignment 2	**Python Strings**	
- Accessing values in strings - Updating strings - String special operators - Concatenation - Repetition		
Assignment 3	**Python List and Python Tuple**	

- Accessing Values
- Updating
- Delete elements
- Basic operations
- Indexing, Slicing
- Built-in Functions

Assignment 4	Python Set

- To create a set
- To change a set in Python
- To remove elements from a set
- Python Set Operations
- Built-in Functions with Set

Assignment 5	Python Dictionary

- To create a Dictionary
- To change a Dictionary in Python
- To remove elements from a Dictionary
- Python Dictionary Operations
- Built-in Functions with Dictionary.

Assignment 6	Decision making Statements

- IF statement
- IF...ELIF...ELSE Statements:
- Nested IF statements:
- while loop
- for loop

Assignment 7	Use SymPy for basic Operations On Matrices

- Addition , Subtraction , Multiplication , power etc
- To Accessing elements, Row, Column of Matrix.
- To create some standard Matrices.

Assignment 8	Use SymPy for Operations on Matrices

- To insert an element in any row or column
- To insert matrix into matrix
- To delete any row or column
- Elementary row opreations

Assignment 9	Use Sympyto obtain

- The determinants of Matrix.
- The rank of Matrix
- The transpose Of Matrix
- The reduced row echelon form of Matrix

Assignment 10	Use SymPy to obtain

- The inverse of a matrix
- The inverse of a matrix by Row reduction
- The minor and co factors of matrix
- The inverse of a matrix by Adjoint Method

Assignment 11	Use SymPy to obtain

- Lower triangular matrix
- Upper triangular matrix

● LU decomposition of matrix	
Assignment 12	**Use SymPy to solve System of Linear equations**
● Cramer's Rule ● Gauss Elimination Method ● Gauss Jordan Method ● LU decomposition Method .	

Savitribai Phule Pune University F.Y.B.Sc. (Computer Science) - Sem – I Course Type: Subject 3 Code : ELC-101-T Course Title : Principles of Analog Electronics		
Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks

Course Objectives

- To study various types of semiconductor devices
- To study elementary electronic circuits and systems
- To study Instrumentation System
- To study various blocks of instrumentation System
- To study smart instrumentation system

Course Outcomes

- Understand the concept of semiconductor diodes.
- Understand the different applications of FET, BJT and MOSFET.
- Understand working principle of different sensors.
- Use Op-amp for different application.

Course Contents

Chapter 1	**Semiconductor Diodes**	**05 Hrs**
	Semiconductor, P and N type semiconductors, Formation of PN junction diode, it's working. Zener diode, LED, Photo diode (Symbol, working principal, list of applications only)	
Chapter 2	**Bipolar Junction Transistor (BJT)**	**05 Hrs**
	Bipolar Junction Transistor (BJT) symbol, types, construction, working principle, Transistor. Amplifier configurations - CB, CC (only concept), CE configuration: input and output characteristics, Definition of α, β and ϒ , Concept of Biasing (numerical problems not expected),	
Chapter 3	**Oscillators**	**05 Hrs**
	Barkhauson Criteria, Low frequency Wein-bridge oscillator, High frequency crystal oscillator	
Chapter 4	**Data converters**	**05 Hrs**

Need of Digital to Analog converters, parameters, weighted resistive network, R-2R ladder network, need of Analog to Digital converters, parameters, Flash ADC

Chapter 5	Introduction to Instrumentation System	05 Hrs

Block diagram of Instrumentation system, Definition of sensor and transducer Classification of sensors: Active and passive sensors. Specifications of sensors: Accuracy, range, linearity, sensitivity, resolution, reproducibility. Temperature sensor (Thermistor, LM-35), Passive Infrared sensor (PIR),

Actuators: DC Motor, stepper motor

Chapter 6	OPAMP as signal Conditioner	05 Hrs

Concept, block diagram of Op amp, basic parameters (ideal and practical): input and output impedance, bandwidth, differential and common mode gain, CMRR, slew rate, IC741/ LM324, Concept of virtual ground.

Reference Books:

1. Electronic Devices and Circuits I – T. L. Floyd- PHI Fifth Edition
2. Principles of Analog Electronics - A.P. Malvino
3. Sedha R.S., A Text Book Of Applied Electronics, S. Chand & Company Ltd
4. Sensors and Transducers : D. Patranabis, PHI publication, 2nd Edition
5. Sensors and Transducers : Prof A.D. Shaligram
6. Op Amp and Linear Integrated Circuits: Ramakant Gaykwad

Savitribai Phule Pune University
F.Y.B.Sc. (Computer Science) - Sem – I
Course Type: Subject 3   Code : ELC-102-P
Course Title : Electronics Practical Course I

Teaching Scheme 04 Hrs/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks

Course Objectives

- To study different semiconductor diodes.
- To understand applications of IC 555 as a multivibrator.
- To study different applications of op-amp.
- To understand applications of sensors

Course Outcomes

- Use different semiconductor diodes for various applications.

- Understand the different applications of FET, BJT and MOSFET.

- Use of different sensors for parameter measurement

Course Contents	
Group A (Any 13)	
1.	Study of forward and reverse bias characteristics of PN junction diode.
2.	To study the forward characteristics of LED for different colours
3.	Study of Zener diode as a voltage regulator
4.	Study of Optocoupler (mechanism and characteristics, Working principle of Light emitting diode, photo diode)
5.	Study of Transistor as a switch.
6.	Study of Transistor as a switch.
7.	Study of IC 555 as astable multivibrator used as square wave generator / clock
8.	Study of Digital to Analog Converter using R-2R ladder network
9.	Study of optical sensor (LDR)
10.	Study of temperature sensor (LM35)
11.	Study of PIR sensor
12.	Study of Study of Op amp as inverting/non-inverting amplifier
13.	Op Amp as a Unity gain follower
14.	Study of Op-amp as adder/subtractor
15.	Study of Flash ADC.
16.	Study of Wein-bridge oscillator.
17.	Study of crystal oscillator

Group B: Activity (Any 1: Equivalent to 2 Practicals)

1. Bipolar Junction Transistor (BJT) symbol, types, construction, working principle, Transistor. Amplifier configurations - CB, CC (only concept), CE configuration: input and output characteristics, Definition of α, β and Υ , Concept of Biasing (numerical problems not expected), Identification of components (Passive and Active) and study of multimeter -

   a. Minimum 10 different types of components are expected.

   b. Identification based on visual inspection / data sheets.

   c. Measure the various parameters using multimeter.

2. Technical survey of 5 electronic appliances used in different fields (Home, Hospital, Agriculture, Chemical industry, Automobile industry)

(Note: basics of the devices will be explained in theory and practical will be based on applications of different types and configurations of the devices learnt in theory. In this way they will learn in class as well as in lab and more concepts can be covered in given number of credits.)

Suggested Readings/Material:

1. Electronic Devices and Circuits I – T. L. Floyd- PHI Fifth Edition
2. Principles of Analog Electronics - A.P.Malvino
3. Sedha R.S., A Text Book Of Applied Electronics, S.Chand& CompanyLtd
4. Sensors and Transducers : D. Patranabis, PHI publication, 2nd Edition
5. Sensors and Transducers : Prof A.D.Shaligram
6. Op Amp and Linear Integrated Circuits: Ramakant Gaykwad

Savitribai Phule Pune University
F.Y.B.Sc. (Computer Science) - Sem – I
Course Type: GE/OE Code : OE-101-CS-T
Course Title :Office Automation I

Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks

Prerequisites
- Previous knowledge of Computer concepts is assumed.
- Knowledge of Computer as operational tool is required.

Course Objectives
- To introduce the foundations of office automation especially word processing.
- To develop the ability to prepare the well formatted word documents.
- To prepare the documents using word processing tools such as tables, figures, shapes etc.
- To prepare the word documents using advanced automated features.

Course Outcomes
On completion of the course, student will be able to :
- Prepare the professional word documents
- Explore various tools in the word processing software.
- Develop documents using word processing advanced tools.

Course Contents

Chapter 1	Working with Documents.	2 Hrs

1.1. Opening & Saving files,
1.2. Editing text documents, Inserting, Deleting,
1.3. Cut, Copy, Paste, Undo, Redo,
1.4. Find, Search, Replace,
1.5. Formatting page &setting Margins,
1.6. Converting files to different formats,
1.7. Importing & Exporting documents, Sending files to others,

	1.8. Using Tool bars, Ruler, Using Icons, using help	
Chapter 2	**Formatting Documents**	**2 Hrs**
	2.1 Setting Font styles 2.2 Font selection- style, size, colour, etc. 2.3 Type face - Bold, Italic, Underline, 2.4 , Case settings, Highlighting, Special symbols. 2.5 Setting Paragraph style. 2.6 Alignments, Indents, Line Space, Margins, 2.7 , Bullets & Numbering	
Chapter 3	**Setting Page Style**	**4 Hrs**
	3.1 Formatting Page 3.2 Page tab : Margins, Layout settings, Paper tray 3.3 Border & Shading 3.4 Columns 3.5 Header & Footer 3.6 Setting Footnotes & End notes 3.7 Shortcut Keys; Inserting manual page break, Column break and line break 3.8 Creating sections & frames 3.9 Anchoring & Wrapping 3.10 Printing Documents	
Chapter 4	**Setting Document Styles**	**2 Hrs**
	4.1 Table of Contents 4.2 Index 4.3 Page Numbering 4.4 date & Time, Author, etc. 4.5 Creating Master Documents 4.6 Web page	
Chapter 5	**Creating Tables**	**7 Hrs**
	5.1 Table settings and Drawing - Inserting ClipArts, Pictures/Files etc., 5.2 Borders, Alignments, 5.3 Insertion, deletion, 5.4 , Merging, Splitting, 5.5 Sorting, 5.6 Formula	
Chapter 6	**Special Features**	**6 Hrs**
	6.1 Inserting Formula, equation, symbols 6.2 Inserting Cliparts, pictures, objects, word art 6.3 Drawing: shapes, smart art, etc 6.4 Charts 6.5 Hyperlinks, bookmarks, cross-references, Digital Signature	
Chapter 7	**Tools**	**7 Hrs**

7.1 Word Completion, Spell Checks,

7.2 Mail merge

7.3 Templates,

7.4 Creating contents for books, Creating Letter/Faxes, Creating Web pages 7.5 Hyperlinks, bookmarks, cross-references

7.5 Using Wizards

7.6 Tracking Changes, Security,.

Reference Books :

1. Illustrated Microsoft Office 365 & Word 2019 Comprehensive by Jennifer Duffy
2. Microsoft Word 365 2019 by Joan Lambert
3. Microsoft Word 2013 Bible by Lisa A Bucki

Savitribai Phule Pune University
F.Y.B.Sc. (Computer Science) - Sem – I
Course Type: GE/OE Code : OE-102-CS-T
Course Title : Introduction to Computers and Basics of Internet

Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks

Prerequisites
- Basic knowledge of Computer concepts is assumed.
- Knowledge of Computer as operational tool is required.

Course Objectives
- To introduce the fundamental concepts of computers
- To introduce the basic concepts of Internet
- To develop the ability to analyses and use the computer peripherals effectively
- To develop the ability to analyses and use the internet effectively

Course Outcomes
On completion of the course, student will be able to :
- Use the computer peripherals effectively
- Use the internet for the day to day life
- Explore various applications available over the internet.

Course Contents

Chapter 1	Fundamentals of Computers	8 Hrs
1.1	Overview of a Computer-Definition, functionalities of Computer	
1.2	Generations and Classification of Computers	
1.3	Functional Components of a Computer	
1.4	Applications Of Computers	
1.5	Software and Hardware-Definition, types of software	

1.6	Introduction to various Operating systems-Windows,Linux,Android,IOS	
Chapter 2	**Introduction to various Computer applications**	**6 Hrs**

2.1 Various Explorers

2.2 Editors such as Notepad, wordpad

2.3 Calculator, calendar, etc

2.4 , Paint.

2.5 Various browsers

2.6 Internet settings

Chapter 3	**Basics of Internet**	**6 Hrs**

3.1 Definition and History of Internet

3.2 Uses and Applications of Internet

3.3 Definition of Web

3.4 Website Address and URL

3.5 Different types of Internet Connections:

- Dial up Connection
- Broad Band (ISDN, DSL, Cable)
- Wireless (Wi-Fi, WiMax, Satellite, Mobile) naming convention

3.6 Modes of Connecting Internet (Hotspot, Wi-Fi, USB Tethering)

Chapter 3	**Browsers and Email**	**10 Hrs**

3.1 Search Engines

3.2 Web Browsers

- Popular Web Browsers (Microsoft Edge, Google Chrome, Mozilla Firefox,Safari, etc.)
- Popular Search Engines.(Google, Bing, Startpage ,DuckDuckGo etc..)

3.3 Portals

3.4 Social Networking sites, blogs

3.5 Using Browsers :

- Viewing webpage
- Downloading and uploading the website

3.6 E-mail:

- Configuring an E-mail Account
- Composing and Sending Mail

- Receiving, Replying to and Forwarding Mail
- Attachments to email

Reference Books:

1. Computer Fundamentals by P.K. Sinha &Priti Sinha, 3rd edition, BPB pub.

2.Fundamental of Computers – By V. Rajaraman B.P.B. Publications

3. The Internet Book by Douglas E Comer

E-Books and Online Learning Material

1. https://www.geeksforgeeks.org/computer-fundamentals-tutorial/

2. https://www.javatpoint.com/computer-fundamaentals

Savitribai Phule Pune University F.Y.B.Sc. (Computer Science) - Sem – I Course Type: GE/OE Code : OE-103-CS-T Course Title : Introduction to Google Apps I		
Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks

Prerequisites
- Basic knowledge of Computer concepts is assumed.
- Knowledge of Computer as operational tool is required.
- Knowledge of Internet is required

Course Objectives
- To introduce the foundations of various Google tools.
- To develop the ability to analyses and use the tools effectively

Course Outcomes

On completion of the course, student will be able to :
- Use the google tools for the day to day life
- Explore various applications available in the google tools.
- Develop the skills to implement the skills available in the google tools.

Course Contents

Chapter 1	Gmail	2 Hrs
1.1 Configuring an E-mail Account 1.2 Composing and Sending Mail 1.3Receiving, Replying to and Forwarding Mail 1.4 Attachments to email		
Chapter 2	**Google Drive**	**3 Hrs**
2.1 Opening the Drive 2.2 Creating folders, google docs, google sheets, google slides 2.3 Managing Files and folders 2.4 Sharing files and folders and managing permissions 2.5 Downloading the files and folders 2.6 Uploading files and folders 2.7 Printing files		
Chapter 3	**Google Docs, Sheets and Slides**	**8 Hrs**
3.1 Creating Google docs, sheets and slides 3.2 Formatting the documents 3.3 Managing the document permissions 3.4 Uploading/downloading the documents 3.5 Special features in the docs, sheets and slides		
Chapter 4	**Google Forms**	**7 Hrs**
4.1 Creating a google form		

4.2 Adding various styles of the questions

4.3 settings of the google form

4.4 Creating the links of the google form and sharing the link

4.5 Creating and managing the permissions

4.6 Managing the data collected through google form

Chapter 5	Other Google tools	10 Hrs

5.1 Google Calendar

5.2 Google Meet

5.3 Google Chat

5.4 Google Contacts

5.5 Google Photos

5.6 Google Maps

Reference Books:

1. Complete Beginners guide to Google Apps Script by Daniel Lawrie.

2. Google Apps made easy by James Bernstein

3. My Google Apps by Sherry Kinkoph Gunter

Savitribai Phule Pune University
F.Y.B.Sc. (Computer Science) - Sem – I
Course Type: GE/OE Code : OE-104-CS-T
Course Title : Fundamentals of Computers I

Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks

Prerequisites

- Basic knowledge of Computer concepts is assumed.

Course Objectives

- To converse with basic terminology of computer
- To understand basics of Computer and working with Operating System
- To develop working skills with productivity enhancing tools
- To perform documentation and accounting operations

Course Outcomes

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

- Understand the concept of input and output devices of Computers
- Learn the functional units and classify types of computers
- Understand concept of software and working of operating system
- Learn basic Word processing, Spreadsheet and Presentation Graphics Software skills
- Study to use the Information Technology safely, legally, and responsibly
- Describe various uses of offices automation tools in accounting Operations

Course Contents

Chapter 1	**Introduction to Computers**	15 Hrs

1.1 Basics of Computers - Definition, Block Diagram, Computer Hierarchy, (Classification),

Characteristics of Computer, Computer Memory Input and Output Devices.
1.2 Introduction to Software - Software Types - System Software, Application Software, Types of Operating Systems, Functions of Operating Systems.
1.3 Working with Windows Operating System:- Structure of Windows, Windows Explorer, File and Folder Operations, The Search, The Recycle Bin, Adding or Removing New Programs using, Control Panel, Applications in windows (Paint, Notepad, WordPad, and Calculator) Data Processing: Files and Records, File Organization (Sequential, Direct/Random, Index)

Chapter 2	**Office Automation Tools**	15 Hrs

2.1 Definition of InformationTechnology (IT) Benefits of Information Technology (IT) Applications of Information Technology (IT)
2.2 Office Automation Tools:
1.2.1 MS-Word: Introduction, Starting MS-Word, MS-Word Screen and its Components, Elementary Working with MS-Word
1.2.2 MS-Excel: Introduction, Starting MS-Excel, Basics of Spread sheet, MS-Excel Screen and its Components, Elementary Working with MS-Excel
MS-PowerPoint: Introduction, Starting MS-PowerPoint, Basics of PowerPoint, MS-PowerPoint Screen and Its Components, Elementary Working with MS PowerPoint.

Reference Books:

1. Computer Fundamentals by: Anita Goel, Pearson Education India ISBN: 9788131742136

2. Connecting with Computer Science, by Greg Anderson, David Ferro, Robert Hilton, Course Technology, Cengage Learning,ISBN:9781439080351

3. Fundamentals of Computer : For undergraduate courses in commerce and management, ITL Education Solutions Limited, Pearson Education, ISBN:9788131733349

4. Introduction to Computer Science, 2/e, ITL Education Solutions Limited, Pearson Education, ISBN:9788131760307

5. Frontiers of Electronic Commerce, Ravi Kalakota, Andrew B. Whinston, Pearson Education,ISBN:9788177583922

6. Internet: The Complete Reference, Margaret Levine Young, Tata McGraw Hill Education Private Limited, ISBN: 9780070486997

7. On the Way to the Web: The Secret History of the Internet and Its Founders, A. Banks,Apress Publication, ISBN: 9781430208693

8. Computers and Commerce: A Study of Technology and Management at Eckert-MauchlyComputer Company, Engineering Research Associates, and Remingto, Arthur L. Norberg, MIT Press (MA),ISBN:9780262140904

9. Essential of E-commerce technology by V.Rajaraman, Prentice Hall India Learning Private Limited ISBN 9788120339378

10. Fundamentals of Computers by E. Balagurusamy, McGraw Hill

11. Computer Fundamentals by Priti Sinha, Pradeep K. Sinha, BPB Publications

Continuous Internal Evaluation – Max. Marks 15 Marks (Min. Passing Marks: 06)(Min. Passing Percentage: 40% of Max. Marks)	

The colleges need to adopt any Two Methods out of the following Methods for Continuous Internal Evaluation:
     12. Offline Written Examination
     13. Power Point Presentations
     14. Assignments / Tutorials
     15. Oral Examination
     16. Open Book Test
     17. Offline MCQ Test
     18. Group Discussion
     19. Analysis of Case Studies	

Semester End Examination: Max. Marks 35 and Duration of Examination is 2 Hours (Min. Passing Marks: 14)(Min. Passing Percentage: 40% of Max. Marks)	
Instructions: *1. Attempt all questions*	
Q. 1. Fill in the Blanks on all Units	05 Marks
Q. 2. Theory Question on Unit-1 OR Unit-2	08 Marks
Q. 3. Numerical Problem on Unit-1 OR Unit-2	14 Marks
Q. 4. Write Short Notes on all Units (Any 2 out of 4)	08 Marks

Savitribai Phule Pune University F.Y.B.Sc. (Computer Science) - Sem – I Course Type: SEC Code : SEC-101-CS-P Course Title : Statistical Methods for Computer Science I		
Teaching Scheme 04 Hrs/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks

Prerequisites
   ● Basic knowledge of Computer concepts is assumed.
   ● Basic Concepts of statistics is assumed.		

Course Outcomes
 On completion of the course, student will be able to :
   ● Present the complex data in tabular format.
   ● Use various diagrammatic and graphical techniques to represent statistical data and interpret the data.
   ● Compute various measures of central tendency, dispersion, skewness, and kurtosis using MS-Excel and interpret the results
   ● Establish relation between variables and estimate response for given bivariate data using software and interpret the results		

List of experiments		
Sr. No.	Title of the Experiment	No. of Experiments

1	Tabulation and construction of frequency distribution. (Use of at least two data sets more than 50 observations- each for constructing frequency distribution)	1
2	Diagrammatic representation of statistical data using EXCEL and data interpretation. (problems like in Paper I of SET and NET examination and other competitive examinations). (simple bar diagram, subdivided bar diagram, multiple bar diagram, percentage bar diagram, pie diagram, spike plot for Likert scale) Data interpretation from diagrams.	1
3	Graphical representation of statistical data: Histogram and frequency curve. Determination of mode graphically,Ogive curves and Pareto chart. Determination of median graphically. Data interpretation from graphs.	1
4	Summary statistics – I: Computation of measures of central tendency for ungrouped data (AM, Median and Mode)using MS-Excel by regular formula method and using direct command. (Discuss use of an appropriate measure).	1
5	Summary statistics – II: Computation of measures of central tendency for grouped data (AM, Median and Mode) using MS-Excel by regular formula method and bydirect command. (Discuss use of an appropriate measure).	1
6	Summary statistics – III: Computation of measures of dispersion for ungrouped data (Range, quartiles, variance, standard deviation, coefficient of variation) using MS-Excel by regular formula method and by direct command. Use of an appropriate measure and interpretation of results	1
7	Summary statistics – IV: Computation of measures of dispersion for grouped data (Range, quartiles, variance, standard deviation, coefficient of variation using MS-Excel by regular formula method and by direct command. Use of an appropriate measure and interpretation of results.	1
8	Computations of raw and central moments (not using the relation formula), measures of skewness and kurtosis (calculations in MS Excel by regular formula method and by direct command, using Karl Pearson's formula and moments). Use of an appropriate measure and interpretation of results.	1
9	Measures of Attributes (without MS Excel)	1
10	Scatter diagram and computation of covariance and Karl Pearson's correlation coefficient (calculations in MS-Excel by regular formula method and by direct command). Use of an appropriate measure and interpretation of results.	1

11	Fitting of line of regression $Y = a + bX$, calculations in MS-Excel by regular formula method and by direct command (use scatter plot for explaining the linear relationship).	1
12	Data Collection, its condensation and representation using MS-Excel.	1

Note:

1. Every practical is equivalent to four theory lectures per batch per week.

2. One hour is reserved for theory explanation of corresponding practical.

3. For project, a group of maximum 8 students be made. All the students in a group are given equal marks for project. Different data sets from primary or secondary sources may be collected.

Semester II

SavitribaiPhule Pune University
F.Y.B.Sc. (Computer Science) - Sem – II
Course Type: Major Course Code : CS-151-T
Course Title :Advanced C Programming

Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks

Prerequisites
- Problem Solving tools like algorithms, flowcharts and pseudocodes.
- Basic knowledge of 'C' language.

Course Objectives
- To study advanced concepts of programming using the 'C' language.
- To understand code organization with complex data types and structures.
- To work with files.

Course Outcomes

On completion of the course, student will be able to :
- Develop modular programs using control structures, function ,pointers, arrays, strings and structures
- Design and develop solutions to real world problems using C.
- Understand and repeat the sequence of instructions and points for a memory location.
- Identification, analyzation, development, verify and document the requirements for a computing environment.

Course Contents

Chapter 1	Pointers	8Hrs

1.1. Introduction to Pointers.
1.2. Declaration, definition, initialization, dereferencing.
1.3. Pointer arithmetic.
1.4. Relationship between Arrays & Pointers- Pointer to array, Array of pointers.
1.5. Multiple indirection (pointer to pointer).
1.6. Functions and pointers- Passing pointer to function, Returning pointer from function, Function pointer.
1.7. Dynamic memory management- Allocation(malloc(),calloc()), Resizing(realloc()), Releasing(free().,
1.8. Memory leak, dangling pointers.
1.9. Types of pointers.

Chapter 2	Strings	6Hrs

2.1 String Literals, string variables, declaration, definition, initialization.
2.2 Syntax and use of predefined string functions
2.3 Array of strings.
2.4. Strings and Pointers
2.5. Command line arguments.

Chapter 3	Structures And Unions	8Hrs
3.1. Concept of structure, definition and initialization, use of typedef. 3.2. Accessing structure members. 3.3. Nested Structures 3.4. Arrays of Structures 3.5. Structures and functions- Passing each member of structure as a separate argument, Passing structure by value / address. 3.6. Pointers and structures. 3.7. Concept of Union, declaration, definition, accessing union members. 3.8. Difference between structures and union.		
Chapter 4	File Handling	6Hrs
4.1. Introduction to streams. 4.2. Types of files. 4.3. Operations on text files. 4.4. Standard library input/output functions. 4.5. Random access to files.		
Chapter 5	Preprocessor	2Hrs
5.1. Role of Preprocessor 5.2. Format of preprocessor directive 5.3. File inclusion directives (#include) 5.4. Macro substitution directive, argumented and nested macro 5.5. Macros versus functions		
Reference Books:		
R1. C: the Complete Reference, Schildt Herbert, 4th edition, McGraw Hill R2. A Structured Programming Approach Using C, Behrouz A. Forouzan, Richard F. Gilberg, Cengage Learning India R3. The 'C' programming language, Brian Kernighan, Dennis Ritchie, PHI R4. Programming in C ,A Practical Approach, Ajay Mittal , Pearson R5. Programming with C, B. Gottfried, 3rd edition, Schaum's outline Series, Tata McGraw Hill. R6. Programming in ANSI C, E. Balagurusamy, 7th Edition, McGraw Hill.		

SavitribaiPhule Pune University F.Y.B.Sc. (Computer Science) - Sem – II Course Type: Major Course Code : CS-151-P Course Title :Lab Course based on CS-151-P		
Teaching Scheme 04 Hrs/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks
Prerequisites ● Problem Solving of mathematical operator and function and array. ● Basic knowledge of 'C' language.		

Course Objectives
- To study advanced concepts of programming using the 'C' language.
- To understand code organization with complex data types and programming structures.
- To work with files and its types.

Course Outcomes

On completion of the course, student will be able to :
- Develop modular programs using function, pointers, arrays, strings and structures
- Design and develop solutions to real world problems using Advanced C programming.

Guidelines:

LabBook: The lab book is to be used as a hands-on resource, reference and record of assignment submission and completion by the student. The lab book contains the set of assignments which the student must complete as a part of this course.

Submission:

Advanced 'C' Programming Assignments:

The problem solving assignments are to be submitted by the student in the form of a journal containing individual assignment sheets. Each assignment includes the Assignment Title, Problem statement, Date of submission, Assessment date, Assessment grade and instructors sign.

Programming Assignments:

Programs should be done individually by the student in the respective login. The codes should be uploaded on either the local server, Moodle, Github or any open source LMS. Print-outs of the programs and output may be taken but not mandatory for assessment.

Assessment:

Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes and good programming practices.

Operating Environment:

For Advanced 'C' Programming:

Operating system: Linux

Editor: Any linux based editor like vi, gedit etc.

Compiler: cc or gcc

LAB Course Contents

Advance C Programming

Assignment 1	Pointers : Operations on pointers
● Pointers - Declaration,	

● definition, initialization, d ● dereferencing ● Pointer arithmetic.	
Assignment 2	**Pointers : Pointers and arrays**
● Pointer to array, ● Array of pointers ● pointer to pointer	
Assignment 3	**Pointers :pointers and functions**
● Passing pointer to function, ● Returning pointer from function, ● Function pointer	
Assignment 4	**Pointers :Dynamic Memory allocation**
Dynamic memory management (Allocation) ● malloc(), ● calloc(), ● Resizing(realloc()),	
Assignment 5	**Pointers :dangling pointers and free**
● Releasing (free ())., ● dangling pointers	
Assignment 6	**Strings : basic operations**
● String Literals, string variables, declaration, definition, initialization and Syntax and use of predefined string functions	
Assignment 7	**Strings : array of strings & pointers**
● Array of strings and Pointers	
Assignment 8	**Structures : Basics**
● Structure, definition and initialization, use of typedef. ● Accessing structure members and Nested Structures	
Assignment 9	Arrays of Structures and functions
● Arrays of Structures and functions- Passing each member of structure as a separate argument, ● Passing structure by value / address.	
Assignment 10	Pointers and Structures
Use of Pointers and Structures	
Assignment 11	**Unions**
Concept of Union, declaration, definition, accessing union members	
Assignment 12	**Command line arguments : basics**
● To access command-line arguments	

- Functions - atoi(), atol() and atof()

Assignment 13	Command line arguments : use of files

- Arithmetic operation on arguments
- Accessing string and file using command line arguments

Assignment 14	File Handling

- Streams and Types of files.
- Operations on text files.
- Standard library input/output functions and   Random access to files.

Assignment 15	Preprocessor

- Preprocessor and Format of preprocessor directive
- File inclusion directives (#include)
- Macro substitution directive, argumented and nested macro and macros versus functions

Reference Books:

R1. C: the Complete Reference, Schildt Herbert, 4th edition, McGraw Hill

R2. A Structured Programming Approach Using C, Behrouz A. Forouzan, Richard F. Gilberg, Cengage Learning India

R3. The 'C' programming language, Brian Kernighan, Dennis Ritchie, PHI

R4. Programming in C ,A Practical Approach, Ajay Mittal , Pearson

R5. Programming with C, B. Gottfried, 3rd edition, Schaum's outline Series, Tata McGraw Hill.

R6. Programming in ANSI C, E. Balagurusamy, 7th Edition, McGraw Hill.

Note: Lab Book be prepared for this course by BOS.

Savitribai Phule Pune University F.Y.B.Sc. (Computer Science) - Sem – II Course Type: Subject 2 Code : MTC-151-T Course Title :Graph Theory		
Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks
Aims : • To give the students a sufficient knowledge fundamental principles ,methods and a clear perception of innumerous power of mathematical ideas and tools and know how to use them by modeling , solving and interpreting. • Reflecting the broad nature of the subject and developing mathematical tools for continuing further study in various fields of science. • Enhancing students' overall development and to equip them with mathematical modeling abilities, problem solving skills, • Creative talent and power of communication necessary for various kinds of employment. • Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study		

● To test, debug and execute programs.

Course Objectives
- A student should be able to recall basic facts about mathematics and should be able to display knowledge of conventions such as notations , terminology and recognize basic geometrical figures and graphical displays, state important facts resulting from their studies.
- A student should get a relational understanding of mathematical concepts and concerned structures, and should be able to follow the patterns involved, mathematical reasoning .
- A student should get adequate exposure to global and local concerns that explore them many aspects of Mathematical

Course Outcomes
Upon successful completion of this course, the student will be able to:
- Work with graphs and identify certain parameters and properties of the given graphs.
- Perform certain algorithms, justify why these algorithms work, and give some estimates of the running times of these algorithms.
- Solve basic exercises of the type: given a graph with properties X, prove that the graph also has property Y.
- Develop an appreciation for the literature on the subject and be able to read and   present results from the literature.
- Write cohesive and comprehensive solutions to exercises and be able to defend their arguments.

Course Contents

Chapter 1	An Introduction to graph	8 Hrs

1.1.Definitions, Basic terminologies and properties of graph.
1.2. Special types of graphs, some applications of special types of graph.
1.3.Matrix representation and elementary results, Isomorphism of graphs.

Chapter 2	Connected graph	7 Hrs

2.1 Walk, trail, path, cycle, more definitions and elementary properties of connectedness.
2.2 Cut edge (Bridge), Cut vertex, cut set, vertex connectivity, edge connectivity, definitions and properties.
2.3 Shortest path problem, Dijkstra's algorithm.

Chapter 3	Euler and Hamilton path	7 Hrs

3.1. The Konigsberg bridge problem, Euler trail, path, circuit and tour, elementary properties and examples, Fleury's algorithm
   3.2. Hamilton path, circuit, definitions, elementary properties and examples

Chapter 4	Trees	8 Hrs

4.1. Definitions, basic terminologies, properties and applications of trees.
4.2. Weighted graph, definition and properties of spanning tree, shortest spanning tree, Kruskal's algorithm, Prim's algorithm.
4.3.Binary tree, definitions and properties, tree traversal: preorder , inorder, postorder, infix, prefix, postfix notations and examples.

Books:

Text Book:
Kenneth Rosen, Discrete Mathematics and its applications. Seventh Edition (Tata McGraw Hill).

Reference Books:
1. John Clark and Derek Holton, A first look at Graph theory, (Allied Publishers)
2. Narsingh Deo, Graph Theory with applications to computer science and engineering.(Prentice Hall)
3. C.L. Liu, Elements of Discrete Mathematics, (Tata McGraw Hill)
4. Douglas B. West, Introduction to Graph Theory, second edition.(Pearson Education)

Savitribai Phule Pune University
F.Y.B.Sc. (Computer Science) - Sem – II
Course Type: Subject 2   Code : MTC-152-P
Course Title :Mathematics Practical II

Teaching Scheme 4 Hrs /Week	No. of Credits 2	Examination Scheme IE:15 Marks UE: 35 Marks
Assignment 1	**Using networkx from python do the following**	

1.Generate graph G with vertex(node) set {1,2,3,4,5} and the edge set {(1,5), (1,3),(1,2),(2,3),(2,4), (3,4), (4,5)} . Draw graph G.

2. Generate graph G1 with vertex set { 'a','b','c','d'} and the edge set {x=('a', 'd'), y=('b','c'), z=('b',''d'), w =('a','c')}. Draw graph G1 showing labeled vertices and edges.

3. Generate graph G2 with vertex set {1,2,3,4,5} and edge set {(4,5),(5,3),

(2, 2),(2,3),(2,4), (3,4), (1,5)} . Draw graph G2 with vertices in red colour and edges in green.

4. Find the number of vertices, number of edges and degrees of all vertices in above graphs.

5. Verify Hand shaking lemma for above graphs.

Assignment 2	**Using networkx from python do the following**

1.   Draw a regular graph on 4 vertices with degree 2.

2.   Draw a regular graph on 5 vertices with degree 3.

3.   Draw the star graphs on 4, 7 and 8 vertices

4.   Draw the Petersen graph . Determine whether G is 2_regular. Is it 3_regular graph?

5.   Find adjacency matrix and incidence matrix of each of above graphs. Find the number of vertices, number of edges and degrees of all vertices in above graphs

Assignment 3	**Using networkx from python do the following**

1. Draw the null graphs different number of vertices for example N_7, N_{17}, N_{12} etc.

2. Draw the complete graphs for example K_5, K_{30}, K_{45} etc.

3. Draw the cycle graphs such as C_8, C_{12}, C_{20}, C_{35} etc.

4. Draw the wheel graphs for such as W_5, W_{10}, W_{21}, W_{30}.

5. Draw the complete bipartite graphs $K_{4,3}$, $K_{1,8}$, $K_{5,9}$ etc.

Assignment 4	Using networkx from python do the following

1. Draw a directed graph D1 with vertex set V= {1, 2, 3, 4,5} and directed edge set E = {(1,4) , (2,3), (1,2), (5,3), (5,1), (4,1), (3,2),(5,2), (5,4)}. Draw underlying graph of D1, Find in degrees and out degrees of all vertices in D1.

2. Draw a directed graph D2 with vertex set V= {1, 2, 3, 4 } and directed edge set

i. {(2,4) , (2,3), (1,3), (4,1), (3,2),(1,2)}.Draw underlying graph of D2, Find indegrees and out degrees of all vertices in D2.

3. Draw any symmetric directed graph on given number of vertices.

4. Draw any asymmetric directed graph on given number of vertices.

5. Draw any complete symmetric directed graph on given number of vertices.

6. Draw any complete asymmetric directed graph on given number of vertices.

Assignment 5	Using networkx from python do the following

1. Create a simple graph G. Draw graph G with nodes and edges in colors of your choice.

2. Create and draw complement of above G. Determine whether the complement is simple graph.

3. Determine whether G is bipartite.

4. Find the number of components in the graph G.

5. Determine whether G is connected. Determine whether the complement of G is connected.

Assignment 6	Using networkx from python do the following

1. Draw K = Complete graph K_5, H= complement of N_5 . Determine whether K is isomorphic to H.

2. Generate and draw any 2 graphs with names G1 and G2. Determine whether G1 is isomorphic to G2.

3. Draw union of graphs G1 and G2.

4. Draw intersection of graphs G1 and G2.

5. Draw product of graphs G1 and G2.

Assignment 7	Using networkx from python do the following

1. Draw any graph G.

2. In the graph G add some vertices and add some edges.

3. From the graph G delete some vertices and delete some edges.

4. Determine whether G is connected graph.

5. Find the vertex connectivity and edge connectivity of the graph G.	

Assignment 8	Using networkx from python do the following

1. Draw any connected graph G.
2. Find all bridges, all cut vertices (articulation points) and cut set in G.
3. Find the vertex connectivity and edge connectivity of G.
4. Find the eccentricity of every vertex in G.
5. Find center, radius and diameter of graph G.

Assignment 9	Using networkx from python do the following

1. Draw any connected graph G.
2. Find all paths in G and all trails in G.
3. Draw paths of some given lengths from G.
4. Find all cycles in graph G. Is it Hamiltonian graph?
5. Determine whether G is Eulerian graph, whether it is Semi Eulerian graph.

Assignment 10	Using networkx from python do the following

1. Draw any connected graph G. Determine whether G is a tree.
2. Draw spanning tree T in G.
3. Find the number of vertices in spanning tree of G.
4. Find the number of edges in spanning tree of G.
5. Determine whether spanning tree T of G is a binary tree.

Assignment 11	Using networkx from python do the following

1. Draw any graph T containing n number of vertices and n – 1 edges.
2. Determine whether T is a tree.
3. Determine whether T is a binary tree.
4. Determine whether T is a bipartite graph .
5. Find center, radius and diameter of graph T.

Assignment 12	Using networkx from python do the following

1. Draw balanced binary trees of heights 2 ,4, and 5 etc.
2. Draw ternary trees of heights 1 and 3 etc.
3. Draw any n-ary tree of height h for given n and h .
4. Find the no of vertices and edges in given trees, Verify the relation between them.
5. Find center, radius and diameter of above trees.

Savitribai Phule Pune University
F.Y.B.Sc. (Computer Science) - Sem – II
Course Type: Subject 3   Code : ELC-151-T
Course Title : Principles of Digital Electronics

Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks

Course Objectives

- To learn different number system and their inter conversion.

- To understand logic gates and their applications.

- To study rules and laws of Boolean Algebra.

- To understand design of combinational circuit and their different types.

Course Outcomes

- 1. To learn different number system and their inter conversion.

- 2. To understand logic gates and their applications.

- 3. To study rules and laws of Boolean Algebra.

- 4. To underst and design of combinational circuit and their different types..

Course Contents

Chapter 1	Number Systems and Digital Codes	07 Hrs
Introduction to decimal, binary, octal and hexadecimal number system and their inter-conversions, the concept of 1's and 2's complements, binary addition, binary subtraction using 1's and 2's complements. BCD code, Excess-3 code, Gray code and ASCII code.		

Chapter 2	Logic Gates	03 Hrs
Logic gates – basic and derived (symbol, Boolean equation and truth table), concept of universal gates.		

Chapter 3	Logic Families	04 Hrs
Introduction of CMOS and TTL logic families. Parameters of logic families: voltage levels, propagation delay, noise margin, fan in, fan out, power dissipation Comparison between CMOS and TTL logic families.		

Chapter 4	Boolean Algebra	05 Hrs
Laws of Boolean Algebra, De-Morgan's theorems, simplification of logic equations using Boolean algebra, minterms, maxterms, Boolean expression in SOP and POS form, conversion of SOP/POS expression to its standard SOP/POS form.		

Chapter 5	Introduction to Karnaugh Map	05 Hrs
Introduction to Karnaugh map,problems based on SOP (up to 4 variables), digital designing using K-map for 3-bit gray tobinary and binary to gray conversion. Ex-OR gate as a 4-bit Parity Checker and Generator.		

Chapter 6	Combinational Circuits	05 Hrs
Introduction to Arithmetic Circuits, half adder, full adder, half subtractor, full subtractor, four-bit parallel adder, universal adder / subtractor, digital comparator, introduction to ALU. Introduction, Multiplexer (2:1, 4:1), demultiplexer (1:2, 1:4) and their applications. Encoders: decimal to BCD/binary, 3x4 matrix keyboard encoder and priority encoder. Decoders: BCD to decimal and BCD to seven segment decoder.		

Reference Books:

1. Digital Design - M. Morris Mano, PHI, New Delhi.
2. Digital Systems Principles and Applications - Ronald J. Tocci.
3. Digital electronics - G. K. Kharate, Oxford University Press.
4. Fundamentals of Digital Circuits - Anand Kumar.

5. Digital Principles and Applications - Malvino and Leach, TMG Hill Edition.

<table>
<tr><td colspan="3">Savitribai Phule Pune University
F.Y.B.Sc. (Computer Science) - Sem – II
Course Type: Subject 3   Code : ELC-152-P
Course Title : Electronics Practical Course II</td></tr>
<tr><td>Teaching Scheme
04 Hrs/ week</td><td>No. of Credits
2</td><td>Examination Scheme
IE : 15 marks
UE: 35 marks</td></tr>
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Course Objectives

- To understand logic gates ICs and their applications in Digital Design.
- To design different digital circuits using logic gates.
- To study different combinational circuits.

Course Outcomes

- Understand the design and build of digital circuits using logic gates.
- Use breadboard / tag-board for building small electronic circuits.
- Design digital circuits for different applications.
- Validate observed outputs with expected theoretical outputs.

Course Contents

Group A (Any 13)

1.	Verification of logic gates by using digital ICs.
2.	Realization of basic gates using discrete components
3.	Realization of basic gates using universal logic gates.
4.	Verification of De Morgan's theorems.
5.	Study of half adder and full adder using logic gates.
6.	Study of half subtractor and full subtractor using logic gates.
7.	4-bit binary parallel adder and subtractor using IC7483.
8.	3-bit binary to Gray conversion using logic gates.
9.	3-bit Gray to Binary conversion using logic gates.
10.	Study of EX-OR gate as a 4-bit parity generator.
11.	Study of EX-OR gate as a 4-bit parity checker.
12.	Study of 1-bit digital comparator.
13.	Study of ALU using IC 74181.
14.	Study of multiplexer and demultiplexer.
15.	Study of Decimal to BCD/Binary encoder.

16.	Study of Priority Encoder IC 74148
17.	Study of BCD to seven segment decoder using IC 7447

Group B: Activity (Any 1: Equivalent to 2 Practicals)

1. Perform any 2 experiments from Group A using circuit simulation software LTSPICE / Circuit Mod / Proteus etc. (Give preference to not performed experiments)

2. Perform survey of following topics –

   a. Study of laboratory safety and precautionary measures.

   b. Study of e-waste management or any relevant topic of Electronics.

Suggested Readings/Material:

1. Digital Design - M. Morris Mano, PHI, New Delhi.
2. Digital Systems Principles and Applications - Ronald J. Tocci.
3. Digital electronics - G. K. Kharate, Oxford University Press.
4. Fundamentals of Digital Circuits - Anand Kumar.
5. Digital Principles and Applications - Malvino and Leach, TMG Hill Edition.

Savitribai Phule Pune University **F.Y.B.Sc. (Computer Science) - Sem – II** **Course Type: GE/OE Code : OE-151-CS-T** **Course Title :Office Automation II**		
Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks

Prerequisites
- Previous knowledge of Computer concepts is assumed.
- Knowledge of Computer as operational tool is required.

Course Objectives
- To introduce the foundations of office automation especially Presentation Skills.
- To develop the ability to prepare the well formatted powerpoint presentations.
- To prepare the presentations using powerpoint presentation tools such as tables, figures, shapes, images, audio, video etc.
- To prepare the presentations using advanced automated features such as animation, slide shows, etc.

Course Outcomes
On completion of the course, student will be able to :
- Prepare the professional presentations
- Explore various tools in the powerpoint presentation software.
- Develop documents using powerpoint advanced tools.

Course Contents

Chapter 1	**Introduction to Presentation**.	**5 Hrs**
1.1. Opening new presentation, 1.2. Different presentation templates, 1.3. Setting backgrounds, 1.4. Selecting presentation layouts		
Chapter 2	**Creating and Formatting Presentation**	**8 Hrs**
2.1 Presentation style, 2.2 Adding text to the Presentation. 2.3 Adding style 2.4 Colour, gradient fills 2.5 Arranging objects 2.6 Adding Header & Footer 2.7 Slide Background, Slide layout		
Chapter 3	**Adding Graphics and effects to Presentation**	**12 Hrs**
3.1 Inserting pictures, movies, tables etc into presentation, 3.2. Drawing Pictures using Draw 3.3. Setting Animation 3.4 Transition Effect		
Chapter 4	**Printing and showing a presentation**	**5 Hrs**
4.1 Printing Handouts 4.2 Generating Standalone Presentation viewer 4.3 Presenting the presentation using various styles		
Reference Books : 1. Microsoft Powerpoint by James Holler 2. Powerpoint for dummies, office 2021 Edition Doug Lowe 3. Learn Microsoft Office 2019 by Linda Foulkes		

Savitribai Phule Pune University **F.Y.B.Sc. (Computer Science) - Sem – II** **Course Type: GE/OE Code : OE-152-CS-T** **Course Title : Computer Fundamentals**		
Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks
Prerequisites ● Basic knowledge of Computer concepts is assumed. ● Knowledge of Computer as operational tool is required.		
Course Objectives ● To introduce the fundamental concepts of computers. ● To study the basics of Computer System ● To introduce the computer peripherals and other devices		

- To learn how to configure computer devices
- To Learn Basic Commands of Operating system and application software

Course Outcomes

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

- Use the computers for the day to day life
- Learn the fundamental concepts of computer science
- Explore various applications available in the computers.
- Explain the needs of hardware and software required for a computation task

Course Contents

Chapter 1	Introduction to Computers	7 Hrs

1.1 Introduction, Characteristics of Computers,

1.2 Block diagram of computer

1.3 Computer Generations

1.4 Types of computers and features- Mini Computers, Micro Computers, Mainframe Computers, Super Computers, Laptops and Tablets

1.5 Types of Programming Languages- Machine Languages, Assembly Languages, High Level Languages

Chapter 2	Introduction to Computer Peripherals	8 Hrs

2.1 Primary And Secondary storage devices

2.2 Primary storage devices – RAM, ROM, PROM, EPROM

2.3 Secondary Storage Devices - CD, HD, Pen drive

2.4 I/O Devices- Scanners, Digitizers, Plotters, LCD, Plasma Display

2.5 Pointing Devices –Mouse, Joystick, Touch Screen

2.6 Number Systems, Octal, Hexadecimal system Conversion, Simple

2.7 Addition, Subtraction, Multiplication, Division

Chapter 3	Number System	6 Hrs

3.1 Introduction to Binary Number System

3.2 Introduction to Octal Number System

3.3 Introduction to Hexadecimal Number System

3.4 Addition, Subtraction, Multiplication, Division

Chapter 4	Operating Systems	4 Hrs

4.1 Definition of Operating System

4.2 Functions of Operating System

4.3 Role of Operating System

4.4 Types of Operating System

Chapter 5	Introduction to Computer Networking	5 Hrs

5.1 Network definition Common terminologies: LAN, WAN, Node, Host, Workstation, bandwidth, Interoperability

5.2 Network Administrator,

5.3 Network Security

5.4 Network Components: Severs, Clients

5.5 Communication Media
5.6 Types of network: Peer to Peer, Clients Server
Reference Books:
1. Computer Fundamentals by P.K. Sinha &Priti Sinha, 3rd edition, BPB pub.
2.Fundamental of Computers – By V. Rajaraman B.P.B. Publications
3. Computer Networks – By Tennenbum Tata MacGrow Hill Publication
E-Books and Online Learning Material
3.   https://www.geeksforgeeks.org/computer-fundamentals-tutorial/
4.   https://www.javatpoint.com/computer-fundamaentals

Savitribai Phule Pune University F.Y.B.Sc. (Computer Science) - Sem – II Course Type: GE/OE Code : OE-153-CS-T Course Title : Introduction to Google Apps II		
Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks
Prerequisites ● Basic knowledge of Computer concepts is assumed. ● Knowledge of Computer as operational tool is required. ● Knowledge of Internet is required		
Course Objectives ● To introduce the specialized Google tools. ● To develop the ability to analyses and use the tools effectively and skillfully		
Course Outcomes On completion of the course, student will be able to : ● Use the google tools for the day to day life ● Explore various applications available in the google tools. ● Develop the skills to implement the skills available in the google tools.		

Course Contents		
Chapter 1	**Creating You Tube Channel**	**10 Hrs**
1.1 Creating a you tube channel 1.2 Managing the channel, permissions, playlists, etc 1.3 Uploading the videos on the channel 1.4 Live Streaming		
Chapter 2	**Creating a website**	**10 Hrs**
2.1 Creating a website 2.2 Managing home page 2.3 Creating Menus on the website 2.4 Adding pages to the site		

2.5 Setting up themes

2.6 Adding tools such as tables, placeholders, hyperlinking, buttons, maps, etc

2.7 Publishing a site

Chapter 3	Google Classroom	10 Hrs

3.1 Creating Google classroom

3.2 Creating a class

3.3 Streaming a class

3.4 Adding students to class

3.5 Adding class work : assignments, quiz, question, material, etc

3.5 Giving grades to the assignments

3.6 joining a class (from student side)

Reference Books:

1. Complete Beginners guide to Google Apps Script by Daniel Lawrie.

2.Google Apps made easy by James Bernstein

3. My Google Apps by Sherry Kinkoph Gunter

Savitribai Phule Pune University
F.Y.B.Sc. (Computer Science) - Sem – II
Course Type: GE/OE Code : OE-154-CS-T
Course Title : Fundamentals of Computers II

Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks

Prerequisites
- Basic knowledge of Computer concepts is assumed.

Course Objectives
- To build an understanding of the fundamental concepts of computer networking.
- To familiarize the student with the basic terminology of the computer networking area.
- To understand computer network technology with various devices independently.
- To identify the different types of network topologies and protocols.

Course Outcomes

On completion of the course, student will be able to :
- Understand the basic concepts of Networking and Cyber Security.
- Describe Cyber Security Laws and concepts of Digital Signature
- Identify the different types of Network devices and their functions within a Network.
- Elaborate the Internet Services and related terms of Internet.
- Evaluate information security threats.

Course Contents

Chapter 1	**Introduction to Computers Network and E-Commerce:**	15 Hrs

1.1 Introduction Importance of Networking Computer Network (LAN, WAN, MAN) Network Components (Hub, Switch, Bridge, Gateway, Router, Modem).

1.2 Network Topology, Wireless Network Internet and Internet application Introduction, Internet evolution, Working of Internet, Use of Internet, Overview of World Wide Web (Web Server

	and Client).	
	1.3 IEEE802.11 -Wi-Fi: Types of Wi-Fi, Uses of Wi-Fi Near by Share : Applications of Nearby share	
Chapter 2	**Introduction to Internet & Cyber Security**	**15 Hrs**

2.1	Concept of Internet, Internet Service Providers(ISP), Services Provided by the Internet: E-mail, Search Engine
2.2	Information security overview – Background and current scenario Types of Attacks, Goals of security:
2.3	Overview of security threats, Weak / Strong passwords and password cracking, Insecure Network connections, Digital Signature.
2.4	Cyber Security: Cybersecurity definition, Cybercrime: Classification of Cybercrime: a)Email spoofing b) Spamming c) Identity Theft d) Online Fraud e) ATM Skimming f) Credit Card Fraud
2.5	Overview of Indian Information Technology Act 2002

Reference Books:

1. Computer Fundamentals by: Anita Goel, Pearson Education India ISBN: 9788131742136

2. Connecting with Computer Science, by Greg Anderson, David Ferro, Robert Hilton, Course Technology, Cengage Learning,ISBN:9781439080351

3. Fundamentals of Computer : For undergraduate courses in commerce and management, ITL Education Solutions Limited, Pearson Education, ISBN:9788131733349

4. Introduction to Computer Science, 2/e, ITL Education Solutions Limited, Pearson Education, ISBN:9788131760307

5. Frontiers of Electronic Commerce, Ravi Kalakota, Andrew B. Whinston, Pearson Education,ISBN:9788177583922

6. Internet: The Complete Reference, Margaret Levine Young, Tata McGraw Hill Education Private Limited, ISBN: 9780070486997

7. On the Way to the Web: The Secret History of the Internet and Its Founders, A. Banks, Apress Publication, ISBN: 9781430208693

8. Computers and Commerce: A Study of Technology and Management at Eckert-Mauchly Computer Company, Engineering Research Associates, and Remingto, Arthur L. Norberg, MIT Press (MA),ISBN:9780262140904

9. Essential of E-commerce technology by V.Rajaraman, Prentice Hall India Learning Private Limited ISBN 9788120339378

10. Fundamentals of Computers by E. Balagurusamy, McGraw Hill

11. Computer Fundamentals by Priti Sinha, Pradeep K. Sinha, BPB Publications

12. Computer Networks - Andrew Tanenbaum (III Edition)

13. Complete Guide to Networking - Peter Norton

14. Data Communications & Networking - Behrouz Ferouzan (III Edition)

15. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives – Nina Godbole, SunitBelapure, Wiley: April 2011 India Publications Released.

16. Cyber Security Essentials- James Graham Richard Howard Ryan Olson

Indian Information Technology Act 2002

Continuous Internal Evaluation – Max. Marks 15 Marks **(Min. Passing Marks: 06)(Min. Passing Percentage: 40% of Max. Marks)**	
The colleges need to adopt any Two Methods out of the following Methods for Continuous Internal Evaluation: 1. Offline Written Examination 2. PowerPointPresentations 3. Assignments / Tutorials 4. OralExamination 5. Open Book Test 6. Offline MCQ Test 7. Group Discussion 8. Analysis of Case Studies	
Semester End Examination: Max. Marks 35 and Duration of Examination is 2 Hours **(Min. Passing Marks: 14)(Min. Passing Percentage: 40% of Max. Marks)**	
Instructions: *1. Attempt all questions* Q. 1. Fill in the Blanks on all Units Q. 2. Theory Question on Unit-1 OR Unit-2 Q. 3. Numerical Problem on Unit-1 OR Unit-2 Q. 4.Write Short Notes on all Units (Any 2 out of 4)	05 Marks 08 Marks 14 Marks 08 Marks

Savitribai Phule Pune University **F.Y.B.Sc. (Computer Science) - Sem – II** **Course Type: GE/OE Code : OE-155-CS-T** **Course Title : AI Tools for Business**		
Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks
Prerequisites ● Basic knowledge of Computer concepts is assumed.		
Course Objectives ● To introduce students to AI applications in business. ● To familiarize students with popular AI tools for automation, marketing, and decision-making. ● To develop hands-on skills in using AI-driven business solutions.		
Course Outcomes On completion of the course, student will be able to : ● Understand the role of AI tools in business operations. ● Utilize AI-powered tools for marketing, automation, and decision-making ● Apply AI solutions to business challenges through practical use cases		
Course Contents		

Chapter 1	**Introduction to AI in Business**	**5 Hrs**

1.1 Basics of Artificial Intelligence (AI) and Machine Learning (ML)

1.2 Role of AI in Business Decision Making

1.3 AI-powered Business Automation: Advantages & Challenges

1.4 Introduction to AI Ethics and Bias

Case Study: AI Implementation in E-commerce and Banking Sectors

Chapter 2	**AI-Powered Tools for Productivity & Automation**	**10 Hrs**

2.1 AI for Communication & Content Creation: ChatGPT, Google Bard, Grammarly, Canva AI

2.2 AI for Meetings & Transcription: Otter.ai, Fireflies.ai

Chapter 3	**AI in Marketing & Customer Engagement**	**08 Hrs**

3.1 AI for Digital Marketing & SEO: Copy.ai, Jasper AI, SurferSEO

3.2 Chatbots & AI-Powered Customer Service: Drift, HubSpot AI, Salesforce Einstein

Chapter 4	**AI for Business Analytics**	**08 Hrs**

4.1 AI for Data Visualization & Business Insights: Tableau AI, Power BI

4.2 Predictive Analytics & Decision Making: AI in Finance & Risk Analysis

Reference Books:

1. Artificial Intelligence in Business: Opportunities and Challenges" – Péter Szeredi & Attila Kiss

2. AI Superpowers: China, Silicon Valley, and the New World Order" – Kai-Fu Lee

3. The AI Advantage: How to Put the Artificial Intelligence Revolution to Work" – Thomas H. Davenport

4. 4Human + Machine: Reimagining Work in the Age of AI" – Paul R. Daugherty & H. James Wilson

5. Artificial Intelligence for Marketing: Practical Applications" – Jim Sterne

Resource Material/Other Online Courses
1.   Google AI for Business (Google AI) 2. AI for Everyone (Coursera – Andrew Ng) 3. LinkedIn Learning: AI in Business Strategy

Continuous Internal Evaluation – Max. Marks 15 Marks (Min. Passing Marks: 06)(Min. Passing Percentage: 40% of Max. Marks)	
The colleges need to adopt any Two Methods out of the following Methods for Continuous Internal Evaluation: 9. Offline Written Examination 10. PowerPointPresentations 11. Assignments / Tutorials 12. OralExamination 13. Open Book Test 14. Offline MCQ Test 15. Group Discussion 16. Analysis of Case Studies	
Semester End Examination: Max. Marks 35 and Duration of Examination is 2 Hours (Min. Passing Marks: 14)(Min. Passing Percentage: 40% of Max. Marks)	
Instructions: *1. Attempt all questions* Q. 1. Fill in the Blanks on all Units Q. 2. Theory Question on Unit-1 OR Unit-2 Q. 3. Numerical Problem on Unit-1 OR Unit-2 Q. 4.Write Short Notes on all Units (Any 2 out of 4)	05 Marks 08 Marks 14 Marks 08 Marks

Savitribai Phule Pune University F.Y.B.Sc. (Computer Science) - Sem – II Course Type: SEC Code : SEC-151-CS-P Course Title : Statistical Methods for Computer Science II		
Teaching Scheme 04 Hrs/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks
Prerequisites ● Basic knowledge of Computer concepts is assumed. ● Basic Concepts of statistics is assumed.		
Course Outcomes On completion of the course, student will be able to :		

- Fit second-degree curve, and exponential curves.
- Estimate trends by using time series data.
- Understand concept of probability.
- Estimate probabilities of standard probability distributions
- Perform tests based on normal, Chi-Square, t and F distributions.

List of experiments

Sr. No.	Title of the Experiment	No. of Experiments
1	Fitting of second-degree curve $Y = a + bX + cX^2$ using MS-Excel. (Use of scatter plot for explaining the nonlinear relationship between two variables)	1
2	Fitting of exponential curve of type $Y = ab^x$, $Y = aX^b$ using MS-Excel. (Use of scatter plot for explaining the nonlinear relationship between two variables)	1
3	Time Series- Estimation of trend by using the method of moving averages by using regular formula method and by using MS-Excel.	1
4	Time Series- Estimation of trend by using exponential smoothing by regular formula and by using MS-Excel.	1
5	Problems on probability theory (P(A∪B), P(A'∪B'), P(A'∩B), P(A'∩B') Use Venn diagram whenever possible.	1
6	Computation of probability values for Normal distribution and Chi-square distribution using MS Excel command.	1
7	Computation of probability values for t distribution and F distribution using MS Excel command.	1
8	Test for means and proportion (Z-test) i) $H_0: \mu = \mu_0$ vs $H_1: \mu \neq / > / < \mu_0$, σ^2 known ii) $H_0: \mu_1 = \mu_2$ vs $H_1: \mu_1 \neq / > / < \mu_2$, σ^2 known iii) $H_0: P = P_0$ vs $H_1: P \neq / > / < P_0$ $H_0: P_1 = P_2$ vs $H_1: P_1 \neq / > / < P_2$	1
9	Test based on students t i) $H_0: \mu = \mu_0$ vs $H_1: \mu \neq / > / < \mu_0$, σ^2 unknown ii) $H_0: \mu_1 = \mu_2$ vs $H_1: \mu_1 \neq / > / < \mu_2$, σ^2 unknown iii) Paired t-test	1
10	Test based on χ^2 i) Goodness of fit ii) Independence of attributes (2 x 2). iii) Independence of attributes (2 x 3 or 3 x 2 or 3 x 3)	1
11	Tests based on F-distribution i) $H_0: \sigma_1^2 = \sigma_2^2$ vs $H_1: \sigma_1^2 \neq / > / < \sigma_2^2$, means known ii) $H_0: \sigma_1^2 = \sigma_2^2$ vs $H_1: \sigma_1^2 \neq / > / < \sigma_2^2$, means unknown	1
12	Project (Part-II) - Analysis of data collected in semester-I	1

Note: 1. Every practical is equivalent to four theory lectures per batch per week 2. One hour is reserved for theory explanation of corresponding practical. 3. For project, a group of maximum 8 students be made. All the students in a group are given equal marks for project. Different data sets from primary or secondary sources may be collected.

Savitribai Phule Pune University, Pune

(Formerly University of Pune)

Syllabus Structure

First Year Bachelor of Science (FYBSC)

Subject – English

(Semester I & II)

Choice Based Credit System Syllabus

NEP 2020

2024

Class: F. Y. B. Sc.

Subject: English

Ability Enhancement Course

Prescribed Text: *Professional Communication Skills*

(Board of Editors) Orient BlackSwan, 2024

Course outcomes:

- CO-1 Read and understand texts in English

- CO-2 Enrich and use vocabulary effectively

- CO-3 Understand and Develop Communicative Competence

- CO-4 Use body language in different situations

- CO-5 Acquaint with digital platforms and technology

- CO-6 Write letter, notice, agenda, minutes and blog

Semester – I

Vertical	Ability Enhancement Course
Course Code	**ENG101**
Course Title	**Professional Communication Skills**
Credit	**2**
Total Hours	**30 hours**

Unit No.	Topic	Allotted Lectures (L)
1.	**Basic Language Skills:** **A) Grammar** 1. Sentence Structures/Patterns 2. Subject - Verb agreement 3. Tenses	**10**

Unit No.	Topic	Allotted Lectures (L)
2.	**B)Vocabulary :** 1. Synonyms and Antonyms 2. Homonyms 3. One-word substitutes 4. Idioms 5. Suffixes and prefixes 6. Collocations.	10
3.	**C) Speaking for Different Purpose:** **a) Meeting and Greeting People** 1. Introducing your Self 2. Introducing People to One another 3. Apologies and Responses 4. Agreeing and Disagreeing 5. General Speaking Strategies **b) Group Discussion, Interview and Interviewing Skills** 1. Initiating a Group Discussion 2. Continuing a Group Discussion 3. Concluding Group Discussion 4. Preparing for an Interview 5. Facing an Interview 6. Interviewing Techniques **c) Presentation Skills** 1. Kinds of Presentation 2. Structuring Content 3. Visual Aids 4. The Language of Presentations 5. Making a Presentation	10

Semester – II

Vertical	AEC
Course Code	**ENG101**
Course Title	**Professional Communication Skills**
Credit	**2**
Total Hours	**30 hours**

Unit No.	Topic	Allotted Lectures (L)
1.	**Forms of Writing:** 1.Letter Writing 2.Writing Resume 3.Report Writing 4.Notice/ Agenda and Minutes 5.Email 6. Blog Writing	**10**
2.	**Soft Skills** **a) Introduction to Soft Skills** 1. Definitions and Nature 2. Soft Skill vs Hard Skill 3. Importance of Soft Skill 4. Types of Soft Skill **b) Soft Skills in Career Prospects** 1. Role of Soft Skills in Professional Success 2. Time and Stress Management 3. Decision Making and Moral values 4. Leadership Skills and Team Building 5. Negotiation Skills and Etiquettes	**10**
3.	**Business Communication:** 1. Nature and Importance of Business Communication 2. Process of Communication 3. Types of Communication 4. Channels of Communication 5. Digital Communication	**10**

Examination Pattern **(FOR BOTH SEMESTER I & II)**	
F. Y. B. Sc. English	
Ability Enhancement Course	
Prescribed Text: *Professional Communication Skills* **(Board of Editors) Orient BlackSwan, 2024**	
For 2 Credits Course- Theory Total Marks: 50	
Semester End Exam Total Marks- 35 (Minimum Marks 14 for passing)	
Internal Assessment Total Marks: 15	
a. Semester End Exam Question Paper Pattern Total Marks 35 (Minimum Marks 14 for passing)	
Time (2 Hours), 2 Credit Course, Marks (35)	
Q.1 Answer the following questions on unit one (any two out of four) Marks – 10	
Q.2 Answer the following questions on unit two (any two out of four) Marks – 10	
Q.3 Answer the following questions on unit three (any three out of five) Marks – 15	
b. Internal Assessment Pattern Total Marks: 15	
Tutorial	Marks – 10
Home assignment /Oral examination/ Students seminar/ presentation	Marks – 05

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Amos, Julie-Ann. *Handling Tough Job Interviews*. Mumbai: Jaico Publishing, 2004.

Barret Grant. Perfect *English Grammar: The Indispensable Guide to Excellent Writing and Speaking.* Fall River Press, 2016

Monippally, Matthukutty, M. *Business Communication Strategies.* New Delhi: Tata McGraw-Hill Publishing Company Ltd., 2001.

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Prasad, H. M. *How to Prepare for Group Discussion and Interview*. New Delhi: Tata McGraw-Hill Publishing Company Limited, 2001.

Pease, Allan. Body Language. Delhi: Sudha Publications, 1998

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Thill, John V. & Courtland L. Bovée, *Excellence in Business Communication*, 10th edition. Boston : Pearson, 2013.

Thorpe, Edgar & Showick Thorpe. *Winning at Interviews*. 2nd Edition. Delhi: Dorling Kindersley, 2006.

SAVITRIBAI PHULE PUNE UNIVERSITY

PHYSICAL EDUCATION SCHEME

CC (Co-curricular Course NEP -2020)
(Syllabus and Guidelines for First Year
Under Graduate Students of All the Faculties)

Effective from Academic Year 2024 - 2025

PHYSICAL EDUCATION SCHEME

Syllabus and Guidelines for First Year Under Graduate Students of All the Faculties

Effective from Academic Year 2024 - 2025

PHYSICAL EDUCATION AND SPORTS (2 CREDITS)

OR

PHYSICAL EDUCATION AND YOGA (2 CREDITS)

Note: College / Institute should offer 2 credits either of Physical Education and Sports or Physical Education and Yoga depending upon facilities available at the college / institute.

Course Title: Physical Education & Sports – 2Credits OR Physical Education & Yoga – 2Credits	
Course Code: CC	**Course Category: Co-Curricular Course (CC)**
Course Title: Sports-1	**Type: Theory & Practical**
Total Contact Hours: 30 (2/week)	**Course Credits: 02**
College Assessment (CA) Marks: 50 Marks	**University Assessment (UA): NA**
Course Objectives: **To enable the students:** • To create interest in sports among students. • To develop the sports knowledge among students. • To explain the importance of sports to the students. • To develop physical and mental health through sports.	
Course Outcomes: • Increase in the physical and mental fitness of students through sports. • The student may develop better grasping power. • Development of student's personality through sports. • The students be encouraged for better competition in sports.	

PHYSICAL EDUCATION AND SPORTS

PHYSICAL EDUCATION AND SPORTS (2 CREDITS) (SEM- II)AIM OF THE

COURSE:

The aim of the course is to make Physical Education as an integral part of educational system and Promote physical activity among sedentary students / non-sportsmen. Students studying in the colleges should have the benefit of physical education to improve their health during the course of college education. It is designed to ensure that on completion of this course, they would attain the minimum prescribed standard.

OBJECTIVE OF THE COURSE:
The objective of the course is to enhance physical efficiency and maintain fitness of mind, and body, which would help the student to be mentally alert and physically efficient to withstand the strain and fatigue of daily life. It would prepare them for the strenuous training which will help them to be fit to face the different barriers in life. The students will undergo this course for the first year of his/her under graduate course education.

COURSE CREDITS :
Semester - II
Physical Education and Sports (02 Credits)

Credit 1: Introduction to Physical Education and Sports
- **Concept of Physical Education, its Definition and Scope.**
- **Concept of Physical Fitness**
  - Components of Health Related Physical Fitness(Cardio-vascular Endurance, Muscular Strength Endurance, Flexibility, and Body Composition) and Activities to improve these components.
- **Physical Activity Guidelines(Physical activity for health benefits)**
- **Concept of Health, Wellness, and Health & Hygiene.**
- **Participation in Games and Sports :**
  A student will have to select one game/sport from the list of Association of Indian Universities, New Delhi (List of events available on website **www.aiuweb.org**). The choice of game/sports will be according to the facilities available in the college.
  The following points to be covered:
  - History of the Game/sport
  - Ground measurements
  - Skills of the game/sport
  - Basic rules of the game/sport

Every student should participate in game/sport selected by him/her for 10hours.

Credit 2: Fitness Assessment

- In order to improve the physical fitness standards of students, they should be given opportunity and facilities to participate in a game / sport from the list of Association of Indian Universities, New Delhi (List of events available on website **www.aiuweb.org**). The choice of game / sports will be according to the facilities available in the college.
- Fitness Assessment
  - Cardiovascular Endurance
  - Flexibility
  - Muscular Strength Endurance and
  - Body Composition (No marks)

REFERENCE BOOKS:

- Bucher, C. A., & Wuest, D. A. (2010). Foundation of Physical Education, Exercise Science and Sports. Tata McGraw Hill Education Private Limited. New Delhi.

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EVALUATION STRUCTURE

Table 1

Semester	Course	Credit	Marks	Mode of Evaluation
II	PHYSICAL EDUCATION AND SPORTS (2 CREDITS)	1*	25	**Project(15 marks)** and **Practical(10 marks)** (10 hrs. of participation in selected game/sport).
		1**	25	Practical – **Fitness Test** (Table 2)

*indicate first credit **indicate second credit

- To complete first credit of Course – 101 Physical Education and Sports, Teacher will have to **conduct 5 theory lectures** (college may schedule these lecture during first or second semester before fitness assessment) and student will have to attend 5 theory lectures and has to participate in selected game / sport for **minimum 10hrs.** and will have to prepare a handwritten project work on the sports event selected for that year in his/her language selected for studies. **The project** to be prepared will be based on the following contents:
  - History of the Game
  - Ground measurements
  - Skills of the game
  - Basic rules of the game

- Procedure for fitness tests are given in the guidelines section which also includes Norms Table. Marks to be awarded in accordance with the norms table.

Fitness Test:

Table 2

Sr. No.	Component	Test	Marks
1	Cardiovascular Endurance (Any One)	1. Modified Queens College Test or 1. 12 Min. Run Walk	10
2	Flexibility	2. Sit and Reach Test	05
3	Muscular Strength Endurance	3. Bent Knee Sit Ups	10
4	Body Composition	4. Fat Percentage	--
		Total :	25

In the second semester the students will have to appear for the Fitness Test (25 marks). Test wise weightage of marks is as per Table 2. The examination will be conducted as per the convenience of the college in second semester.

CRITERIA OF PASSING

Table 3

Semester	Course	Credit	Max. Marks	Minimum Passing %	Max. Marks	Minimum Passing %
II	PHYSICAL EDUCATION AND SPORTS (2 CREDITS)	1	25	40%	50	40%
		1	25	40%		

- To pass a student shall have to get minimum 40% in each credit and aggregate 40% in each course.
- Student who have failed/who have been absent for the entire course/who have not completed any task will have to complete the entire course during the 4th semester.
- Student will not be considered eligible for 5th semester without completing the Course (i.e. Course 101 PHYSICAL EDUCATION AND SPORTS).

CONSIDERATIONS AND EXEMPTIONS:

Differently Able Students
Differently able students will be exempted from the course 101 PHYSICAL EDUCATION AND SPORTS after producing the valid documents.This is not depriving them from the equality of opportunity with other students. The student shall have to submit his/her medical certificate at the time of admission from a Civil Surgeon of respective District Civil Hospital.

Important Note:
- Temporary illness will not give students exemption from the course. If he / she miss any assessment/task he / she will be given opportunity in the ensuing semester.

Exemption
Any Student representing college / institute in the enlisted games of Association of Indian Universities / Indian Olympic Association / State Olympic Association shall be **exempted from mandatory participation in selected game / sport for minimum 15 sessions** of first credit of Course – 101 Physical Education and Sports.

GRADING:
Grading will be done as follows.

Table 4

Range of Marks	Grade	Grade Points
41-50	O	10
35-40	A+	09
30-34	A	08
28-30	B+	07
25-27	B	06
23-24	C	05
20-22	P	04
00-19	F	00
Absent	Ab	00
	Ex	Exempted

SAVITRIBAI PHULE PUNE UNIVERSITY

PHYSICAL EDUCATION AND SPORTS
Guidelines

(for First Year Under Graduate Students of
All the Faculties)

Effective from Academic Year 2024 - 2025

ORGANIZATIONAL GUIDELINES :

1) **STAFF:** The colleges are expected to have qualified teachers in Physical Education and Sports. The Course can be managed with the help of contributory teachers but, the regular teacher in-charge of sports and physical education will have to be appointed to streamline the working of the department.

For facilitating the smooth working of the course, every class should be divided into a group of 30 students each with a team leader who would help the college Director of Physical Education and Sports in the organization of the work.

The evaluation of students should be done by the Director of Physical Education with the help of other teaching staff.

2) **FACILITIES AND EQUIPMENT:**

a) **PLAYGROUD :** The sports facilities available at the college should be maintained for the regular practices and should be made available to conduct the tests.

b) **EQUIPMENT :** According to the playing facilities available in the college, the required equipment for the same needs to be made available to the students.

3) **FINANCIAL PROVISION:**

a) **FEES :** For the conduct of this scheme fees as per University rules should be collected by college and the amount collected thereof should be strictly utilized in consultation with Director of Physical Education and Sports for the promotion of sports and for the conduct of Physical Education Scheme.

GENERAL GUIDELINES TO IMPLEMENT THE COURSE

1. **APPOINTMENT OF STUDENT LEADERS :**
   To run the program throughout the year effectively, every college shall appoint student leaders amongst the students as per their requirement.
   Normally after every 30 students, the college may appoint 01 student leader who shall extend his/her help to conduct the program under the supervision or as per the guidelines given by the college Director of Physical Education.

2. **STUDENT LEADERS ORIENTATION PROGRAM :**
   The College Director of Physical Education at the beginning of the academic session shall organize at least three days orientation program for the selected student leaders. It is expected that the entire course related important responsibilities shall be conveyed to the student leaders, if possible with the required demonstrations.

3. **TRAINING TO STUDENT LEADERS :**
   The College Director of Physical Education at the beginning of the academic session, selects the student leaders as per his/her requirement and shall train them to conduct the decided program. Normally, following training shall be given to the student leaders.
   - Method of taking attendance
   - Preparation of weekly program
   - Record keeping
   - Preparation of test sheets
   - Marking of play grounds
   - Checking of equipment specifications
   - Class Controlling

Program and Activities to be arranged during orientation of Student Leaders:
   - Warming up Exercises
   - Conditioning Exercises
   - Demonstration of Various Tests
   - Imparting of training schedule
   - Group dynamics
   - Various methods of testing
   - Introduction and operational use of the equipments
   - Method of extension of help during the tests

4. **ADMINISTRATION IN ABSENTIA :**
The College Director of Physical Education normally shall have to supervise, guide, control and has to visit various places during the conduct of Intercollegiate Sports programs, hence, in his/her absence the student leaders shall conduct the decided programs as per the guidelines issued by the Director of Physical Education of Sports from time to time.

5. **REQUIREMENT OF FINANCIAL ASSISTANCE TO CONDUCT THE STUDENT LEADERS' ORIENTATION PROGRAM :**
The head of the institution shall make available the required financial assistance to the College Director of Physical Education to conduct the student leaders' orientation program. The college authorities may seek the help of the team leaders rendering the services through Earn and Learn Scheme.
Every year at the beginning of the session the College Director of Physical Education shall submit the required budget to the Head of the College. The expenditure on the same shall be incurred from the fees collected for this program.

6. **INFORMATION ABOUT THE COURSE :**
The College Director of Physical Education and Sports at the beginning of the academic session shall inform and explain the course to the admitted students.

7. **APPLICATION FORM :**
The College Director of Physical Education at the beginning of the academic session shall issue and collect the duly filled prescribed application form from the students admitted to First year of the Courses. (Appendix –II)
The College Director of Physical Education at the beginning of the academic session shall sort the duly filled in application forms and accordingly make the required arrangements.

8. **CLASSES OF THE ACTIVITIES :**
5 Lectures of the decided time shall be conducted by the College Director of Physical Education or with the help of Guest Faculty. Although the evaluation will be done in second semester theory lectures and practical sessions may be arranged in first semester also.

9. **CERTIFICATE TO STUDENTS LEADER :**
Every year at the end of the academic year the Director of Physical Education and Sports of the College shall award certificate to the student leader as per the Appendix - III.

Achievement Card for

PHYSICAL EDUCATION AND SPORTS

Fitness Test

Name of the Student : ....

College : ....

Sr. No	Activity	Particular	Out Of Marks	Performance	Marks
1	**Fitness Assessment**	• **Cardiovascular Endurance**	**10**		
		• **Flexibility**	**5**		
		• **Muscular Strength Endurance**	**10**		
		• **Body Composition**	**--**		--
		Total :	**25**	--	

Signature of the Student

Signature of Teacher In- charge : ....

Signature of Principal : ....

Date :   /   /

College
Seal
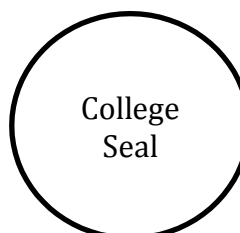
Application Form

PHYSICAL EDUCATION AND SPORTS

Paste latest passport size photograph

Name of Student	
Address for Correspondence	
Class	

Section	
Semester	
Sex	**Male / Female**
Date of Birth	
Age	
Blood Group	
Height	
Weight	
Game Selected	
Medical History / Illness If any	

** The Student shall have to choose any one game/sports event as per the availability of the infrastructure and equipments in the college. For his/her convenience they may consult the College Director of Physical Education.

I, the undersigned declare that, I shall practice the selected events as per the instructions given by the College Director of Physical Education and abide by the rules made thereof. Further, I certify that, I shall not change or switch over to any other event in the mid of the session and appear the final test in the events selected under this form.

Signature of the Student

Date :   /   /
Place : ....

APPENDIX – III

Certificate of Appreciation

This is to certify that Shri/ Smt/ Kum. _____ of _____

_____

Has successfully rendered his/her valuable services for the smooth conduct of theSports

and Physical Education Course designed by the University for the Academic Year _____

_____

Date: /   /

Director of Physical Education of the College	Seal of College	Principal of the College

---

Exemption Form

(Sports Participation)

PHYSICAL EDUCATION AND SPORTS

(**Mandatory participation in selected game / sport for minimum 10 hours)**

Name of Student	
Address for Correspondence	
Class	

Section	
Semester	
Sex	**Male / Female**
Sports/Game	
Date of competition	
Place of competition	
Level of Competition	

Signature of the Student

Date :   /   /

Place : ....

Exemption Granted / Exemption Not Granted

Director of Physical Education of the College	**Seal of College**	**Principal of the College**

APPENDIX – V

Exemption Form

(Differently Able Students)
PHYSICAL EDUCATION AND SPORTS

Name of Student	
Address for Correspondence	
Class	

Section	
Semester	
Sex	**Male / Female**
Nature of Disability	
Yes / No	**Copy of certificate from competent authority attached**

_____

Signature of the Student

Date :   /   /
Place : ....

Exemption Granted / Exemption Not Granted

Director of Physical Education of the College	Seal of College	Principal of the College

SPORTS / GAME PARTICIPATION LOG

PHYSICAL EDUCATION AND SPORTS

Name of Student	
Class	
Section	
Semester	
Sports/Game	

Date	Activity	Student Sign.	Student Leader Sign.

Signature of the Director of sports & PE

Date :   /   /
Place : ....

SAVITRIBAI PHULE PUNE UNIVERSITY

PHYSICAL EDUCATION AND SPORTS
PHYSICAL EDUCATION AND SPORTS

FITNESS TEST MANUAL

(for First Year Under Graduate Students of All the Faculties)

Effective from Academic Year 2024 - 2025

TEST DESCRIPTION

1. MODIFIED QUEENS COLLEGE STEP TEST :

OBJECTIVE :

To provide a practical, convenient means for assessing cardio respiratory fitness.

VALIDITY :

using maximal oxygen consumption as the criterion, a correlation of - .75 was obtained between the first heart rate recovery score (5-20 seconds after exercise) and max. VO_2 expressed in ml/kg/min

RELIABILITY :

A reliability coefficient of .92 was reported

EQUIPMENT AND MATERIALS :

Bleachers serve as stepping bench (16.25 inches). A metronome is used for the cadence. Women 22 steps per minute and Men 24 steps per minute.

PROCEDURE :

Half of the class may be tested at one time with the other half serving as partners to count pulse. Following the explanations of the test and pulse-counting procedures, the counters are allowed several practices in counting their partners pulse rates for 15-seconds intervals.

The test consists of stepping up and down on the bleachers step for 3 minutes. At the end of the time period, the subjects remain standing while the partners count pulse rate for 15 seconds interval beginning 5 seconds after the cessation of exercise. The counters and steppers then exchange places and the other half of the class is tested.

SCORING :

The 15- seconds pulse count is multiplied by 4 to express the score in beats per minute.

NORMS :

Men & Women (Performance in Beats per minute)	Marks out of 10
≤ 148	10
149 – 156	9
157 – 160	8
161 – 163	7
164 – 166	6
167 – 170	5
171 – 172	4
173 – 180	3
181 – 184	2
≥185	1

Marks based on percentile norms Ref.: Johnson, B. L. & Nelson, J. K. (1986). Practical Measurement for evaluation in physical education (3rd edn) Mc Millan Publishing Company USA. Pg. 161

2. TWELVE MINUTE RUN AND WALK TEST (COOPER'S TEST) :

OBJECTIVE :

To measure cardio-respiratory endurance.

VALIDITY :

Validity is 0.90 when correlated with treadmill measurements of oxygen consumption and aerobic capacity.

RELIABILITY :

Reliability is 0.94 with test-retest method.

EQUIPMENT AND MATERIALS :

Stopwatch or clock with sweep second hand, whistle or starter's pistol, track, football field, or some running area marked so that distance travelled in 12 minutes can be calculated easily.

PROCEDURE :

Performers assemble behind starting line. At the starting signal, they run or walk as far as possible within the 12 minute time limit. An experienced pacer should accompany performers around the running area during the actual test. Performers should have experienced some practice in pacing. At the signal to stop, performers should remain where they finished long enough for test administrators to record the distance covered. Ample time should be given for stretching and warm-up as well as post-test cool down.

SCORING :

Score is distance in meter covered in 12 minutes.

NORMS :

Men (In meters)	Women (In meters)	Marks out of 10
≥2641	≥2261	10
2461 – 2640	2111 – 2260	9
2351 – 2460	2001 – 2110	8
2271 – 2350	1941 - 2000	7
2191 – 2270	1871 – 1940	6
2131 – 2190	1811 – 1870	5
2061 – 2130	1761 – 1810	4
1971 – 2060	1681 – 1760	3
1871 – 1970	1621 – 1680	2
≤ 1870	≤ 1620	1

(Marks based on percentile norms Ref: Hoffman J. (2006). Norms for fitness performance & health. Human Kinetics. USA. Pg. 73)

3. SIT AND REACH :

OBJECTIVE :

To measure the hip and back flexion as well as extension of the hamstring muscles of the legs.

VALIDITY :

Face validity was accepted for this test.

RELIABILITY :

An 'r' of 0.94 was found when the best score of three trials was recorded from separate testing and correlated.

EQUIPMENT AND MATERIAL :

Flexomeasure case with yard stick and tape.

PROCEDURE :

i. Line up the 15 inch mark of the yardstick with a line on the floor and tape the ends of the stick to the floor so that the flexomeasure case (window side) is face down.

ii. Sit down and line up your heels with the near edge of the 15 inch mark and slide your seat back beyond the zero end of the yardstick.

iii. Have a partner stand and brace his or her toes against your heels. Also, have and assistant on each side to hold your knees in a locked position as you prepare to stretch.

iv. With heels not more than 5 inches apart, slowly stretch forward, while pushing the flexomeasure case as far down the stick as possible with the fingertips of both hands. Take your reading at the near edge of the flexomeasure case.

SCORING :

The best of three trials measured in centimeter is your test score.

NORMS :

Men (in cms)	Women (in cms)	Marks out of 5
≥ 42.01	≥42.51	5
38.01 – 42.00	40.01 – 42.50	4
34.51 – 38.00	36.51 – 40.00	3
29.51 – 34.50	32.51 – 36.50	2
≤ 29.50	≤ 32.50	1

(Marks based on percentile norms Ref.: Hoffman J. (2006). Norms for fitness performance & health. Human Kinetics. USA. Pg. 102)

4. BENT KNEE SIT UPS :

OBJECTIVE :
To measure the dynamic (isotonic) endurance of abdominal muscles.

EQUIPMENT AND MATERIALS :
A stopwatch and a mat or dry turf or clean floor.

PROCEDURE :
The subject is asked to lie on the back with knees bent, feet on the floor with heels not more than 12 inches from the buttocks. The angle of the knees should not be less than 90degree. The subject is asked to put his or her hand on the back of the neck with finger clasped and to place the elbows squarely on the mat or turf or floor. The subject's feet are held by a companion to ascertain that the feet do not leave the surface and remain touching it. Then the subject is asked to tighten the abdominal muscles and to bring the head and elbows to the knees. The entire above process constitutes one sit up.

The subject is asked to return to starting position with his/her elbows on the surface before sitting up again. The tester gives the above demonstration to all the subjects to be tested before the actual performance of the test. The timer gives the starting signals ready, go ! at the word 'go' the timer starts the stopwatch and the subject starts the sit ups performance as quickly as possible with /her best efforts. The tester starts counting the number of sit ups performed. After 60 seconds, the timer gives the signal stop and the subject stops, while the tester records the number of correctly executed sit ups performed by the subject in 60 seconds. This gives the score of the test.

Only one trail is given unless the tester believes that the subject has not had a fair opportunity to perform. A subject is not allowed any rest in between sit ups during his performance. No incorrect sit ups is counted in which the subject does either of the following mistakes:
 a) Keeps the fingers unclasped behind the neck.
 b) Returns to the incomplete starting position with elbows not flat on the surface before starting the next sit up.
 c) Brings both elbows forward by pushing of the floor with any elbow.

SCORING :
Number of correctly executed sit ups performed by the subject in 60 seconds

NORMS :

PERFORMANCE (NUMBER OF SIT UPS) Men	PERFORMANCE (NUMBER OF SIT UPS) Women	Marks out of 10
≥ 44	≥ 35	10
40 – 43	30 – 34	9
37 – 39	28 – 29	8
35 – 36	25 – 27	7
32 – 34	23 – 24	6
30 – 31	21 – 22	5
28 – 29	18 – 20	4
25 – 27	15 – 17	3
23 – 24	11 – 14	2
≤22	≤ 10	1

(Marks based on percentile norms Ref: The Cooper Institute (2006). Physical fitness specialist course and certification. Texas, USA. Pg. 29 & 36)
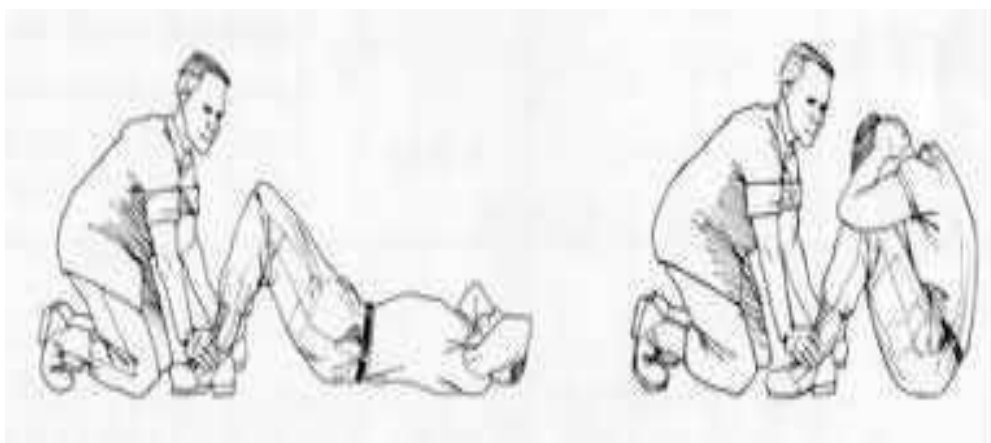
5. **PERCENTAGE BODY FAT :**

Bioelectrical Impedance (BI) :

Bio electrical is gaining popularity because of its ease in administration and its similarity to skin fold measurements regarding accuracy. BI is based on the relationship between total body water and lean body mass. Since water is an excellent conductor of electricity, a greater resistance to an electrical current passing through the body indicates a higher percentage of body fat. Likewise decrease when there is higher percentage of lean tissue. Since BI is sensitive to changes in body water, subject should refrain from drinking or eating within 4 hours of the measurement, void completely before the measurement, and refrain from consuming any alcohol caffeine, or diuretic agent before assessment. Failure to do so increases measurement error. For this Omron Body Fat Monitor can be used.

SAVITRIBAI PHULE PUNE UNIVERSITY

PHYSICAL EDUCATION AND YOGA
Syllabus

(For First Year Under Graduate Students of All the Faculties)

Effective from Academic Year 2024 - 2025

PHYSICAL EDUCATION AND YOGA

PHYSICAL EDUCATION AND YOGA (2 CREDITS)

AIMS & OBJECTIVES OF THE COURSE:

The aim of the course is to create awareness among students about Yoga, and to facilitate knowledge about Asanas, Pranayam and Shuddikriya. This will help them to incorporate yogic practices in their lifestyle.

COURSE CREDITS :
Semester - II
Physical Education and Yoga (02 Credits)

Credit 1: Introduction to Physical Education and Yoga
- **Concept of Physical Education, its Definition and Scope.**
- **Introduction to Yoga -** History of Yoga, Introduction to Ashtanga Yoga.
- **Prayer**
- **Mobility exercises – Neck up & down, Side to side, shoulder rotation, Twisting, Squats.**
- **Practice of Prone and Supine Asanas**
  A student will have to perform standing and seating asanas
  - Pavanmuktasana
  - Shavasana
  - Setubandhasana
  - Ardha Halasana
  - Salabhasana
  - Bhujangasana
  - Halasana
  - Makarasana
  - Dhanurasana

  The following points to be covered:
  o Benefits &Contraindication of each asana

Credit 2: Sitting and Standing Asanas and Pranayam
- **Practice of Sitting and Standing Asanas**
  A student will have to perform sitting and standing asana
  - Vajrasana
  - Dandasan
  - Vakrasana
  - Ushtrasana
  - Uttanmandukasana
  - Bhadrasan
  - Vrikshasana
  - Shashankasan
  - Trikonasana
  - Padahastasana
  - Chakrasana - sideward
  - Tadasana

  The following points to be covered:
  o Benefits & Contraindication of each asana

- **Practice of Pranayam**
  A student will have to perform pranayama
  - Anulom-Vilom
  - Bhramari
  - Kapalbhati

  The following points to be covered:
  o Benefits & Contraindication of eachPranayama

<u>REFERENCE BOOKS:</u>

- Iyengar, B.K. (2008).Light on Yoga. Orient LongmanPvt. Ltd.Mumbai

- Iyengar, B.K. (2008).Light on Pranayama. Orient LongmanPvt. Ltd.Mumbai

- Iyengar, B.K. (2008).Light on Astanga Yoga. Alchemy Publishers. New Delhi.

- Iyengar, B.K. (2008). Yoga the Path to Holistic Health. Dorling Kindersley. London.

- Gharote, M. L. (2013). Guidelines for Yogic Practices. The Lonavla Yoga Institute. India.

- अय्यंगार, गी. (२०१६). िTयांसाठी योग– एक वरदान. रोहन ꠰काशन. पुणे.

- अय्यंगार, बी. के. (२०१७). आरोीय–योग. रोहन ꠰काशन. पुणे.

- घरोटे ल. म. (२०१०) ꠰ाणायाम – &ासाचे शाT. ꠰द लोणावळा योग इि:ɜthूट. इंिडया.

EVALUATION STRUCTURE

Table 1

Semester	Course	Credits	Marks	Mode of Evaluation
II	PHYSICAL EDUCATION AND YOGA – II (2 CREDITS)	2	50 (10marks x 5)	1. Demonstration and Explanation of Asana, and pranayam (total 5 – out of which 3 of student choice and2 of examiners choice)

EVALUATION OF THE ASANAS :

Each Asana will be awarded from 0-10 Marks. The evaluation is further distributed as under :-
    a) Technical Execution (Presentation) 4 Marks
    b) Complete Posture 4 Marks
    c) Retention period 2 Marks

EXPLANATION :

a) Technical Execution (Presentation) 4 marks. It involves methodical approach in itspresentation which further depends on
    i) Arriving to the posture,
    ii)Alighting fromthe posture,
    iii) Expression,
    iv) Breathing

b) Complete Posture 4 marks. Attainment of the final posture and while being in thisposition certain aspects deem necessary to be taken into consideration to constitutea complete posture
    i) Stability in the posture,
    ii) Calmness & tranquillity,
    iii)Exactness and correctness,
    iv) Smoothness and degree of flexibility,
    v) Bodyalignment, its angles and beauty.

c) Retention 2 marks. All postures are required to be held for20 seconds each. During retention period no shivering, no untoward movement, consistentbreathing, calm face expression and proper body language is essential.

PASSING CRITERIA

Semester	Course	Credits	Max. Marks	Minimum Passing %
II	PHYSICAL EDUCATION AND YOGA – II (2 CREDITS)	2	50	40%

- To pass a student shall have to get minimum 40% in aggregate in course.
- Student who have failed/who have been absent for the entire course will have to complete the entire course during the 4th semester.
- Student will not be admitted to 5th semester without completing the Course.

GRADING:

Grading will be done as follows.

Table 3

Range of Marks	Grade	Grade Points
41-50	O	10
35-40	A+	09
30-34	A	08
28-30	B+	07
25-27	B	06
23-24	C	05
20-22	P	04
00-19	F	00
Absent	Ab	00
	Ex	Exempted

I.K.S. (Generic)- Year-I, Sem- I Syllabus [Level 4.5]			
Course Type	**Indian Knowledge System (IKS)**	**Credits-2 (Theory)**	**Weeks-15 Hours-30**
IKS 101HIS	**History of Knowledge Production in India (Generic)**	**Int. Marks 15**	**Ext.Marks 35**

Course Objectives:

1. To understand the nature of knowledge.
2. To understand the evolution of the scientific approach in the Indian subcontinent.
3. To study contributions made by different people to the various branches of knowledge before modernity evolved in India.

Course Outcomes:

1. The concept of the ancient intellectual knowledge tradition will be understood.
2. Developments in science from ancient times will be introduced.
3. Developments in humanities from ancient times will be understood.

Syllabus (from 2024-25)

Unit 1. Introduction to Indian Knowledge System 06

    a. Definition, Scope and importance of knowledge
    b. nature of Indian Knowledge System
    c. Evolution of scientific approach

Unit 2. Development of Sciences 12

    a. Astronomy- Aryabhatta, Varahamihira, Sawai Jaisingh
    b. Medicine- Ayurveda and Yunani
    c. Metallurgy- Copper, Iron, Bronze & alloys

Unit 3. Development of Humanities 12

    a. Language - Prakrit, Sanskrit, Farsee
    b. Philosophy- Vedic, Lokayat, Buddhist, Jaina
    c. Education system in ancient India – Takshashila, Nalanda, Valabhi University
    d. Architecture

References:
English:

1. Abdur Rahman, *Science and Technology in Medieval India: A Bibliography of Source Materials in Sanskrit, Arabic, and Persian*, Indian National Science Academy, New Delhi, 1982.
2. Bag A. K. (ed), History of Technology in India(Vol I) (From Antiquity to C. 1200 A.D.), Indian National Science Academy, Delhi, 1997.
3. Chattopadhyaya, Debiprasad, *History of science and technology in ancient India: the beginnings*, Firma KLM Pvt. Ltd. 1986.
4. Dasgupta Surendranath, *A History of Indian Philosophy*, Cambridge University press, 1922.
5. Gopal L. and V. C. Shrivastava, *History of Agriculture in India (Upto 1200 A. D.)*, Concept Publishing, New Delhi, 2008.
6. Irfan Habib (ed.), *People's History of India – Vol 20 : Technology in Medieval India, c. 650–1750*, Aligarh Historians Society and Tulika Books, 2016.
7. Jan Gonda, *A History of Indian Literature*, Otto Harrassowitz, Wiesbaden, 1975.
8. PadmanabhaThanu (ed.), *Astronomy in India : A Historical Perspective*, Indian National Science Academy, Springer, New Delhi. 2014.
9. Sohoni Pushkar, *Introduction to the History of Architecture in India*, IISER, Pune, 2020.
10. Tripathi Radhavallabh, *Vāda in theory and practice : studies in debates, dialogues and discussions in Indian intellectual discourses*, IIAS, Shimla, 2016.

मराठी:
1. अळतेकर सदाशिव अनंत, प्राचीन भारतीय शिक्षण पद्धती, नागपूर, १९३५.
2. कोसंबी दा.ध., प्राचीन भारतीय संस्कृती आणि सभ्यता, डायमंड प्रकाशन, पुणे, २०१६.
3. कोसंबी दा. ध. संतापजनक निबंध, लोकवाङ्मय गृह, मुंबई, २०२१.
4. गायधनी र.न. व राहूरकर व.ग., प्राचीन भारताचा सांस्कृतिक इतिहास, कॉन्टिनेन्टल पुणे, १९९४.
5. दीक्षित, राजा, मराठीतील विज्ञानविषयक लेखन, साफुपुवि प्रकाशन, २०१४.
6. मेहंदी, प्राचीन भारत समाज आणि संस्कृती, प्रज्ञा पाठशाळा मंडळ, वाई, २००१.
7. शर्मा आर. एस., प्राचीन भारत, के सागर प्रकाशन, पुणे. १९९७.
8. सिंग उपिंदर, प्राचीन भारत- विरोधाभासांची संस्कृती, सनय प्रकाशन, २०२४.

Examination Pattern:

A) I. K. S.Theory Paper: Total 2 Credits   -   Total Marks: 50

Marks Scheme of Examination: Theory Paper

     a. **Semester End Exam** 35 Marks (Minimum Marks 14 for passing)

     b. Internal Assessment 15 Marks (Minimum Marks 06 for passing)

     c. The details of Question Paper Pattern for offline Examination -

      Time (2 Hours), 2 Credit Course, Marks (35)

     Q.1) Answer the following questions in 200 words (any 1 out of 2) 10 Marks

     Q.2) Answer the following questions 200 words (any 1 out of 2)   10 Marks

     Q.3) Answer the following questions in 200 words (any 1 out of 2) 10 Marks

     Q.4) Write short notes (any 1 out of 2) 5 Marks

     Internal Assessment

Total Marks: 15 =

10 Marks - Mid Semester Exam. –

5 Marks-   Home Assignment, Oral, Students Seminar, PPT presentation. (any One)

SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE

NATIONAL CADET CORPS (NCC)

CC (Co-curricular Course NEP -2020)

(Syllabus and Guidelines for First Year and Second Semester

Under Graduate Students of All the Faculties)

Effective from Academic Year 2024 - 2025

Course Code : NCC/CC/151
(Semester - II)

Title of the Paper :

National Cadet Corps (NCC)

Preamble :

NCC is a discipline that instills among the youth the qualities of unity, discipline, social service, leadership, personality development and patriotism. Presently, the youth in India need to be motivated and inspired to join armed forces and to provide selfless service to the country. NCC has proved to be an effective means of developing character of the students and making them the citizens worthy of the nation. Therefore, it was felt necessary that the discipline should be made a part of the curriculum. As a result, the subject NCC Studies has been introduced as an elective course.

OBJECTIVES :

1. Develop character, camaraderie, discipline, secular outlook, the spirit of adventure, sportsman spirit and ideals of selfless service amongst cadets by working in teams.
2. To create interest in cadets by including and laying emphasis on those aspects of institutional Training which attract young cadets into the NCC.
3. To inculcate defence Services work ethos that is characterized by hard work, sincerity of purpose, honesty, ideal of selfless service, dignity of labour, secular outlook, comradeship, spirit of adventure and sportsmanship.
4. To create a pool of organized, trained and motivated youth with leadership qualities in all walks of life, who will serve the Nation regardless of which career they choose.
5. To provide conducive environment to motivate young Indians to choose the Armed Forces as a career.
6. To teach and develop the qualities such as self-discipline, self-confidence, self-reliance and dignity of labour in the cadets.

Structure of the Course :

Semester	Course Code	Course Title	No of Credits	No of Lectures	Practical Hrs
II	NCC/CC/151	National Cadet Corps Paper I	02	15 L	30 P

Paper I : National Cadet Corps

Course code : NCC/CC/151

Course Objectives:

1. To make the cadets aware of the origin and development of NCC

2. To inculcate a sense of fellow feeling and comradeship among the cadets

3. To make the cadets aware of their duties towards the society and country

4. To develop the cadets as responsible citizens of India

5. To instill sense of selfless service among the cadets

6. To inculcate unity and discipline among the cadets

Course Outcomes: On successful completion of this course, students will be able to

CO 1– develop a sense of comradeship

CO 2–realize his/her duties towards the society and nation

CO 3– contribute in the development and safety and security of the country

CO 4– behave as a responsible person

CO 5 – assist the society without any expectations

CO 6 –make oneself a disciplined human being

Course Content

UNIT	Description	L / P	Credits	CO
I	**Personality Development**			
	1. Factors 2. Self-Awareness 3. Empathy 4. Creative and Critical Thinking Decision Making and Problem Solving	**15 L**	**1**	**CO 1** **CO 2** **CO 3**
II	**Practical**			
	1. Social Service and Community Development 2. Swachh Bharat Abhiyan 3. Celebration of Republic Day; Case Study 4. Social Awareness Rally	**30 P**	**1**	**CO 4** **CO 5** **CO 6**

College Assessment (CA) Marks: 50 Marks : Home Assignment / Practical / Parade / Fitness Test / Unit Test / Oral Test / Seminar / Field Work / Study tour Report / Case Study / Skill Test etc, Choice of Subject Teacher.

Co-Curricular Activity:

Exposure visit to a place of national importance

Field Visit to a place such as army camp, NDA etc

References:

DGNCC Mobile App by HQ, Directorate General NCC, New Delhi

Cadets Handbook: Common Subjects. DGNCC

Cadets Handbook: Specialized Subject-Army. DGNCC

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Savitribai Phule Pune University
(Formerly University of Pune)

Four Year Degree Program
B.Sc.(Computer Science)

With

Major: Computer Science

(Faculty of Science and Technology)

Syllabi for
S.Y.B.Sc. (Computer Science)

(For Colleges Affiliated to Savitribai Phule Pune University)

Choice Based Credit System (CBCS) Syllabus
Under National Education Policy (NEP)
To be implemented from Academic Year 2025-2026

Title of the Course: B.Sc. (Computer Science)

Preamble:

       The B. Sc. (Computer Science) and B. Sc. (Computer Science) (Honors) and (Research) course is a systematically designed program with Computer Science as a major subject under the faculty of Science and Technology. The objective of the course is to prepare students to undertake careers involving problem solving using computer science and technologies, or to pursue advanced studies and research in computer science. The syllabus which comprises of Computer Science (Major) subject along with that of the three allied subjects (Mathematics, Electronics and Statistics) (Minor) covers the foundational aspects of computing sciences and also develops the requisite professional skills and problem solving abilities using computing sciences.

Introduction:

       At the first year of under-graduation, the basic foundations of two important skills required for software development are laid. A course in problem solving and programming along with a course in database fundamentals forms the preliminary skill set for solving computational problems. The practical courses are designed to supplement the theoretical training in the year. Along with Computer Science (Major), VSC and SEC courses help in building a strong technical foundation. Another aspect of this course is IKS which tells about the rich heritage and advancement of India in the field of computation.

       In the second year of under-graduation, computational problem solving skills are further strengthened by a course in Data structures, C++ and python programming. Software engineering concepts that are required for project design are also introduced. Essential concepts of computer networking are also introduced this year. The practical course included in both semesters complements the theory courses. Field projects/ OJT are introduced so that students can implement the concept they have learnt in first year.

       In Second Year, the "Subject 1: Computer Science" will be the 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

       At the third year of under-graduation, all the subjects are designed to fulfill core Computer Science requirements as well as meet the needs of the software industry. Theory courses are adequately supplemented by hands-on practical courses. Major elective courses are taking care of recent advancement in the field of computer science. Minor and Skill Enhancement courses enable the students to acquire additional skills.

       At the fourth year (honors) and (research) of under-graduation, all the subjects are designed to fulfill core Computer Science requirements as well as meet the needs of the software industry. Practical courses and field projects enable students to get hands-on training. Various learning tracks are open through Major elective courses. Research methodology course will create interest among the students to carry research in the field of computer science.

Objectives:

- To develop problem solving abilities using a computer.
- To build the necessary skill set and analytical abilities for developing computer based solutions for real life problems.
- To train students in professional skills related to the Software Industry.
- To prepare the necessary knowledge base for research and development in Computer Science.
- To help student's build-up a successful career in Computer Science and to produce entrepreneurs who can innovate and develop software products.

Eligibility

a) H.S.C. (10 + 2) Science stream with Mathematics.
b) Three years diploma course after S.S.C. (10th std.) of Board of Technical Education conducted by Government of Maharashtra or its equivalent.

Programme Out comes:

PO No.	Outcomes
PO1	Develop creative skills, critical thinking, analytical skills and research to address the real world problems using computational skills
PO2	Understand and apply mathematical foundation, computing and domain knowledge and develop computing models for defined problems
PO3	Understand software project management and computing principles with computing knowledge to manage projects in multidisciplinary environments
PO4	Illustrate the concepts of systems fundamentals, including architectures and organization, operating systems, networking and communication
PO5	Understand and apply the concepts of Digital Electronics, Computer Architecture, IoT etc.
PO6	Recognize the need for and develop the ability to engage in continuous learning as a Computing professional
PO7	Apply modern computing tools, skills and techniques necessary for innovative software solutions
PO8	Communicate effectively with the computing community as well as society by being able to comprehend effective documentations and presentations
PO9	Gain Self Discipline and commit Professional Ethics in global economic environment
PO10	Individual & Team Work: Ability to work as a member or leader in diverse teams in multidisciplinary environment
PO11	Identify opportunities, entrepreneurship vision and use innovative ideas to create value and wealth for the betterment of the individual and society

Savitribai Phule Pune University
Structure of UG Program as per NEP-2020
Name of Program :- B.Sc. (Computer Science)
Major Course: - Computer Science

Level:- 4.5 (First Year)   Sem:-I

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Subject 1	CS-101-T	Problem Solving using 'C' Programming	2		2		15	35	50
	CS-102-P	Lab Course based on CS-101-T		2		4	15	35	50
Subject 2	MTC-101-T	Matrix Algebra	2		2		15	35	50
	MTC-102-P	Mathematics Practical I		2		4	15	35	50
Subject 3	ELC-101-T	Principles of Analog Electronics	2		2		15	35	50
	ELC-102-P	Electronics Practical Course I		2		4	15	35	50
IKS(2)	IKS-101-T	Generic IKS	2		2		15	35	50
GE/OE*(2)	OE-101-CS -T/ OE-102-CS -T/ OE-103-CS-T / OE-104-CS-T	Office Automation I / Introduction to Computers and Basics of Internet / Introduction to Google Apps I / Fundamentals of Computers I	2		2		15	35	50
SEC (2)	SEC-101-CS	Statistical Methods for Computer Science I		2		4	15	35	50
AEC(2)	AEC-101-ENG	English	2		2		15	35	50
VEC(2)	VEC-101-ENV	EVS-I	2		2		15	35	50
Total			14	08	14	16			550

* The subjects offered to other faculty students under OE vertical are OE-101-CS -P/ OE-102-CS -T/OE-103-CS-P / OE-104-CS-T. The students of B.Sc. (Computer Science) will opt the subjects offered by other faculty given in University Basket.

Level:- 4.5 (First Year)   Sem:-II

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Subject 1	CS-151-T	Advanced C Programming	2		2		15	35	50
	CS-152-P	Lab Course Based on CS-151-T		2		4	15	35	50
Subject 2	MTC-151-T	Graph Theory	2		2		15	35	50
	MTC-152-P	Mathematics Practical II		2		4	15	35	50
Subject 3	ELC-151-T	Principles of Digital Electronics	2		2		15	35	50
	ELC-152-P	Electronics Practical Course II		2		4	15	35	50
GE/OE* (2)	OE-151-CS-T / OE-152-CS-T / OE-153-CS-T OE-154-CS-T	Office Automation II / Computer Fundamentals / Introduction to Google Apps II/ Fundamentals of Computers II	2		2		15	35	50
SEC(2)	SEC-151-CS-P	Statistical Methods for Computer Science II		2		4	15	35	50
AEC(2)	AEC-151-ENG	English	2		2		15	35	50
VEC(2)	VEC-151-ENV	EVS-II	2		2		15	35	50
CC(2)	CC-151-T	From University Basket	2		2		15	35	50
Total			14	08	14	16			550

The subjects offered to other faculty students under OE vertical are OE-151-CS -P/ OE-152-CS -T/OE-153-CS-P / OE-154-CS-T. The students of B.Sc. (Computer Science) will opt the subjects offered by other faculty given in University Basket.

Exit option: *Award of UG Certificate in Major with 44 credits and an additional 4 credits core as per university guidelines OR Continue with Major and Minor*

Continue option: Student will select one subject among the (subject 2 and subject 3) as minor and subject 1 will be major subject

In Second Year, the "Subject 1: Computer Science" 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	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core (4+2)	CS-201-MJ-T	Data Structure -I	2		2		15	35	50
	CS-202-MJ-T	Database Management System I	2		2		15	35	50
	CS-203-MJ-P	Lab Course based on CS-201-MJ-T & CS-202-MJ-T		2		4	15	35	50
VSC(2)	CS-221-VSC-T	Software Engineering	2		2		15	35	50
IKS	CS-201-IKS-T	Indian Knowledge System in Computing	2		2		15	35	50
FP/OJT/ CEP(2)	CS-231-FP	Mini Project		2		4	15	35	50
Minor (2+2)	CS-241-MN-T	Mathematics or Electronics	2		2		15	35	50
	CS-242-MN-P	Mathematics or Electronics		2		4	15	35	50
GE/OE(2)	OE-201-CS-T OE -202-CS-T OE-203-CS-T OE-204-CS-T	E commerce I / Web Design I / Digital Marketing I/ AI for everyone I	2		2		15	35	50
AEC(2)	AEC-201-T	From University Basket	2		2		15	35	50
CC(2)	CC-201-T	From University Basket	2		2		15	35	50
Total			16	06	16	12			550

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

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core (4+2)	CS-251-MJ-T	Data Structure - II	2		2		15	35	50
	CS-252-MJ-T	Database Management System II	2		2		15	35	50
	CS-253-MJ-P	Lab Course based on CS-251-MJ-T & CS-252-MJ-T		2		4	15	35	50
VSC(2)	CS-271-VSC-P	Advanced Python Programming		2		4	15	35	50
FP/OJT/ CEP(2)	CS-281-FP	Mini Project		2		4	15	35	50
Minor (2+2)	CS-291-MN-T	Mathematics or Electronics	2		2		15	35	50
	CS-292-MN-P	Mathematics or Electronics		2		4	15	35	50
GE/OE(2)	OE-251-CS-T / OE-252-CS-T / OE-253-CS-T / OE-254-CS-T	E commerce II/ Web Design II/ Digital Marketing II / AI for everyone - II	2		2		15	35	50
SEC(2)	SEC-251-CS-P / SEC-252-CS-P	Computer Networks / Statistical Analysis using R Software		2		4	15	35	50
AEC(2)	AEC251	From University Basket	2		2		15	35	50
CC(2)	CC-251-T	From University Basket	2		2		15	35	50
Total			12	10	12	20			550

Exit option: Award of UG Diploma in Major and Minor with 88 credits and an additional 4 credits core as per university guidelines OR Continue with Major and Minor

Level:- 5.5 (Third Year)   Sem:-V

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core (8+4)	CS-301-MJ-T	Core Java	2		2		15	35	50
	CS-302-MJ-T	Operating Systems	2		2		15	35	50
	CS-303-MJ-T	Web Technology-I	2		2		15	35	50
	CS-304-MJ-T	Theory of Computer Science	2		2		15	35	50
	CS-305-MJ-P	Lab Course based on CS-302-MJ-T		2		4	15	35	50
	CS-306-MJ-P	Lab Course based on CS-301-MJ-T & CS-303-MJ-T		2		4	15	35	50
Major Elective (2+2)	CS-307-MJ-T	Data Science	2		2		15	35	50
	CS-308-MJ-P	Lab Course based on CS-307-MJ-T		2		4	15	35	50
	OR								
	CS-309-MJ-T	Database Technologies	2		2		15	35	50
	CS-3010-MJ-P	Lab Course on CS-309-MJ-T		2		4	15	35	50
	OR								
	CS-3011-MJ-T	Embedded Systems	2		2		15	35	50
	CS-3012-MJ-P	Lab Course on CS-3011-MJ-T		2		4	15	35	50
VSC(2)	CS-321-VSC-P	Advanced Python Programming		2		4	15	35	50
FP/OJT/ CEP(2)	CS-331-FP	Project		2		4	15	35	50
Minor (2)	CS-341-MN-T	Mathematics or Electronics	2		2		15	35	50
Total			12	10	12	20			550

Level:- 5.5 (Third Year)   Sem:-VI

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core (8+4)	CS-351-MJ-T	Advanced Java	2		2		15	35	50
	CS-352-MJ-T	Design Framework	2		2		15	35	50
	CS-353-MJ-T	Web Technology-II	2		2		15	35	50
	CS-354-MJ-T	Compiler Construction	2		2		15	35	50
	CS-355-MJ-P	Lab Course based on CS-352-MJ-T		2		4	15	35	50
	CS-356-MJ-P	Lab Course based on CS-351-MJ-T & CS-353-MJ-T		2		4	15	35	50
Major Elective (2+2)	CS-357-MJ-T	Android Programming	2		2		15	35	50
	CS-358-MJ-P	Lab Course based on CS-357-MJ-T		2		4	15	35	50
	OR								
	CS-359-MJ-T	Software Testing Tools	2		2		15	35	50
	CS-3510-MJ-P	Lab Course based on CS-359-MJ-T		2		4	15	35	50
	OE								
	CS-3511-MJ-T	Internet of Things							
	CS-3512-MJ-P	Lab Course based on CS-3511-MJ-T							
VSC(2)	CS-321-VSC-P	Agile Processes		2		4	15	35	50
FP/OJT/ CEP(4)	CS-381-OJT	OJT		4		8	30	70	100
Total			10	12	10	24			550

Level:- 6.0 (Fourth Year)   Sem:-VII (Research)

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core (6+4)	CS-401-MJ-T	Advanced Operating System	2		2		15	35	50
	CS-402-MJ-T	Artificial Intelligence	2		2		15	35	50
	CS-403-MJ-T	Principles of Programming Language	2		2		15	35	50
	CS-404-MJ-P	Lab Course based on CS-401-MJ-T		2		4	15	35	50
	CS-405-MJ-P	Lab Course based on CS-402-MJ-T		2		4	15	35	50
Major Elective (2+2)	CS-406-MJ-T	Advance Databases and Web Technologies	2		2		15	35	50
	CS-407-MJ-P	Lab Course on CS-406-MJ-T		2		4	15	35	50
	OR								
	CS-408-MJ-T	Cloud Computing	2		2		15	35	50
	CS-409-MJ-P	Lab Course on CS-408-MJ-T		2		4	15	35	50
	OR								
	CS-410-MJ-T	C# .NET Programming	2		2		15	35	50
	CS-411-MJ-P	Lab Course on CS-410-MJ-T		2		4	15	35	50
FP/OJT/ CEP/RP (4)	CS-431-RP	Research Project		4		8	30	70	100
	CS-451-MN	Research Methodology	4		4		30	70	100
Total			12	10	12	20			550

Level:- 6.0 (Fourth Year)   Sem:-VIII (Research)

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core (6+4)	CS-451-MJ-T	Design and Analysis of Algorithms	2		2		15	35	50
	CS-452-MJ-T	Mobile App Development Technologies	2		2		15	35	50
	CS-453-MJ-T	Software Project Management	2		2		15	35	50
	CS-454-MJ-P	Lab Course based on CS-451-MJ-T		2		4	15	35	50
	CS-455-MJ-P	Lab Course based on CS-452-MJ-T		2		4	15	35	50
Major Elective (2+2)	CS-456-MJ-T	Full Stack Development I	2		2		15	35	50
	CS-457-MJ-P	Lab Course based on CS-456-MJ-T		2		4	15	35	50
	OR								
	CS-458-MJ-T	Web Services	2		2		15	35	50
	CS-459MJ-P	Lab Course based on CS-458-MJ-T		2		4	15	35	50
	OR								
	CS-460-MJ-T	ASP DOT Net Programming	2		2		15	35	50
	CS-461-MJ-P	Lab Course based on CS-460-MJ-T		2		4	15	35	50
FP/OJT/ CEP(8)	CS-481-FP	Research Project		8		16	60	140	200
Total			08	14	08	28			550

Level:- 6.0 (Fourth Year)　Sem:-VII (Honors)

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core (10+4)	CS-401-MJ-T	Advanced Operating System	2		2		15	35	50
	CS-402-MJ-T	Artificial Intelligence	2		2		15	35	50
	CS403MJ-T	Principles of Programming Language	2		2		15	35	50
	CS-404-MJ-P	Lab Course based on CS401MJ		2		4	15	35	50
	CS-405-MJ-P	Lab Course based on CS402MJ		2		4	15	35	50
	CS-406-MJ-T	Advanced Networking	2		2		15	35	50
	CS-407-MJ-T	Digital Marketing	2		2		15	35	50
Major Elective (2+2)	CS-408-MJ-T	Advance Databases and Web Technologies	2		2		15	35	50
	CS-409-MJ-P	Lab Course on CS-408-MJ-T		2		4	15	35	50
	OR								
	CS-410-MJ-T	Cloud Computing	2		2		15	35	50
	CS-411-MJP-T	Lab Course on CS-410-MJ-T		2		4	15	35	50
	OR								
	CS-412-MJ-T	C# .NET Programming	2		2		15	35	50
	CS-413-MJ-P	Lab Course on CS-412-MJ-T		2		4	15	35	50
	CS-441-MN-T	Research Methodology	4		4		30	70	100
Total			16	06	16	12			

Level:- 6.0 (Fourth Year)   Sem:-VIII (Honors)

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hr/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CE	EE	Total
Major Core (10+4)	CS-451-MJ-T	Design and Analysis of Algorithms	2		2		15	35	50
	CS-452-MJ-T	Mobile App Development Technologies	2		2		15	35	50
	CS-453-MJ-T	Software Project Management	2		2		15	35	50
	CS-454-MJ-P	Lab Course based on CS-451-MJ-T		2		4	15	35	50
	CS-455-MJ-P	Lab Course based on CS-452-MJ-T		2		4	15	35	50
	CS-456-MJ-T	Crypto Currency Technologies	2		2		15	35	50
	CS-457-MJ-T	Cyber Security	2		2		15	35	50
Major Elective (2+2)	CS-458-MJ-T	Full Stack Development I	2		2		15	35	50
	CS-459-MJ-P	Lab Course based on CS-458-MJ-T		2		4	15	35	50
	OR								
	CS-460-MJ-T	Web Services	2		2		15	35	50
	CS-461-MJ-P	Lab Course based on CS-460-MJ-T		2		4	15	35	50
	OR								
	CS-462-MJ-T	ASP DOT Net Programming	2		2		15	35	50
	CS-463-MJ-P	Lab Course based on CS-462-MJ-T		2		4	15	35	50
FP/OJT/ CEP(4)	CS-481-OJT	OJT		4		8	30	70	100
Total			12	10	12	20			

Semester III

Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science) - Sem – III
Course Type: Major Core
Course Code: CS-201-MJ-T
Course Title: Data Structure I

Teaching Scheme	No. of Credits	Examination Scheme
02 Hrs/week	2	IE : 15 marks
		UE: 35 marks

Prerequisites
- Knowledge of C programming language
- Memory management and pointers concepts
- Basic data handling techniques

Course Objectives
- To analyze the efficiency of algorithm and solve the problem in systematic way.
- To understand the different methods of organizing large amount of data.
- To design and implement the different data structures.
- To implement solutions for the specific problems.
- To apply different data structures to solve real life problems.

Course Outcomes

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

CO1: Understand basics of data structure and algorithm analysis

CO2: Apply working strategy for different data Structures to solve related problems

CO3: Implement Data Structure and its Applications

CO4: Develop real words application based on data structure like array, link list, stack and queue

CO5: Design data structure to solve problems using appropriate algorithmic techniques.

Course Contents

Chapter 1	**Introduction to Data Structures and Algorithm Analysis**	**03 Hours**

1.1   Introduction

    1.1.1 Need of Data Structure

    1.1.2 Definitions - Data and Information, Data type, Data object, ADT, Data Structure

    1.1.3 Types of Data Structures

1.2   Algorithm Analysis

    1.2.1 Space and Time Complexity

    1.2.2 Best, Worst, Average case analysis, Asymptotic notations (Big-O (O) , Omega Ω, Theta (Θ)), Problems on time complexity calculation.

Chapter 2	Array as a Data Structure	08 Hours

2.1	ADT of array, Operations and Applications of Array
2.2	Searching Techniques
	2.2.1 Sequential / Linear search
	2.2.2 Binary Search
	2.2.3 Comparison of Searching Techniques
2.3	Sorting Techniques
	2.3.1 Terminology- Internal, External, Stable, In-place Sorting
	2.3.2 Comparison Based Sorting Techniques - Bubble Sort, Insertion Sort, Selection Sort
	2.3.3 Algorithm design strategies -Divide and Conquer strategy, Merge Sort, Quick Sort
	2.3.4 Non Comparison Based Sorting: Counting Sort, Radix Sort
	2.3.5 Analysis of sorting techniques.
	2.3.6 Comparison of sorting Techniques.

Chapter 3	Linked List	08 Hours

3.1	Introduction to Linked List
3.2	Implementation of Linked List – Static & Dynamic representation,
3.3	Types of Linked List-– Singly, Doubly, Circular (Singly)
3.4	Operations on Linked List - create, display, insert, delete, reverse, search, sort, concatenate and merge
3.5	Applications of Linked List – Polynomial Representation, Addition of two polynomials
	3.5.1 Generalized linked list – Concept, Representation

Chapter 4	Stack	06 Hours

4.1	Introduction to Stack
4.2	Operations – init(), push(), pop(), isEmpty(), isFull(), peek(), time complexity of operations.
4.2	Representation - Static (Array) and Dynamic (Linked List)
4.3	Applications of stack
	4.3.1 Function call and recursion, String reversal, palindrome checking
	4.3.2 Expression types - infix, prefix and postfix, expression conversion and evaluation (Implementation of infix to prefix , infix to postfix, evaluation of postfix)

Chapter 5	Queue	05 Hours

5.1	Introduction to Queue
5.2	Operations - init(), enqueue(), dequeue(), isEmpty(), isFull(), peek(),time complexity of operations, differences with stack.
5.3	Implementation – Static (Array) and Dynamic (Linked List) with comparison
5.4	Types of Queue - Linear Queue, Circular Queue, Priority Queue, Double Ended Queue (only Concept of Doubly Ended Queue)
5.5	Applications of queue

Reference Books :-

1.   Data Structures Through C – Yashavant Kanetkar (BPB Publications)
2.   Data Structures, Algorithms, and Applications in C – Sartaj Sahni (Universities Press)
3.   C and Data Structures – Balagurusamy (McGraw Hill)
4.   Data Structures Using C and C++ – Tanenbaum, Langsam, and Augenstein (Pearson Education

<table>
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Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science) - Sem – III
Course Type: Major Core
Course Code: CS-202-MJ-T
Course Title: Database Management System I

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Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks

Prerequisites
- Basic knowledge of computer architecture, storage and algorithm.
- Basic knowledge of programming language.

Course Objectives
- To learn the fundamental concepts of database using PostgreSQL.
- To understand user requirements and frame it in data model.
- To Execute Database Queries like creations, manipulation on database.

Course Outcomes

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

CO1: Solve real world problems using appropriate set, function, and relational models.

CO2: Design E-R Model for given requirements and convert the same into database tables.

CO3: Design and create relational database systems.

CO4: Evaluate and apply database management operations to use database systems.

Course Contents

Chapter 1	Introduction to DBMS	3 Hours

1.1   Introduction to Data, Database and DBMS.

1.2   File system vs DBMS

1.3   Levels of abstraction and data independence

1.4   Architectures of DBMS

1.5.   Users of DBMS

1.6   Advantages and Disadvantages of DBMS

1.7   Applications of DBMS

Chapter 2	Conceptual Design	10 Hours

2.1   Overview of DB design process.

2.2   Introduction to data models (E-R model, Relational model, Network model, Hierarchical model)

2.3   Conceptual design using ER data model (entities, attributes, entity sets, relations, relationship sets) and symbols.

2.4   Extended features–Specialization, Aggregation, Generalization (Pictorial representation).

2.5	Constraints (domain constraints, entity integrity constraints referential integrity constraints and key constraints).	
2.6	Structure of Relational Databases (concepts of a table)	
2.7	Case Studies on ER model	

Chapter 3	**SQL**	**9 Hours**
3.1	Introduction to query languages	
3.2	Basic structure	
3.3	Commands in SQL	
	3.3.1 DDL Commands	
	3.3.2 DML Commands	
	3.3.3 DCL Commands	
	3.3.4 TCL Commands	
3.4	Forms of a basic SQL query (Expression and strings in SQL)	
3.5	SQL Operations	
	3.5.1 Set operations	
	3.5.2 Aggregate functions	
	3.5.3 Date, Time functions	
	3.5.4 Simple queries	
	3.5.5 Nested queries	
3.6	Joins in SQL (Cartesian Product, Inner joins, Outer joins and their types)	
3.7	Views.	
3.8	Examples on SQL (case studies)	

Chapter 4	**Relational Database Design**	**8 Hours**
4.1	Introduction to Relational-Database Design	
	4.1.1 Undesirable properties of a RDB design	
4.2	Functional Dependency	
	4.2.1 Basic concepts	
	4.2.2 Closure of relation (F+)	
	4.2.3 Closure of an Attribute set	
	4.2.4 Armstrong's axioms	
4.3	Concept of Decomposition	
4.4	Desirable Properties of Decomposition	
	4.4.1. Lossless and Lossy join Decomposition.	
	4.4.2 Dependency Preserving Decomposition.	
4.5.	Concept of Normalization	
4.6	Normal Forms 1NF, 2NF ,3NF, BCNF and its Examples.	
4.7	Keys Concept : Primary Key, Candidate Keys ,Composite Key, Alternate Key and Super Key.(Find out candidate key and super key with examples)	

	Reference Books:
1.	Database System Concepts, Henry F. Korth, Abraham Silberschatz, S. Sudarshan, ISBN:9780071289597, Tata McGraw-Hill Education
2.	Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, McGraw-Hill Science/ Engineering/ Math; 3 edition, ISBN: 9780072465631
3.	Database Systems, Shamkant B Navathe, Ramez Elmasri, ISBN:9780132144988, Pearson Higher Education
4.	Beginning Databases with PostgreSQL: From Novice to Professional, Richard Stones, Neil Matthew, ISBN:9781590594780, Apress
5.	PostgreSQL, Korry Douglas, ISBN:9780672327568, Sams
6.	Practical Postgresql, By Joshua D. Drake, John C Worsley (O'Reilly publications)
7.	"An introduction to Database systems", Bipin C Desai, Galgotia Publications

Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science) - Sem – III
Course Type: Major Core
Course Code: CS-203-MJ-P
Course Title: Lab Course based on CS-201-MJ-T & CS-202-MJ-T

Teaching Scheme 4 Hrs / week	No. of Credits 2	Examination Scheme IE : 15 Marks UE: 35 Marks

Prerequisites

- Knowledge of computer architecture, storage and algorithms
- Knowledge of programming fundamentals, including concepts like loops, arrays, stacks, recursion, and basic mathematics concepts.

Course Objectives

- To understand design and implementation, and manipulation of databases
- To apply theoretical concepts to real-world scenarios.
- Understand and Implement Searching Techniques
- Apply Sorting Algorithms for Data Organization
- Implement and Utilize Data Structure
- Develop Problem-Solving and Analytical Skills

Course Outcomes: -

On completion of this course, students will be able to:

CO1: Apply Linear and Binary Search techniques to efficiently

CO2: Analyze and implement sorting techniques

CO3: Develop Singly and Doubly Linked Lists with operations such as insertion, deletion, searching, reversal, and concatenation.

CO4: Evaluate the performance of Circular and Doubly Circular Linked Lists for dynamic memory-based data handling.

CO5: To design and implement relational database systems, including creating tables, defining relationships, and implementing constraints.

CO6: To understand Entity-Relationship (ER) diagrams to model database structures and convert them into relational models.

Operating Environment:

For Data Structures I

    Operating system: Linux

    Editor: Any linux based editor like vi, gedit etc.

    Compiler: cc or gcc

For Database Management System

    Operating system: Linux

    Editor: Any linux based editor like vi, gedit etc.

Suggested List of Assignments:

A) Data Structures I

Assignment 1.:- Searching Algorithm

       1. Topic name:- Implementation of Linear search algorithm

       2. Topic name :- Implementation of Binary Search algorithm

Assignment 2:- Sorting Algorithm

       1. Topic name:- Implementation of Bubble Sort algorithm

       2. Topic name:- Implementation of Insertion sort algorithm

       3. Topic Name:- Implementation of the Selection sort algorithm

       4. Topic Name:- Implementation of Merge sort algorithm

       5. Topic Name:- Implementation of Quick Sort Algorithm

       6 Topic Name:- Implementation of Count Sort

Assignment 3.:- Singly Linked List

       1. Topic name:- Implementation of Singly Linked List

                Create, Insert, Delete, Display, Search, Sort, Reverse

       2. Topic name - Merging of two linked list.

       3. Topic name:- Concatenation of two singly linked list

       4. Topic name:- Implementation of Singly Circular Linked List

                Create, Insert, Delete, Display, Search

Assignment 4:- Doubly Linked List

       1 . Topic name:- Implementation of Doubly Linked List Create, Insert, Delete,

                Display, Search operation

       2. Topic name:- Implementation of Doubly Circular Linked List

                Create, Insert, Delete, Display, Search

Assignment 5:- Stack

       1 . Topic name:- Static and Dynamic implementation of Stack

       2. Topic name:- Infix to Postfix conversion

       3. Topic Name:- Evaluation of postfix expression

Assignment 6:- Queue

       1. Topic name:- Static and Dynamic implementation of linear Queue

       2. Topic name:- Implementation of circular queue

B.   Database Management Systems

Assignment 1.

Create simple tables including all data types.

a.   Primary key constraint (as a table level constraint & as a column level constraint)

b.   Check constraint (All types)

c.   Unique constraint

d.   Null/Not null constraint

Assignment 2.

Create more than one table, with referential integrity constraint.

Assignment 3.

Drop a table, Alter schema of a table.

Insert / Update / Delete records using tables created in previous Assignments.

Assignment 4.

- Write queries on the tables using simple form of select statement.

Select <field-list> from table [where <condition> order by <field list>], Select <field-list, aggregate functions> from table [where <condition> group by <> having <> order by <>]

- To create views

Assignment 5.

Write queries on the table, using set operations (minus operation, union, union all, intersect, intersect all)

Assignment 6.

Write nested queries on the tables (Use of Except, Except, all , Exists, Not exists)

Note: Laboratory handbook prepared by the University

Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science) - Sem – III
Course Type: VSC
Course Code: CS 221-VSC-T
Course Title : Software Engineering

Teaching Scheme **2 Hours /Week**	No. of Credits **2**	Examination Scheme IE : 15 marks UE: 35 marks

Prerequisites
 ER Modeling

Course Objectives

1. To get knowledge and understanding of software engineering discipline.
2. To learn analysis and design principles for software project development.
3. Implement Agile Development Methodologies in real life Software Projects.

Course Outcomes

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

CO1: Identify data requirements, analyze and prepare data models.

CO2: Understand basic software engineering concepts and Process models.

CO3: Compare and chose a process model for a software project development.

CO4: Design different UML Diagrams.

Course Contents

Chapter 1	**Introduction to Software Engineering**	**5 Hours**

1.1   Definition of Software

1.2   Nature of Software Engineering

1.3   Changing nature of software

1.4   Mc Call's Quality factors

1.5   Software Process

1.6   The Process Framework

1.7   Umbrella Activities

1.8   Process Adaptation

Chapter 2	Software Development Life Cycle	5 Hours

2.1 Introduction, Activities of SDLC

2.2 Preliminary Investigation and its activities.

2.3 Requirements engineering tasks (Inception, Elicitation, Elaboration, Negotiation, Specification, Validation, Requirements Management)

2.4 Fact finding techniques (Interview, Questionnaire, Record Review, Observation)

2.5 Determination of system requirements

2.6 Design of a system

2.7 Development of software

2.8 System testing (Unit Testing, Integration Testing, System Testing, Acceptance Testing)

2.9 System Implementation and Evaluation

2.10 System maintenance

Chapter 3	Process Models	7 Hours

3.1 Generic Process Model

3.2 Prescriptive Process Models

    3.2.1. The Waterfall Model

    3.2.2 V-model

3.3 Incremental and Iterative Process Models

3.4 Evolutionary Process Models- Prototyping, Spiral Model

3.5 Rapid Application Development(RAD)

3.6 Concurrent Models

3.7 The Unified Process

Chapter 4	Requirements Modeling-UML	8 Hours

4.1 Introduction to UML

4.2 Structural Modeling

    4.2.1 Class Model

    4.2.2 Object Model

    4.2.3 Deployment Model

    4.2.4 Component Model

4.3 Behavioral Modeling

    4.3.1 Use case model

    4.3.2 Activity model

    4.3.3 State Chart Model

    4.3.4 Sequence model

4.4 Interaction Model-

    4.4.1 Sequence Model

    4.4.2 Collaboration Model

Chapter 5	**Agile Development**	5	**Hours**

5.1   Agility: Introduction, use, purpose

5.2   Agile Process

      5.2.1   Agility Principles

      5.2.2   Human Factors

5.3   Extreme Programming(XP)

      4.3.4   XP Values

      4.3.5   XP Process

      4.3.6   Industrial XP Agile

4.4   Adaptive Software Development(ASD)

      4.4.1   Scrum

      4.4.2   Dynamic System Development Model (DSDM)

      5.4.3   Agile Unified Process (AUP)

Reference Books:

1. Software Engineering: A Practitioner's Approach - Roger S. Pressman, McGraw hill (Eighth Edition) ISBN-13: 978-0-07-802212-8, ISBN-10: 0-07-802212-6

2. A Concise Introduction to Software Engineering - Pankaj Jalote, Springer ISBN: 978-1-84800-301-9

3. The Unified Modeling Language Reference Manual - James Rambaugh, Ivar Jacobson, Grady Booch ISBN 0-201-30998-X

<table>
<tr><td colspan="3">

Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science) - Sem – III
Course Type: IKS
Course Code: CS-201-IKS-T
Course Title : Indian Knowledge System in Computing

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</table>

Teaching Scheme **2 Hours /Week**	No. of Credits **2**	Examination Scheme IE : 15 marks UE: 35 marks

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

Chapter 1	**Vedic Mathematics & Computational Thinking**	**8 hours**

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

Chapter 2	**Introduction to Nyaya (Indian Logic)**	**8 hours**

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 (Pramaṇa): 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

Chapter 3	Panini's Astadhyayi & Chandasāstra	8 hours

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 Chandasastra's Binary logic and combinatorial techniques

Chapter 4	Applications of IKS in Computer Science	6 hours

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

Reference Books

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. Shamasastry (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

	Savitribai Phule Pune University	
	S.Y.B.Sc. (Computer Science) - Sem – III	
	Course Type: FP/OJT/CEP	
	Course Code: CS-231-FP	
	Course Title : Mini Project	
Teaching Scheme 4 Hours /Week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks

Prerequisites
   ER Modeling

Course Objectives
1.   To get knowledge and understanding of software engineering discipline.
2.   To learn analysis and design principles for software project development.
3.   Implement Agile Development Methodologies in real life Software Projects.

Course Outcomes
On completion of the course, student will be able to-
CO1: Identify requirements, analyze and prepare models.
CO2: Understand basic SW engineering concepts and Process models.
CO3: Compare and chose a process model for a software project development.
CO4: Design different UML Diagrams.

Course Contents

Assignment No	**Title**	**No of hours**
1	Preliminary Investigation and its activities	2 Slots
2	Requirement Specification	2 Slots
3	Database Design	3 Slots
4	Design of a system	4 Slots
5	Input Form Design and Output Screen layout	1 Slot

Note: 1 slot = 4 Hours

<table>
<tr><td colspan="3" align="center">Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science) - Sem –III
Course Type:GE/OE.   Course Code: OE-201-CS-T
Course Title: Ecommerce I</td></tr>
<tr><td>Teaching Scheme
02 Hours /Week</td><td>No. of Credits 2</td><td>Examination Scheme
IE :15 Marks
UE:35Marks</td></tr>
</table>

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

Chapter1	**E- Commerce and Business Model Concepts**	**7 Hours**

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.

Chapter2	**E-Marketing and E- Commerce Application**	**7 Hours**

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

Chapter 3	**E-commerce Payment Method**	**6 Hours**

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.

Chapter 4	**E-Commerce Laws & Regulations**	**5 Hours**

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.

Chapter 5	**Future Trends in E-Commerce**	**5 Hours**

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.

Reference Books:

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. (Computer Science) - Sem – III
Course Type: GE/OE   Course Code: OE-202-CS-T
Course Title :Web Design I

Teaching Scheme	No. of Credits	Examination Scheme
02 Hrs/ week	2	IE :15 marks UE: 35 marks

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

Chapter 1	**Introduction to Web Design**	**8 hours**

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

Chapter 2	Getting Started with HTML	6 hours

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

Chapter 3	Tables	6 hours

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

Chapter 4	Frame / Forms	6 hours

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

Case Studies	4 hours
Case study 1: Creation of forms, small case study to create HTML pages using all the above learnt techniques. **Case study 2:** Creation of Forms layout designing by using div element with CSS property **Case study 3:** Create Multiple Web pages link them to publish a small website.	
Reference Books:	
1. Computer Programming For Beginners:Learn The Basics Of HTML5-Joseph Connor 2. The Complete Reference HTML & CSS-Fifth Edition-Thomas A.Powell 3. Learning Web Design: A beginner's Guide to HTML, CSS, Javascript, and Web Graphics - Jennifer Robbins 4. HTML5: The Missing Manual - Matthew MacDonald.	

Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science) - Sem –III
Course Type:GE/OE.   Course Code: OE-203-CS-T
Course Title: Digital Marketing I

Teaching Scheme 02 Hours /Week	No. of Credits 2	Examination Scheme IE :15 Marks UE:35Marks

Prerequisites

- Creative & Logical thinking ability,
- Digital devices operational skills and Knowledge

Course Objectives

- To understand Digital Marketing as the most powerful marketing tool.
- Learn to create digital marketing artworks.
- Learn how to use email campaigns, blogging to produce worthwhile, pertinent material that draws in and engages a target audience.

Course Outcomes

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

CO1: Learn and visualize power to explore new ideas.

CO2: Analyze and develop their Marketing skills.

CO3: Analyze and understand tacts with corporate objectives and produce quantifiable outcomes from e-payment mechanisms.

CO4: Identify and apply target demographics and company objectives, increasing brand awareness and boosting conversions.

Course Contents

Chapter1	**History of Digital Marketing**	**8 Hours**

1.1. Introduction
1.2. Offline digital marketing - Electronic billboards, Radio marketing, T.V. marketing, Phone marketing
1.3. Online marketing - Search Engine Optimization (SEO), Social media marketing, E-mail marketing
1.4. Difference between conventional marketing and online marketing.

Chapter2	**Internet Marketing**	**8 Hours**

2.1. Structure of Website - Team
2.2. Types of website - Static Website, Dynamic website, Personal, Commercial, Governmental, Non-profit organization
2.3. Web Portals - Type of Portals

Chapter3	Classification of e-Commerce	8 Hours
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		
Case Study		**6 Hours**
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, Netfix 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		
Reference Books:		
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. (Cyber and Digital Science)		
Subject Code: OE-204-CS-T		
Subject Name:AI for Everyone - I		
Teaching Scheme: 2 hours / week	No. of Credits: **2**	Examination Scheme: CA:15 Marks UA: 35Marks

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	

Unit4	Ethical and Social Implications of AI	8 hours
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	
Reference Books:		
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	

Semester IV

Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science) - Sem – IV
Course Type: Major
Course Code: CS-251-MJ-T
Course Title : Data Structure II

Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE: 15 marks UE: 35 marks

Prerequisites
- Understanding of Fundamentals of Data Structures
- Proficiency in Memory Management and Pointers
- knowledge of Algorithmic Concepts.

Course Objectives
- Understand the fundamental concepts of trees, search trees, graphs, and hash tables to analyze their structure and properties.
- Apply appropriate tree and graph traversal techniques to solve real-world computational problems.
- Analyze the efficiency of various searching, graph algorithms, and hashing techniques for optimized data retrieval.
- Design and implement tree, graph, and hash-based data structures to develop efficient algorithmic solutions.

Course Outcomes

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

CO1: Learn traversal algorithms to solve computational problems efficiently.

CO2: Analyze the performance of different data structures.

CO3: Design graph-based solutions using representations techniques

CO4: Evaluate the efficiency of different strategies of data storage and retrieval.

Course Contents

Chapter 1	**Tree**	**10 Hours**

1.1   Concept and Terminologies

1.2   Types of Binary Trees - Binary Tree, Skewed Tree, Strictly Binary Tree, Full Binary Tree, Complete Binary Tree, Expression Tree, Binary Search Tree.

1.3   Representation – Static and Dynamic

1.4   Implementation and Operations on Binary Search Tree - Create, Insert, Delete, Search,

1.5   Tree traversals– preorder, inorder, postorder (recursive implementation), Level-order traversal using queue, Counting leaf, non-leaf and Total nodes, Copy, Mirror.

1.6   Applications of trees - Heap Sort.(Max heap and Min Heap)

Chapter 2	Search Trees	4 Hours

2.1	Basic Terminology: Balanced tree - AVL Tree, Red Black tree
2.2	AVL Tree- Rotations (LL, LR, RL, RR)
2.3	Red Black tree – Operation (Insertion, Deletion)
2.4	Multi-way search tree -
	2.4.1 B tree and B+ tree - Concept, Operation (Insertion)

Chapter 3	Graph	11 Hours

3.1	Concept and terminologies
3.2	Graph Representation –Adjacency Matrix, Adjacency List, Inverse Adjacency list, Adjacency Multi List.
3.3	Graph Traversals – Breadth First Search and Depth First Search (with implementation)
3.4	Applications of graph
	3.4.1 Topological sorting
	3.4.2 Use of Greedy Strategy in Minimal Spanning Trees (Prims and Kruskals algorithm)
	3.4.3 Single Source Shortest Path - Dijkstra's algorithm
	3.4.4 Dynamic Programming Strategy - All Pair Shortest Path - Floyd Warshall algorithm
	3.4.5 Use of graphs in social networks

Chapter 4	Hash Table	5 Hours

4.1	Concept of Hashing
4.2	Terminologies – Hash table, Hash function, Bucket, Hash address, Collision, Overflow
4.3	Hash Function -
	4.3.1 Properties
	4.3.2 Methods/ Functions (Division, MID Square, Folding etc.)
4.4	Collision resolution techniques
	4.4.1 Open Addressing - Linear probing, Quadratic probing, Rehashing
	4.4.2 Chaining - Coalesced , Separate Chaining

Reference Books:

1. Fundamentals of Data Structures in C- Ellis Horowitz, Sartaj Sahni,Susan Anderson-Freed, 2nd Edition, Universities Press.
2. Data Structures Using C – Reema Thareja
3. Introduction to Algorithms – Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein
4. Data Structures, Algorithms, and Applications in C++ – Sartaj Sahni

<table>
<tr><td colspan="3" align="center">**Savitribai Phule Pune University**
S.Y.B.Sc. (Computer Science) - Sem – IV
Course Type: Major
Course Code: CS-252-MJ-T
Course Title : Database Management System-II</td></tr>
<tr><td align="center">Teaching Scheme
02 Hrs/ week</td><td align="center">No. of Credits
2</td><td align="center">Examination Scheme
IE : 15 marks
UE: 35 marks</td></tr>
</table>

Prerequisites
- Basic Knowledge of DBMS
- Knowledge of SQL Queries
- Basics concepts of Relational Database Design and ER models

Course Objectives
- To teach fundamental concepts of RDBMS (PL/PGSQL)
- To teach database management operations
- Be familiar with the basic issues of transaction processing and concurrency control
- To teach data security and its importance

Course Outcomes

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

CO1: Understand PL/PGSQL database techniques and its programming skill.

CO2: Apply and relate the concepts of database transaction management.

CO3: Implement the concurrency control mechanism and recovery techniques in the databases.

CO4: Inculcate concepts of modern databases.

CO5: Apply the database security concepts in real life situation.

Course Contents

Chapter 1	Relational Database Design Using PL/PGSQL	12 Hours

1.1   Introduction

1.2   PL/PGSQL: Data types, Language Structure

1.3   Controlling the program flow.

    1.3.1   Conditional Statements

    1.3.2   Loops

1.4   Stored Procedures

1.5   Functions

1.6   Handling Errors and Exceptions

1.7   Cursors

1.8   Triggers

Chapter 2	Transaction Concepts and concurrency control	8 Hours
2.1	Transaction - Concept, Properties of transaction, States of transaction	
2.2	Transaction Execution	
	2.2.1 Types of Execution	
	2.2.2 Associated Problem in Concurrent execution.	
2.3	Schedules – Concept	
	2.3.1 Types of Schedule	
	2.3.2 Concept of Serializability	
	2.3.3 Precedence Graph for Serializability.	
2.4	Ensuring Serializability by Locks,	
	2.4.1 Different Lock Modes	
	2.4.2 2PL and its variations.	
2.5	Basic timestamp method for concurrency, Thomas Write Rule.	
2.6	Locks with Multiple Granularity, Dynamic Database Concurrency (Phantom Problem).	
2.7	Timestamps vs Locking.	
2.8	Deadlock and Deadlock Handling –	
	2.8.1 Deadlock Avoidance (Wait-Die, Wound-Wait),	
	2.8.2 Deadlock Detection (Wait for Graph).	
	2.8.3 Deadlock Recovery	
Chapter 3	Database Integrity and Security Concepts	4 Hours
3.1	Constraints	
	3.1.1 Domain Constraints	
	3.1.2 Referential Integrity Constraint	
3.2	Database Security Concepts.	
3.3	Methods for Database Security	
	3.3.1. Discretionary Access Control (DAC)	
	3.3.2. Mandatory Access Control (MAC)	
	3.3.3. Role Base Access Control for Multilevel Security.	
3.4	Use of views in Security Enforcement.	
3.5	Overview of Encryption Technique for Security.	
3.6	Statistical Database Security.	
Chapter 4	Crash Recovery	4 Hours
4.1	Concepts of failure, Failure Classification	
4.2	Recovery Concepts	
4.3	Log Base Recovery Techniques	
	4.3.1 Deferred	
	4.3.2 Immediate Update	
4.4	Checkpoints, Relationship between Database Manager and Buffer Cache	
4.5	Aries Recovery Algorithm.	

4.6	Recovery with Concurrent Transactions (Rollback, Checkpoints, Commit)	
4.7	Database Backup and Recovery from Catastrophic Failure	
Chapter 5	**Other Databases**	**2 Hours**
5.1	Introduction to Parallel and Distributed Databases	
5.2	Object Based Databases	
5.3	XML Databases	
5.4	NoSQL Database	
5.5	Multimedia Databases	
5.6	Big Data Databases	

Reference Books:		
1.	Database System Concepts, By Silberschatz A., Korth H., Sudarshan S., 6th Edition, McGraw Hill Education	
2.	Database Management Systems, Raghu Ramakrishnan, Mcgraw-Hill Education	
3.	Database Systems, Shamkant B. Navathe, Ramez Elmasri, PEARSON HIGHER EDUCATION	
4.	Fundamentals of Database Systems, By: Elmasri and Navathe, 4th Edition Practical PostgreSQL O'REILLY	
5.	Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, McGraw-Hill Science/Engineering/Math; 3 edition, ISBN: 9780072465631	
6.	NoSQL Distilled, Pramod J. Sadalage and Martin Fowler, Addison Wesley	
7.	An Introduction to Database Systems", C J Date, Addison-Wesley	
8.	Database Systems: Concepts, Design and Application", S.K.Singh, Pearson, Education	
9.	MongoDB: The Definitive Guide, Kristina Chodorow, Michael Dirolf, O'Reilly Publication	

Savitribai Phule Pune University	

Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science) - Sem – IV
Course Type: Major
Course Code: CS-253-MJ-P
Course Title : Lab Course based on CS-251-MJ-T & CS-252-MJ-T

Teaching Scheme	No. of Credits	Examination Scheme
04 Hrs/ week	2	IE : 15 marks
		UE: 35 marks

Prerequisites
- Fundamentals concepts of Pointers, Data Structures,
- knowledge of Algorithm and proficiency in memory management
- Basic Knowledge of DBMS and SQL Queries.
- Basics concepts of Relational Database Design and ER model.

Course Objectives
- Apply tree-based data structures by implementing Binary Search Trees (BST) and traversal techniques.
- Analyze graph representations and perform fundamental graph operations, including traversal, topological sorting, and spanning tree algorithms.
- Evaluate shortest path algorithms and their efficiency in solving real-world pathfinding problems.
- Design and implement hash table techniques for efficient data storage and retrieval.

Course Outcomes: -
On completion of this course, students will be able to:
CO1: Understand the basic concepts of data structures.
CO2: Choose the appropriate data structure for a given problem.
CO3: Design and implement database applications to solve real-world problems.
CO4: Implement database security concept and access control mechanism.

Operating Environment:
For Data Structures II
   Operating system: Linux
   Editor: Any linux based editor like vi, gedit etc.
   Compiler: cc or gcc
For Database Management System II
   Operating system: Linux
   Editor: Any linux based editor like vi, gedit etc.

Suggested List of Assignments:

A)   Data Structures II

Assignment 1. Binary Search Tree and Traversals

1. Implementation of Binary Search Tree (BST) to perform Create, Search, Insert, Copy operation on BST
2. Implementation of Traversal Techniques: Inorder, Preorder and Postorder

Assignment 2. Binary Search Tree Operations and Applications

1. Implement Binary Search Tree (BST) to perform following operations on BST–copy and mirror image of BST, counting leaf, non-leaf and total nodes.
2. Level-order traversal of binary search tree using queue.
3. Heap sort

Assignment 3. Graph implementation

1. Implement Graph as adjacency matrix and adjacency list
2. Calculate indegree and outdegree of vertices
3. Graph traversals: BFS and DFS.

Assignment 4. Graph Applications - I

1. Implementation of Topological sorting
2. Implementation of Prims/Kruskals Minimum spanning tree algorithm

Assignment 5. Graph Applications - II

1. Implementation of Dijkstra's shortest path algorithm for finding Shortest Path from a given source vertex using adjacency cost matrix.
2. Implementation of Floyd Warshall algorithm for all pairs shortest path.

Assignment 6. Hash Table

1. Implementation of static hash table with Linear Probing.
2. Implementation of static hash table with chaining.
3. Implementation of linked hash table with chaining.

B)   Database Management Systems II:

Lab Book:

Assignment 1: Stored Procedure

1. A Simple Stored Procedure
2. A Stored Procedure with IN, OUT and IN/OUT parameter

Assignment 2: Function

1. A Simple Stored Function
2. A Stored Function that returns
3. A Stored Function recursive

Assignment 3: Cursors

1. A Simple Cursor
2. A Parameterize Cursor

Assignment 4: Exception Handling
   1.   Simple Exception- Raise Debug Level Messages
   2.   Simple Exception- Raise Notice Level Messages
   3.   Simple Exception- Raise Exception Level Messages

Assignment 5: Triggers
   1.   Before Triggers (insert, update, delete)
   2.   After Triggers (insert, update, delete)

Note: Laboratory handbook prepared by the University.

Savitribai Phule Pune University **S.Y.B.Sc. (Computer Science) - Sem – IV** **Course Type: VSC** **Course Code: CS-271-VSC-P** **Course Title : Advance Python Programming**		
Teaching Scheme 04 Hrs/ week	No. of Credits 2	Examination Scheme IE : 15 marks UE: 35 marks

Prerequisites -
- Basic Python Programming Knowledge
- Basic Understanding of pattern matching and String operations
- Knowledge of file handling

Course Objectives
- Understand and manipulate operations on data in Python
- Develop the ability to write reusable functions to organize code better and improve efficiency.
- Learn to structure their programs using functions and modules to improve readability and maintainability.

Course Outcomes

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

CO1: Read and write data from & to files in Python.

CO2: Express proficiency in the handling of strings and functions

CO3: Identify the commonly used operations involving file systems and regular expressions.

CO4: Develop application using python.

Course Contents

Assignment 1	**Data Frame**	**1 Slot**

- Creating Data Frame - User define, using csv file
- View Data Frame
- Preprocessing on Data Frame - Null Values, Duplicate values
- Modify Data in DataFrame
- Grouping and Aggregating Data
- Merging and Joining DataFrames

Assignment 2	Functions in Python	2 Slots

- Creating user defined functions
- Calling a function
- Function Arguments
- Return Statement
- Functions returning multiple values
- Anonymous Functions
- Recursive Functions

Assignment 3	Iterators & Generators in Python	2 Slots

- Function ducktyping
- List comprehension
- Unpacking argument list
- Creating Iterator
- Creating Generator

Assignment 4	Modules	1 Slot

- Importing module
- Creating & exploring modules
- Math module
- Random module
- Time module

Assignment 5	Packages	1 Slot

- Importing package
- creating package

Assignment 6	Working with Files	2 Slots

- Creating files and Operations on files (open, close, read, write),
- File object attributes,
- file positions,
- Listing Files in a Directory,
- Testing File Types,
- Removing files and directories,
- copying and renaming files

-

Assignment 7	**Regular Expression**	**2 Slots**
• Concept of regular expression, • various types of regular expressions • function related to regular expressions.		
Assignment 8	**Exception Handling**	**1 Slot**
• Built-in Exceptions • Handling Exceptions • Exception with Arguments • User-defined Exceptions.		

Note: 1 Slot = 4 Hours

<table>
<tr><td colspan="3" align="center">Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science) - Sem – IV
Course Type: VSC
Course Code: CS-281-FP
Course Title : Mini Project</td></tr>
<tr><td align="center">Teaching Scheme
4 Hours /Week</td><td align="center">No. of Credits
2</td><td align="center">Examination Scheme
IE : 15 marks
UE: 35 marks</td></tr>
</table>

Prerequisites

 ER Modeling

Course Objectives

1. To get knowledge and understanding of software engineering discipline.
2. To learn analysis and design principles for software project development.
3. Implement Agile Development Methodologies in real life Software Projects.

Course Outcomes

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

CO1: Identify requirements, analyze and prepare models.

CO2: Understand basic SW engineering concepts and Process models.

CO3: Compare and chose a process model for a software project development.

CO4: Design different UML Diagrams.

Course Contents

Assignment No	Title	No of hours
1	Preliminary Investigation and Requirement Specification	2 Slots
2	Design of a system	2 Slots
3	Database Design	2 Slots
4	Input and Output Screen layout	1 Slots
5	Coding and Implementation	5 Slot

Note: 1 Slot = 4 Hours

<table>
<tr><td colspan="3" align="center">Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science) - Sem – IV
Course Type: SEC
Course Code: SEC-251-CS-P
Course Title : Computer Networks</td></tr>
</table>

Teaching Scheme **2 Hours /Week**	No. of Credits **2**	Examination Scheme IE: 15 marks UE: 35 marks

Prerequisites

- Understanding of computer hardware components.
- Understanding of basic data communication terminology.
- Knowledge of how data is transmitted over networks (packets, frames).

Course Objectives

- To learn basic concepts and terminology related to computer networks
- To understand cyber security principles and techniques to secure networks.
- To understand and analyze different network devices.
- To equip students with the knowledge and skills necessary to design, implement, manage, and secure computer networks in various environments.

Course Outcomes

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

CO1: Understand the principles of wireless networking.

    CO2: Configure wireless networks.

CO2: Demonstrate the ability to apply theoretical knowledge in practical lab settings.

CO3: Utilize troubleshooting techniques and tools to diagnose and resolve common network issues effectively.

CO4: Identify potential security threats to networks and apply appropriate security measures.

CO5: Apply security practices in real-world scenarios.

Course Contents

Assignment 1	**Study of Network Devices , Cables and Configuration**	1 Slot

- Identify various network cables (Ethernet, Coaxial, Fiber Optic).
- Use a crimping tool to create a straight-through and cross-over Ethernet cable.
- Test cable connectivity using a network tester or direct connection between two devices.

Assignment 2	Understanding IP Addressing	2 Slots

- Understand IP address classes (A, B, C, D, E) and their ranges.
- Perform subnetting and supernetting calculations.
- Configure IP addresses on different devices using Packet Tracer.

Assignment 3	Connecting Computers and Configuration Commands	2 Slots

Use network cables and switches to connect multiple computers.

- Assign IP addresses to each computer.
- Verify network connectivity using ping and tracert commands.
- Execute commands such as ping, tracert, nslookup, ifconfig/ipconfig.
- Configure a router using basic commands (show, enable, configure terminal, etc.).
- Save and restore router configurations.

Assignment 4	Initial Switch Configuration	2 Slot

- Configure hostname, console password, VTY password, and privileged EXEC mode password.
- Assign an IP address to VLAN1 and set up a default gateway.
- Verify the configuration using show running-config and ping commands.

Assignment 5	Router Configuration and Encryption	2 Slots

- Configure hostname, enable password, and encrypted secret password.
- Set up banner messages for security purposes.
- Configure console and VTY passwords and test access control.
- Set up a Linksys Wireless Router and configure SSID.
- Enable WEP encryption and configure a passkey.
- Connect a client device and verify secure connectivity.

Assignment 6	Network Address Translation (NAT) and Testing Static and Dynamic Routing	2 Slots

- Observe NAT behavior using Packet Tracer Simulation Mode.
- Identify inside local, inside global, outside local, and outside global addresses.
- Verify successful NAT translation using show NAT translations.
- Configure static routes between multiple networks.
- Set up dynamic routing protocols such as RIP, EIGRP, or OSPF.
- Compare routing performance using tracert and show ip route.

Assignment 7	Cyber Threats and Attacks	1 Slot

- Simulating a Phishing Attack (Ethical Demonstration)
- Detecting Malware Using Virtual Machines
- Password Cracking (Brute Force & Hash

Assignment 8	Cyber Security and Policies	1 Slot
• Password security and Hashing • Ethical Hacking • Network Scanning		
Reference Books: 1. "Computer Networking: A Top-Down Approach" - James Kurose and Keith Ross. 2. "Computer Networks" -Authors: Andrew S. Tanenbaum and David J. Wetherall 3. "TCP/IP Illustrated, Volume 1: The Protocols" - W. Richard Stevens 4. "Network Security Essentials: Applications and Standards"- William Stallings 5. "Applied Cryptography: Protocols, Algorithms, and Source Code in C"- Bruce Schneier		

Note: 1 Slot = 4 Hours

Savitribai Phule Pune University **S.Y.B.Sc. (Computer Science) - Sem –IV** **Course Type:GE/OE. CourseCode: OE-251-CS-T** **Course Title: Ecommerce II**		
Teaching Scheme 02Hours /Week	No. of Credits 2	Examination Scheme IE :15 Marks UE:35Marks

Prerequisites
- Knowledge of basic e-commerce concepts, business models and payment systems.
- Understanding of digital marketing, financial systems, and internet technologies

Course Objectives
- To understand the technical and security aspects of e-commerce.
- To explore data-driven decision-making and analytics in e-commerce.
- To study supply chain and logistics management in e-commerce.
- To gain insights into global e-commerce trends and challenges.
- To learn about the integration of AI, Blockchain, and Cloud Computing in e-commerce.

Course Outcomes

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.

Course Contents

Chapter1	**E-Commerce Logistics and Supply Chain Management**	**6 Hours**

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

Chapter2	**Data Analytics and Consumer Behavior in E-Commerce**	**7 Hours**

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	
Chapter3	**E-Commerce Security and Privacy**	**6 Hours**

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

Chapter4	**Advanced E-Commerce Technologies**	**5 Hours**

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

Chapter5	**Global Trends of E-Commerce**	**6 Hours**

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

Reference Books:

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

SavitribaiPhule Pune University
S.Y.B.Sc. (Computer Science) - Sem – IV
Course Type: GE/OE   Course Code: OE-252-CS-T
Course Title :Web Design II

Teaching Scheme 02 Hrs/ week	No. of Credits 2	Examination Scheme IE :15 marks UE: 35 marks

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

Chapter 1	CSS(Cascading Style Sheet)	8 Hours

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

Chapter 2	XML(Extensible Markup Language)	8 Hours

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

Chapter 3	Introduction to JavaScript	8 Hours
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.	

Case Study	6 Hours
Case study 1: Creation of forms, small case study to create HTML pages using all the above learnt techniques. **Case study 2:** Redesigning the Website of a Small Business. **Case study 3:**Create a Styled Web Page for a Coffee Shop.	

Reference Books:
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

Note: 1 Slot = 4 Hours

Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science) - Sem –IV
Course Type:GE/OE.   Course Code: OE-253-CS-T
Course Title: Digital Marketing II

Teaching Scheme 02 Hours /Week	No. of Credits 2	Examination Scheme IE :15 Marks UE:35Marks

Prerequisites

- Digital marketing requires creativity and problem-solving abilities.
- Experience with social media platforms (Facebook, Instagram, Twitter, LinkedIn, etc.) is beneficial, as digital marketing

Course Objectives

- To understand Digital Marketing as the most powerful marketing tool.
- To Learn to create digital marketing artworks.
- To use social media sites like Facebook, Instagram, Twitter, LinkedIn, and others to raise sales, engage customers, and establish your brand.

Course Outcomes

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.

Course Contents

Chapter1	**Online Consumer Behavior Analysis**	**8 Hours**

1.1   Consumer Behavior
1.2   Segmentation and Targeting online customers
1.3   Psychological Responses
1.4   Social Trends

Chapter2	**Social Media Marketing**	**8 Hours**

2.1.   Social Media Sites
2.2. - Influence of Social Media Marketing
2.3.   Power of Social Media
2.4.   Monetization through Social Media

Chapter3	Future of Digital Marketing	8 Hours
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.		
Case Study		**6 Hours**
Case Study 1 Experiential Learning: Creating a website. Case Study 2 Online Consumer Behavior Analysis for an E-Commerce Fashion Brand		
Reference Books:		
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		

<table>
<tr><td colspan="3" align="center">Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science) - Sem –IV
Course Type: GE/OE.   Course Code: OE-254-CS-T
Course Title: AI for Everyone II</td></tr>
</table>

Teaching Scheme: 2 hours / week	No. of Credits: **2**	Examination Scheme: CA:15 Marks UA: 35Marks

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 if 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

Chapter 1	**Advanced AI Fundamentals**	**6 Hours**

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

Chapter 2	**AI for Advanced Text & Content Creation**	**8 Hours**

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

Chapter 3	**Advanced AI for Image & Video Processing**	**8 Hours**

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

Chapter 4	**AI Tools**	**8 Hours**
4.1	Chat GPT (Open AI)	
4.2	Google Gemini (Bard AI)	
4.3	Canva, Beautiful. AI, Gamma**,** Slides AI	
4.4	Rytr, Grammarly	
References:		
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.	https://www.grammarly.com/ai/ai-writing-tools/article-writer	

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Savitribai Phule Pune University
Minor Course offered by BOS in Electronics Science for all UG Programs under Faculty of Science & Technology except B. Sc. (Electronic Science) and allied programs
or
for all UG programs under any Faculty other than Faculty of Science & Technology for SEM III ONLY
ES – 241 - MN: Data Communications (2024 Pattern)

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Teaching Scheme: TH: 02 Hours/Week	Credits 02	Examination Scheme: Continuous Evaluation: 15 Marks End-Semester : 35 Marks

Course Objectives:
- To understand the fundamental concepts of data communication, networking standards, protocols and technologies.
- To be familiar with OSI and TCP/IP Models, signals, transmission impairments and performance
- To study different techniques for framing, error detection, access control and channelization

Course Outcomes: After successful completion of this course, learner will be able to-
- Define basic concepts in data communication and applications of Computer Network
- Compare and contrast OSI and TCP/IP models
- Determine Bandwidth and delays
- Demonstrate understanding and need of Data-link layer protocols

	Course Contents	
Unit I	**Introduction to Data Communications**	**7Hrs**

Data communications, Characteristics of Data Communication
Data Representation – Text, Numbers, Images, Audio, Video
Types of Data flow – Simplex, Half Duplex, Full Duplex
Computer Networks applications –Business Application, Home Application, Mobile User
Broadcast and point-to-point networks
Network Topologies - Bus, Star, Ring, Mesh
Network Types- LAN, MAN, WAN, Wireless Networks, Home Networks, internetworks
Protocols and standards – Definition of a Protocol, Protocol standards: De facto and De jure, RFC

Unit II	**Network Models**	**7 Hrs**

OSI Model – layered architecture, peer-to-peer processes, encapsulation
TCP/IP Model – layers and Protocol Suite
Addressing-Physical, Logical, Port addresses, Specific addresses

Unit III	**Signals, Transmission & Performance**	**8 Hrs**

Analog and Digital data, Analog and Digital signals, Digital Signals-Bit rate, Bit length
Baseband Transmission, Broadband Transmission
Transmission Impairments– Attenuation, Distortion and Noise
Data Rate Limits– Noiseless channel: Nyquist's bit rate, noisy channel : Shannon'slaw
Performance of the Network Bandwidth, Throughput, Latency (Delay), Bandwidth – Delay
Product, Jitters
Line Coding Characteristics, Line Coding Schemes–Unipolar -NRZ, Polar-NRZ-I, NRZ-L,
RZ, Manchester and Differential Manchester, Problems
Transmission Modes, Parallel Transmission and Serial Transmission– Asynchronous and
Synchronous
Multiplexing, FDM and TDM
Switching-Circuit Switching, Message Switching and Packet Switching.

Unit IV	Framing, Error Detection, Channelization	8 Hrs

Framing – Concept, Methods – Character Count, Flag bytes with Byte Stuffing, Starting &
ending Flags with Bit Stuffing
Error detection codes – Hamming Distance, CRC
Elementary data link protocols - Simplex stop & wait protocol, Simplex protocol for noisy
channel, PPP, HDLC
Sliding Window Protocols – 1-bit sliding window protocols, Pipelining – Go-Back N and
Selective Repeat
Random Access Protocols - ALOHA– pure and slotted, CSMA-1- persistent, p-persistent
and non-persistent CSMA/CD,CSMA/CA
Controlled Access - Reservation, Polling and Token Passing
Channelization – Definitions – FDMA, TDMA and CDMA

Text Books:

1. Data Communications and Networking by Behrouz Forouzan, Fifth Edition,
   ISBN 978-0-07-337622-6 McGraw Hill.
2. Computer Networks, ANDREW S. Tanenbaum, Fifth Edition, ISBN-13: 978-0-13-
   212695-3, Pearson

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ES – 242 - MNP: Data Communications Laboratory (2024 Pattern)

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

Course Objectives:
- To become familiar with various network devices
- To study protocols for serial and parallel communications and data-link layer

Course Outcomes: After successful completion of this course, learner will be able to -
- Use networking devises
- Implement Serial and Parallel communication protocols
- Implement Data link Layer protocols

Guidelines for Instructor's Manual

The instructor shall frame at least 14 assignments. Manual for the Instructor consisting of University syllabus, conduction and Assessment guidelines be developed

Guidelines for Student Journal

The laboratory assignments should be submitted by every student in the form of a journal consisting of Certificate, table of contents, and handwritten write-up for each assignment. Write-up shall include Title, Problem statement, date of completion etc. The students must submit program source codes with sample output of performed assignments in a soft form. A DVD with students programs should be maintained the by lab In-charge. One or two journals may be retained by the faculty with program prints.

Guidelines for Assessment

Continuous assessment of laboratory work is to be carried out by the instructor based on overall performance of students. For each lab assignment, the instructor will assign grade/marks based on parameters such as timely completion, understanding, neatness etc. with appropriate weightage.

Assignment No	Topics for the Assignments	No. of Sessions
1	Using RJ-44 and RJ-11 connectors, crimping of RJ-45 Connectors	01
2	Study of network devices – NIC, cables, switches, Modem etc.	01
3	Implement Client-Server "Echo" program using Asynchronous communication	01
4	Repeat Assignment 3 by varying parameters – Stop bits, Parity etc.	01
5	Implement Client-Server "Echo" program using Synchronous	01

		communication		
6		Implement Simple stop and wait protocol	01	
7		Implement 1-bit Sliding window protocol	01	
8		Program to generate a series of random numbers using, say, a formula $N_{i+1} = (5 + N_i) \bmod 19 - 1$	01	
9		Program to print a text file using parallel communication	01	
10		Measuring upload and download speeds	01	
11		Program to simulate error detection using Hamming Distance	01	
12		Finding type of address (unicast, multicast or broadcast) from the given Ethernet destination address, say, 05:01:02:03:04:05	01	
13		Program to carry out given operations on given polynomials	01	
		Total Number of Sessions per Batch	**13**	

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ES – 291 - MN: Communications Networks (2024 Pattern)

Teaching Scheme: TH: 02 Hours/Week	Credits 02	Examination Scheme: Continuous Evaluation: 15 Marks End-Semester : 35 Marks

Course Objectives:
- To study IPV4, IPV6 addresses, mapping and Routing
- To Become familiar with TCP and UDP Protocols
- To Understand various protocols at Application Layer

Course Outcomes: After successful completion of this course, learner will be able to-
- Compare and contrast different routing and switching techniques
- Differentiate between TCP and UDP
- Define architecture of various protocols used at Application Layer

Course Contents		
Unit I	**Internet Protocol, Address mapping and Routing**	**8 Hrs**

Review of basic concepts in Data Communication, Network models, Physical and Data Link Layers

IPv4 addresses: Address space, Notations, Classful and Classless addressing, NAT

Internetworking – Need of Network layer, Internet as a Datagram and as a connectionless network

IPv4: Datagram, Fragmentation, checksum, options

IPv6 addresses: Structure, addrss space, packet format, Extension headers

Address mapping – ARP, RARP, BBOTP and DHCP

ICMP – Types and formats of messages, Error reporting, Introduction to IGMP

Direct and indirect delivery, Forwarding techniques, process and routing table

Unicast and Multicast Routing protocols

Unit II	UDP and TCP	8 Hrs

6.1. Process-to-Process Delivery- Client-server, Multiplexing and De-multiplexing, Connectionless Vs. Connection oriented service, Reliable Vs. unreliable service

6.2. User Datagram Protocol (UDP) – Ports, User Datagram, Checksum, UDP operations, Use of UDP

6.3. Transmission Control Protocol (TCP) - TCP Services, TCP Features, Segment, TCP Connection, Flow Control, Error Control, Congestion Control

Unit III	DNS, Remote Login, Email and File Transfer	7 Hrs

Domain Name System (DNS) - Distribution of Name Space, DNS in the Internet, Resolutions, DNS Messages, Header, Records, Registers, DDNS, Encapsulation

Remote Login – TELNET

E-MAIL - Architecture, User Agent, Message Transfer Agent - SMTP, POP and IMAP, Web Based Mail

FTP, Anonymous FTP

	WWW and HTTP	7 Hrs

WWW – Architecture, Client, Server, URL, Cookies, WEB Documents – Static, Dynamic and Active documents

HTTP - HTTP Transaction, Persistent Vs. Nonpersistent connection, Proxy Server

Introduction to Simple Network Management – Management components, structure of Management information, MIB, Security

Reference Books:

1. Data Communications and Networking by Behrouz Forouzan, Fifth Edition, ISBN 978-0-07-337622-6 McGraw Hill.
2. Computer Networks, ANDREW S. Tanenbaum, Fifth Edition, ISBN-13: 978-0-13-212695-3, Pearson

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ES – 292 - MNP: Communications Networks Laboratory (2024 Pattern)

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

Pre-requisite Course: BCA 111

Course Objectives:
- To study network commands
- To understand network and transport layers
- To Understand useful protocols at Application layer

Course Outcomes: After successful completion of this course, learner will be able to -
- Use Networking commands
- Implement Socket programming using TCP and UDP
- Apply protocols at Application layer

Guidelines for Instructor's Manual

The instructor shall frame at least 14 assignments. Manual for the Instructor consisting of University syllabus, conduction and Assessment guidelines be developed

Guidelines for Student Journal

The laboratory assignments should be submitted by every student in the form of a journal consisting of Certificate, table of contents, and handwritten write-up for each assignment. Write-up shall include Title, Problem statement, date of completion etc. The students must submit program source codes with sample output of performed assignments in a soft form. A DVD with students programs should be maintained the by lab In-charge. One or two journals may be retained by the faculty with program prints.

Guidelines for Assessment

Continuous assessment of laboratory work is to be carried out by the instructor based on overall performance of students. For each lab assignment, the instructor will assign grade/marks based on parameters such as timely completion, understanding, neatness etc. with appropriate weightage.

Assignment No	Topics for the Assignments	No. of Sessions
1	Using Networking commands – ping, hostname, traceroute, netstat, ifconfig, who, nmap, nslookup etc	01
2	Study of LAN Environment – IP, MAC addresses, DHCP Server	01
3	To convert the given IP addresses from binary to dotted-decimal notion	01
4	To convert the given IP addresses from dotted-decimal notion to binary notation	01
5	To find netid and hosted of the given IP addresses	01
6	To find class of the given IP addresses	01
7	UDP Based Client-Server "Echo" application using socket programming	01
8	TCP Based Client-Server "Echo" application using socket programming	01
9	Use and study important "Setting options" in GMAIL	01
10	To back up email messages in a gmail account	01
11	Explore POP and IMAP in Gmail	01
12	Use and study of FTP Command, Anonymous FTP	01
13	Using HTTP protocol and understand standard ports	01
14	Using TELNET	01
Total Number of Sessions per Batch		**14**

Syllabus Of Mathematics (Computer Science)

MTC -241MN : Mathematics for Computer Science-I
(Numerical Techniques)

Course type: Minor   **No. of Credits: 02(T)**

Course Outcomes: Students will able to

1. Understand and apply numerical methods to solve algebraic and transcendental equations, including bisection, false position, and Newton-Raphson methods, with an emphasis on error analysis and convergence.

2. Develop a strong foundation in finite difference concepts, including forward, backward, central, and other difference operators, and understand their roles in numerical approximation.

3. Apply interpolation techniques for estimating intermediate values, using Newton's Gregory formulas, Lagrange's interpolation, and divided differences.

4. Utilize numerical integration methods such as the trapezoidal rule, Simpson's one-third rule, and Simpson's three-eighth rule to approximate definite integrals.

5. Solve ordinary differential equations numerically using Euler's method, Euler's modified method, and Runge-Kutta methods, understanding their accuracy and applicability.

6. Analyze the efficiency, accuracy, and limitations of various numerical methods, enabling selection of appropriate techniques for solving real-world mathematical problems.

Course Content

Unit 1: Algebraic and Transcendental Equation   **(06 Hours)**

1.1 Errors

1.2 Bisection Mehtod

1.3 False Position Method

1.4 Newton-Raphson Method

Unit 2: Calculus of Finite Differences and Interpolation   **(10 Hours)**

1.1 Differences

      1.1.1 Forward Differences

      1.1.2 Backward Differences

      1.1.3 Central Differences

      1.1.4 Other Differences

2.2 Relation between Operators

2.3 Newton's Gregory Formula for Forward Interpolation

2.4 Newton's Gregory Formula for Backward Interpolation

2.5 Lagrange's Interpolation Formula

2.6 Divided Difference

2.7 Newton's Divided Difference Formula

Unit 3: Numerical Integration (06 Hours)

3.1 General Quadrature Formula

3.2 Trapezoidal Rule

3.3 Simpson's one-Third Rule

3.4 Simpson's Three-Eight Rule

Unit 4: Numerical Solution of Ordinary Differential Equation (08 Hours)

4.1 Euler's Method

4.2 Euler's Modified Method

4.3 Runge-Kutta Second Order Method

4.4 Runge-Kutta Fourth Order Method (Without Proof)

Text Book:

1. A Textbook of Computer Based Numerical and Statistical Techniques, by A. K. Jaiswal and Anju Khandelwal, New Age International Publishers.

   Chapter 1: 2.1,2.4, 2.5, 2.7

   Chapter 2: 3.1, 3.2, 3.4, 3.5,4.1, 4.2, 4.3, 5.1, 5.2, 5.4, 5.5

   Chapter 3: 6.1, 6.3, 6.4, 6.5, 6.6, 6.7

   Chapter 4: 7.1, 7.4, 7.5, 7.6

Reference Books:

1. S. S. Sastry; Introductory Methods of Numerical Analysis, 3rd edition, Prentice Hall of India, 1999.

2. H. C. Saxena; Finite differences and Numerical Analysis, S. Chand and Company.

3. K. E. Atkinson; An Introduction to Numerical Analysis, Wiley Publications.

4. Balguruswamy; Numerical Analysis.

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MTC-242MNP: Practical on Mathematics for Computer Science-I
Course type: Minor   No. of Credits: 02(P)

1) Plotting of the graph of function y= f(x) against x. Understanding geometric meaning of root of equation f(x) = 0 by plotting graph of function f(x).

2) i. Writing python program to solve Algebraic and Transcendental Equations:

   Bisection method

   ii. Plotting of the graph of function y= f(x) against x and plotting roots in the given interval graphically to understand the bisection method

3) i. Writing python program to solve Algebraic and Transcendental Equations:

   using Regula Falsi method.

   ii Writing python program to solve Algebraic and Transcendental Equations:

   Newton-Raphson Method

4) Writing python programs to prepare difference table .

   i. Newton's Forward Difference table

   ii. Newton's Backward Difference table

5) Writing python program to prepare difference table .

   i. Divided Difference table

6) Writing python programs for

   i. Newton's Forward interpolation formula

   ii. Newton's Backward interpolation formula

7) Writing python program for Newton's divided difference formula.

8) Writing python program for Lagrange's interpolation for unequal interval.

9) Writing python program for generating Lagrange's polynomial.

10) Writing python programs for Numerical Integration using

   i. Trapezoidal Rule.

   ii. Simpson's (1/3)rd rule.

   iii. Simpson's (3/8)th rule.

11) Writing python programs for Numerical Solution of Ordinary Differential Equation

   i. Euler's Method

   ii. Euler's Modified Method

12) Writing python programs for Numerical Solution of Ordinary Differential Equation
   i. Runge-Kutta Method 2nd order
   ii. Runge-Kutta Method 4th order

MTC-291MN: Mathematics for Computer Science-II (Computational Geometry)

Course type: Minor   **No. of Credits: 02(T)**

Course Outcomes: Students will able to

1. Understand the fundamental concepts and mathematical representations of two-dimensional transformations, including translation, rotation, scaling, reflection, and shearing.

2. Apply transformation matrices to perform and combine 2D geometric transformations on points, lines, and simple shapes using homogeneous coordinates.

3. Analyze three-dimensional transformations such as scaling, shearing, reflection, and ro- tation about coordinate axes and planes, and their application in object manipulation.

4. Construct and interpret different types of projections, including orthographic, axonomet- ric, and oblique projections, for visualizing 3D objects on 2D planes.

5. Develop parametric representations of common plane curves such as circles and hyperbo- las, and generate these curves through mathematical methods.

6. Demonstrate the ability to integrate multiple transformation techniques and projections to solve basic computer graphics problems involving geometric modeling.

Course Content

Unit 1: Two dimensional transformations   **(10 Hours)**

1.1 Introduction

1.2 Representation of points

1.3 Transformations and matrices.

1.4 Transformation of points.

1.5 Transformation of straight lines

1.6 Midpoint Transformation

1.7 Transformation of parallel lines

1.8 Transformation of intersecting lines

1.5 Transformation: rotations, reflections, scaling, shearing

1.6 Combined transformations

1.7 Transformation of a unit square.

1.8 Solid body transformations

1.9 Translations and homogeneous coordinates

Unit 2: Three dimensional transformations   (07 Hours)

2.1 Introduction

2.2 Three dimensional Scaling, shearing, rotation, reflection, translation

2.3 Multiple transformations

2.4 Rotation about an axis parallel to coordinate axes,

2.5 Reflection through coordinate planes

Unit 3: Projection   (07 Hours)

3.1 Orthographic projections.

3.2 Axonometric projections.

3.3 Oblique projections.

3.4 Application of projection

Unit 4: Plane Curves   (06 Hours)

4.1 Introduction

4.2 Curve representation

4.3 Parametric curves
4.4 Parametric representation of a circle and generation of circle

4.5 Parametric representation of an Parabola and generation of Parabola

Text Book:

1. D. F. Rogers, J. A. Adams, Mathematical elements for Computer graphics, Mc Graw Hill Intnl Edition.

   Chapter 1: 2-1 to 2.14

   Chapter 2: 3.1 to 3.7,

   Chapter 3: 3.12 to 3.12

   Chapter 4: 4.1, 4.2, 4.6

Reference books:

1. Schaum Series, Computer Graphics. .

2. M. E. Mortenson, Computer Graphics Handbook, Industrial Pres Inc

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MTC-292MNP: Practical on Mathematics for Computer Science-II

Course type: Minor   **No. of Credits: 02(P)**

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1) Plotting 2D bar graphs, histographs, pie charts and subplots etc.

2) Plotting 3D Surface Plots, Wireframes plots and Surface Plots.

3) Using sympy generation of 2D geometrical objects like points, line segments, lines, triangles , other polygons and regular polygons. Transformations of straight lines .

4) Finding area, perimeter, midpoint of line segment or centroid of 2D objects. Point of intersections of two objects and angles between them etc.

5) Plotting of 2D geometrical objects like points, line segments, triangles and other polygons.

6) Finding rotations, reflections, scaling, shearing and translation of given 2D objects.

7) Plotting original 2D object and transformed object after applying any of the 2D transformations such as rotation, reflection, scaling, shearing and translation.

8) Using combined transformations on 2D object and finding transformed figure. Plotting both.

9) Using sympy and/or transformation matrices finding 3D rotations, reflections, scaling, shearing and translation of given 3D objects such as points or line segments etc.

10) Generation and plotting of uniformly spaced n- points on circumference of standard Circle $x^2 + y^2 = r^2$ and on arc of a circle.

11) Generation and plotting of uniformly spaced n- points on parabola when x range or y range is given