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.(10^{th} 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

	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

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

	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	No. of Credits	Examination Scheme
02 Hrs/ week	2	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	No. of Credits	Examination Scheme
02 Hrs / week	2	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	No. of Credits	Examination Scheme
04 Hrs/ week	2	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	No. of Credits	Examination Scheme
02 Hrs/ week	2	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	No. of Credits	Examination Scheme
02 Hrs/ week	2	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	No. of Credits	Examination Scheme
02 Hrs/ week	2	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	No. of Credits	Examination Scheme
02 Hrs/ week	2	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	No. of Credits	Examination Scheme
04 Hrs/ week	2	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	No. of Credits	Examination Scheme
4 Hrs /Week	2	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.

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

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	No. of Credits	Examination Scheme
02 Hrs/ week	2	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	No. of Credits	Examination Scheme
02 Hrs/ week	2	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	No. of Credits	Examination Scheme
02 Hrs/ week	2	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	No. of Credits	Examination Scheme
02 Hrs/ week	2	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	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 – II
Course Type: GE/OE Code : OE-155-CS-T
Course Title : AI Tools for Business

Teaching Scheme	No. of Credits	Examination Scheme
02 Hrs/ week	2	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	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 – II
Course Type: SEC Code : SEC-151-CS-P
Course Title : Statistical Methods for Computer Science II

Teaching Scheme	No. of Credits	Examination Scheme
04 Hrs/ week	2	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.