Faculty of Science & Technology

Savitribai Phule Pune University, Pune

Syllabus Structure for
B. Sc. (Computer Applications)
(2024 Pattern)

(with effect from A. Y. 2024-25)

Preamble

The field of computing is rapidly expanding and changing, especially, since the last decade with continuous emergence of new disruptive technologies such as artificial intelligence, data science, cyber security, Internet of things, robotics and so on.

21st Century has witnessed rapid technological developments in every sector including the field of Computing. Moreover, it has created new job roles and massive job opportunities for budding graduates. Premium Institutes, public and private Universities, autonomous and affiliated colleges in India have always played a crucial role in producing human resources with required skill sets by capturing and monitoring these developments and offered various UG and PG programmes.

The Savitribai Phule Pune University, Pune has made its significant contribution by offering degree programmes as per the trends from time to time. In the year 1989, it started offering a degree programme Bachelor of Computer Science (BCS), now called B. Sc. (Computer Science) and was its unique offering in the state of Maharashtra. Later the University offered undergraduate and graduate programmes such as Master of Computer Management (MCM), Bachelor of Computer Applications (BCA), Master of Computer Applications (MCA), M. Sc (Computer Science), M. Sc. (Computer Applications) etc.

The Savitribai Phule Pune University, Pune has taken a leading role in design and implementation of Programmes as per the guidelines and recommendations of National Education Policy (NEP) 2020. The university decided to offer UG and PG programmes with features recommended by NEP-2020 such as Multiple-entry/exit, inter and multi-disciplinary education, focus on skilling, on-job training/field projects, research, incorporation of Indian Knowledge System etc for the holistic development of students.

The university has adopted the guidelines provided by the state Sukanu Samittee and prepared the credit structure for this UG programmes.

The Ad-hoc Board of Studies in Computer Applications has prepared a structure for **Bachelor of Science (Computer Applications)** with following features

- The structure of the course is designed as per National Education Policy (NEP) 2020 and is in line with University guidelines.
- The total credits offered for the three years with six semesters are 132 credits with 22 credits assigned for each of the six semesters. Candidate has an option to continue with fourth year either for Hon. with research or Hon. degree, each with 176 credits
- The programme has Multiple Entry/exit feature: A candidate may exit the programme after first, second, third or fourth year and shall be awarded with UG Certification, UG Diploma, Degree and Hon. Degree with Research / Hon. Degree respectively
- Various types of courses includes – Major Core (MJ), Mandatory Elective (ME), Open Electives (OE), Minor (MN), Ability Enhancement (AEC), Value education (VEC), Vocational Skill (VSC), Skill enhancement (SEC), Indian Knowledge System (IKS), Co-curricular (CC) courses as well as courses on On-job Training (OJT), Field Project (FP), Community Engagement Programmes (CEP), Research Methodology (RM) and Research Project (RP).

I am thankful to Hon. Vice-Chancellor Prof. Dr. S W. Gosavi, Hon. Dean of FoS&T, Prof. Dr. P D Patil, Former Dean of F0S&T, Prof. Dr. M G Chaskar, Prof. Dr. Sanjay Dhole for their guidance. I am thankful to all board members Prof. Dr. Rahul Patil, Prof. Dr. Razak Sayyad, Mr. Atul Kahate and Mr. Milnd Tanksale for their valuable inputs as well as the teachers from affiliated colleges for their active participation in preparing the draft syllabus.

Prof. Dr. S S Sane
Chairman,
Ad-hoc Board of Studies in Computer Applications
Faculty of Science and Technology, SPPU

Programme Outcomes:

After successful completion of the Programme, the students shall be able to

PO 01: Demonstrate understanding of fundamental concepts in the field of Computing

PO 02: Design and develop computer-based applications.

PO 03: Analyze existing research reported in the literature

PO 04: Propose alternate solutions by undertaking research work.

PO 05: Create efficient, reliable, readable and maintainable code.

PO 06: Demonstrate a deeper understanding of the chosen domain.

PO 07: Select appropriate method/algorithm to solve the given problem

PO 08: Explain complex technical concepts clearly and effectively, both in written and oral forms.

PO 09: Demonstrate ability to collaborate effectively with team members, understand different perspectives, and contribute productively to become successful professional.

PO 10: Demonstrate ability to work with integrity and a sense of social responsibility.

PO 11: Demonstrate self and life-long learning skills

PO 12: Solve computational problems innovatively

PO 13: Apply knowledge gained and critical thinking to develop real-world applications.

Table of Contents

Level 4.5 (FY) Semester - I

Course Code	Course Type	Course Name	Teaching Scheme Hrs/Week			Examination Scheme and Marks			Credits			
			TH	TU	PR	CE	EE	Total	TH	TU	PR	Total
CA-101 - T	Subject 1	Problem Solving and Programming in C	02	--	--	15	35	**50**	02	--	--	**02**
CA-102 - P		Lab course on CA-101 – T	--	--	04	15	35	**50**	--	--	02	**02**
CA-103 - T	Subject 2	Computer Organization & Architecture	02	--	--	15	35	**50**	02	--	--	**02**
CA-104 - P		Lab course on CA-103 – T	--	--	04	15	35	**50**	--	--	02	**02**
CA-105 - T	Subject 3	Discrete Mathematics and Statistics	02	--	--	15	35	**50**	02	--	--	**02**
CA-106 - P		Laboratory course on CA-105 - T	--	--	04	15	35	**50**	--	--	02	**02**
OE-101-CA	GE/ OE	Introduction to Data Science	02	--	--	15	35	**50**	02	--	--	**02**
SEC-101-CA	SEC	HTML and Web Page Designing	--	--	04	15	35	**50**	--	--	02	**02**
IKS – 100 – T	IKS Generic	Course from Basket of courses prepared by the University	02	--	--	15	35	**50**	02	--	--	**02**
AEC – 101 - ENG	AEC	Course from University Basket	02	--	--	15	35	**50**	02	--	--	**02**
VEC – 101 - ENV	VEC	Course from University Basket	02	--	--	15	35	**50**	02	--	--	**02**
Total			**14**	**00**	**16**	**165**	**385**	**550**	**14**	**00**	**08**	**22**

Level 4.5 (FY) Semester - II

Course Code	Course Type	Course Name	Teaching Scheme Hrs/Week			Examination Scheme and Marks			Credits			
			TH	TU	PR	CE	EE	Total	TH	TU	PR	Total
CA-151 - T	Subject 1	Advanced C Programming	02	--	--	15	35	**50**	02	--	--	**02**
CA-152 - P		Lab course on CA-151 - T	--	--	04	15	35	**50**	--	--	02	**02**
CA-153 - T	Subject 2	Introduction to Microcontrollers	02	--	--	15	35	**50**	02	--	--	**02**
CA-154 - P		Lab course on CA-153 - T	--	--	04	15	35	**50**	--	--	02	**02**
CA-155 - T	Subject 3	Linear Algebra	02	--	--	15	35	**50**	02	--	--	**02**
CA-156 - P		Laboratory course on CA-155 - T	--	--	04	15	35	**50**	--	--	02	**02**
OE-151-CA	GE/OE	Data Science Using Spreadsheet Software	--	--	04	15	35	**50**	--	--	02	**02**
SEC-151-CA	SEC	Software Tools for Business Communications	--	--	04	15	35	**50**	--	--	02	**02**
AEC-151-ENG	AEC	Course from University Basket	02	--	--	15	35	**50**	02	--	--	**02**
VEC – 151 - ENV	VEC	Course from University Basket	02	--	--	15	35	**50**	02	--	--	**02**
CC – 151 - PE	CC	Course from University Basket	02	--	--	15	35	**50**	02	--	--	**02**
Total			**12**	**00**	**20**	**165**	**385**	**550**	**12**	**00**	**10**	**22**

Exit option: Award of UG Certification in B. Sc. (Computer Application) with 44 credits and an additional 4 credits (for either a course by Microsoft/CCNA/Salesforce/Google/AWS/Oracle/ RedHat etc or Swayam/ NPTEL/MKCL Course equivalent to core NSQF course or an Internship) or else Continue with Major and Minor

Level 5.0 (SY) Semester - III

Course Code	Course Type	Course Name	Teaching Scheme Hrs/Week			Examination Scheme and Marks			Credits			
			TH	TU	PR	CE	EE	Total	TH	TU	PR	Total
CA-201 – MJ	MJ	Data Structures	04	--	--	30	70	**100**	04	--	--	04
CA-202 – MJP		Lab course on CA-201 - MJ	--	--	04	15	35	**50**	--	--	02	**02**
CA-221 – VSC	VSC	C++ Programming	01	--	02	15	35	**50**	01	--	01	**02**
CA-231-FP	FP	Field Project	--	--	04	15	35	**50**	--	--	02	**02**
CA – 241 – MN	MN	Programming with Python	02	--	--	15	35	**50**	02	--	--	**02**
CA – 242 – MNP		Lab Course on CA – 241 – MN	--	--	04	15	35	**50**	--	--	02	**02**
OE – 201 – CA	GE/ OE	Introduction to Artificial Intelligence	02	--	--	15	35	**50**	02	--	--	**02**
CA – 200 – IKS	IKS	Indian Knowledge for Computing Systems	02	--	--	15	35	**50**	02	--	--	**02**
	AEC	Course from University Basket	02	--	--	15	35	**50**	02	--	--	**02**
	CC	Course from University Basket	02	--	--	15	35	**50**	02	--	--	**02**
Total			**15**	**00**	**14**	**165**	**385**	**550**	**15**	**00**	**07**	**22**

Level 5.0 (SY) Semester – IV

Course Code	Course Type	Course Name	Teaching Scheme Hrs/Week			Examination Scheme and Marks			Credits			
			TH	TU	PR	CE	EE	Total	TH	TU	PR	Total
CA-251-MJ	MJ	Database Management Systems	04	--	--	30	70	**100**	04	--	--	04
CA-252-MJP		Lab course on CA-251 – MJ	--	--	04	15	35	**50**	--	--	02	**02**
CA-271-VSC	VSC	Python Programming	01	--	02	15	35	**50**	01	--	01	**02**
CA-281 CEP	CEP	Community Project	--	--	04	15	35	**50**	--	--	02	**02**
CA – 291 – MN	MN	Introduction to Artificial Intelligence and Machine Learning	02	--	--	15	35	**50**	02	--	--	**02**
CA – 292 – MNP		Lab course on CA – 291 – MN	--	--	04	15	35	**50**	--	--	02	**02**
OE – 251 – CA	GE/ OE	Software Tools for Office Administration	--	--	04	15	35	**50**	--	--	02	**02**
SEC-251-CA	SEC	Spreadsheet Applications	--	--	04	15	35	**50**	--	--	02	**02**
	AEC	Course from University Basket	02	--	--	15	35	**50**	02	--	--	**02**
	CC	Course from University Basket	02	--	--	15	35	**50**	02	--	--	**02**
Total			**11**	**00**	**22**	**165**	**385**	**550**	**11**	**00**	**11**	**22**

Exit option: Award of UG Diploma in B. Sc. (Computer Application) with 88 credits and an additional 4 credits (for either a course by Microsoft/CCNA/Salesforce/Google/AWS/Oracle/ RedHat etc or Swayam/ NPTEL/MKCL Course equivalent to core NSQF course or an Internship) or else Continue with Major and Minor

Level 5.5 (TY) Semester – V

Course Code	Course Type	Course Name	Teaching Scheme Hrs/Week			Examination Scheme and Marks			Credits			
			TH	TU	PR	CE	EE	Total	TH	TU	PR	Total
CA-301 - MJ	MJ	Software Engineering and Testing	04	--	--	30	70	**100**	04	--	--	**04**
CA-302 - MJ		Fundamentals of Artificial Intelligence	02	--	--	15	35	**50**	02	--	--	**02**
CA-303 - MJP		Lab course on CA-302-MJ	--	--	04	15	35	**50**	--	--	02	**02**
CA-304 - MJ		Fundamentals of Data Science	02	--	--	15	35	**50**	02	--	--	**02**
CA-305 – MJP		Lab course on CA-304-MJ	--	--	04	15	35	**50**	--	--	02	**02**
CA-310- MJ	ME	User Interface and User Experience (UI-UX) Design	02	--	--	15	35	**50**	02	--	--	**02**
CA-311- MJP		Lab course on CA - 310- MJ	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-312- MJP		Cloud Computing	02	--	--	15	35	**50**	02	--	--	**02**
CA-313- MJP		Lab course on CA-312 - MJ	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-314- MJ		Cyber Security	02	--	--	15	35	**50**	02	--	--	**02**
CA-315- MJP		Lab course on CA-314-MJ	--	--	04	15	35	**50**	--	--	02	**02**
CA-321 VSC	VSC	Core JAVA Programming	01	--	02	15	35	**50**	01	--	01	**02**
CA-331 FP	FP	Field Project	--	--	04	15	35	**50**	--	--	02	**02**
CA – 341 – MN	MN	Introduction to AR-VR	02	--	--	15	35	**50**	02	--	--	**02**
Total			**13**	**00**	**18**	**165**	**385**	**550**	**13**	**00**	**09**	**22**

Level 5.5 (TY) Semester – VI

Course Code	Course Type	Course Name	Teaching Scheme Hrs/Week			Examination Scheme and Marks			Credits			
			TH	TU	PR	CE	EE	Total	TH	TU	PR	Total
CA-351-MJ	MJ	Software Project Management	02	--	--	15	35	**50**	02	--	--	**02**
CA-352-MJ		Web Programming	02	--	--	15	35	**50**	02	--	--	**02**
CA-353-MJP		Lab course on CA-352-MJ	--	--	04	15	35	**50**	--	--	02	**02**
CA-354-MJ		Operating system Design	04	--	--	30	70	**100**	04	--	--	**04**
CA-355-MJP		Lab course on CA-354-MJ	--	--	04	15	35	**50**	--	--	02	**02**
CA-360-MJ	ME	Prompt & Generative AI	02	--	--	15	35	**50**	02	--	--	**02**
CA-361-MJP		Lab course on CA-360 -MJ	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-362-MJ		Big Data and Analytics	02	--	--	15	35	**50**	02	--	--	**02**
CA-363-MJP		Lab course on CA-362- MJ	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-364-MJ		Mobile Application Development	02	--	--	15	35	**50**	02	--	--	**02**
CA-365-MJP		Lab course on CA-364 -MJ	--	--	04	15	35	**50**	--	--	02	**02**
CA-371 VSC	VSC	Advanced JAVA Programming	01	--	02	15	35	**50**	01	--	01	**02**
CA- 381 OJT	OJT	On-Job Training/ Internship	--	--	08	30	70	**100**	--	--	04	**04**
Total			**11**	**00**	**22**	**165**	**385**	**550**	**11**	**00**	**11**	**22**

Exit option: Award of B. Sc. (Computer Application) with 132 credits OR else Continue with Major and Minor

Level 6.0 Hon. with Research Semester – VII

Course Code	Course Type	Course Name	Teaching Scheme Hrs/Week			Examination Scheme and Marks			Credits			
			TH	TU	PR	CE	EE	Total	TH	TU	PR	Total
CA401-MJ	MJ	Object-oriented Modeling and Design	04	--	--	30	70	**100**	04	--	--	**04**
CA402-MJ		Operations Research	02	--	--	15	35	**50**	02	--	--	**02**
CA403-MJP		Lab course on CA-401-MJ	--	--	04	15	35	**50**	--	--	02	**02**
CA404-MJP		Lab course on CA-402-MJ	--	--	04	15	35	**50**	--	--	02	**02**
CA410-MJ	ME	Natural Language Processing	02	--	--	15	35	**50**	02	--	--	**02**
CA411-MJP		Lab course on CA-410-MJ	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA412-MJ		Machine Learning	02	--	--	15	35	**50**	02	--	--	**02**
CA413-MJP		Lab course on CA-412-MJ	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA414-MJ		Full Stack	02	--	--	15	35	**50**	02	--	--	**02**
CA415-MJP		Lab course on CA-414-MJ	--	--	04	15	35	**50**	--	--	02	**02**
CA431-RP	RP	Course Work and Literature Review	--	--	08	30	70	**100**	--	--	04	**04**
CA432-RP	RM	Fundamentals of Scientific Research	04	--	--	30	70	**100**	04	--	--	**04**
Total			**12**	**00**	**20**	**165**	**385**	**550**	**12**	**00**	**10**	**22**

Level 6.0 Hon. with Research Semester – VIII

Course Code	Course Type	Course Name	Teaching Scheme Hrs/Week			Examination Scheme and Marks			Credits			
			TH	TU	PR	CE	EE	Total	TH	TU	PR	Total
CA-451-MJ	MJ	Deep Learning	04	--	--	30	70	**100**	04	--	--	**04**
CA-452-MJ		Design and Analysis of Algorithms	02	--	--	15	35	**50**	02	--	--	**02**
CA-453-MJP		Lab course on CA-451-MJ	--	--	04	15	35	**50**	--	--	02	**02**
CA-454-MJP		Lab course on CA-452-MJ	--	--	04	15	35	**50**	--	--	02	**02**
CA-460-MJ	ME	Design Thinking	02	--	--	15	35	**50**	02	--	--	**02**
CA-461-MJP		Lab course on CA-460-MJ	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-462-MJ		Data Mining Techniques	02	--	--	15	35	**50**	02	--	--	**02**
CA-463-MJP		Lab course on CA-462-MJ	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-464-MJ		Block Chain	02	--	--	15	35	**50**	02	--	--	**02**
CA-465-MJP		Lab course on CA-464-MJ	--	--	04	15	35	**50**	--	--	02	**02**
CA-481-RP	RP	Project Work	--	--	16	60	140	**200**	--	--	08	**08**
Total			**08**	**00**	**28**	**165**	**385**	**550**	**08**	**00**	**14**	**22**

Award of B. Sc. (Computer Application) Hon. with Research with 176 credits

Level 6.0 Hon. Degree Semester – VII

Course Code	Course Type	Course Name	Teaching Scheme Hrs/Week			Examination Scheme and Marks			Credits			
			TH	TU	PR	CE	EE	Total	TH	TU	PR	Total
CA-401-MJ	MJ	High Performance Databases	04	--	--	30	70	**100**	04	--	--	**04**
CA-402-MJ		Computer Graphics	04	--	--	30	70	**100**	04	--	--	**04**
CA-403-MJP		Lab course on CA-401-MJ	--	--	04	15	35	**50**	--	--	02	**02**
CA-404-MJP		Lab course on CA-402-MJ	--	--	04	15	35	**50**	--	--	02	**02**
CA-405-MJ		DevOps	02	--	--	15	35	**50**	02	--	--	**02**
CA-410-MJ	ME	Mobile Web Programming	02	--	--	15	35	**50**	02	--	--	**02**
CA-411-MJP		Lab course on CA-410-MJ	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-412-MJ		ERP	02	--	--	15	35	**50**	02	--	--	**02**
CA-413-MJP		Lab course on CA-412-MJ	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-414-MJ		Full Stack	02	--	--	15	35	**50**	02	--	--	**02**
CA-415-MJP		Lab course on CA-414-MJ	--	--	04	15	35	**50**	--	--	02	**02**
CA-432-RP	RM	Fundamentals of Research Methodology	04	--	--	30	70	**100**	04	--	--	**04**
Total			**16**	**00**	**12**	**165**	**385**	**550**	**16**	**00**	**06**	**22**

Level 6.0 Hon. Degree Semester – VIII

Course Code	Course Type	Course Name	Teaching Scheme Hrs/Week			Examination Scheme and Marks			Credits			
			TH	TU	PR	CE	EE	Total	TH	TU	PR	Total
CA-451-MJ	MJ	Deep Learning	04	--	--	30	70	**100**	04	--	--	**04**
CA-452-MJ		Design and Analysis of Algorithm	02	--	--	15	35	**50**	02	--	--	**02**
CA-453-MJ		Management Information System	04	--	--	30	70	**100**	04	--	--	**04**
CA-454-MJP		Lab course on CA-451-MJ	--	--	04	15	35	**50**	--	--	02	**02**
CA-455-MJP		Lab course on CA-452-MJ	--	--	04	15	35	**50**	--	--	02	**02**
CA-460-MJ	ME	Design Thinking	02	--	--	15	35	**50**	02	--	--	**02**
CA-461-MJP		Lab course on CA-460-MJ	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-462-MJ		GO Programming	02	--	--	15	35	**50**	02	--	--	**02**
CA-463-MJP		Lab course on CA-462-MJ	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-464-MJ		Block Chain	02	--	--	15	35	**50**	02	--	--	**02**
CA-465-MJP		Lab course on CA-464-MJ	--	--	04	15	35	**50**	--	--	02	**02**
CA-481-OJT	OJT	On-job Training / Internship *	--	--	08	30	70	**100**	--	--	04	**04**
Total			**12**	**00**	**20**	**165**	**385**	**550**	**12**	**00**	**10**	**22**

Award of B. Sc. (Computer Application) Hon. with 176 credits

Detailed Drafts
SEMESTER I

Savitribai Phule Pune University First Year of B. Sc. (Computer Applications) - (2024 Course) CA – 101 – T : Problem Solving and Programming in C		
Teaching Scheme: Theory: 02 Hrs/Week	Credits 02	Examination Scheme: Continuous Evaluation: 15 Marks End-Semester : 35 Marks

Course Objectives:
- To provide a broad overview of problem solving techniques
- To learn C programming to solve problems

Course Outcomes: At the end of the course, students will be able to
- Define algorithms and explain their characteristics
- Formulate algorithm and draw flow chart to solve a given problem
- Explain use of appropriate data types, control statements
- Demonstrate ability to use top-down program design

Course Contents		
Unit I	**Problem solving, algorithms and flowcharts**	**06 Hrs**

Types of Problems, Problem solving using computer, Difficulties with problem solving, Problem solving aspects.

Definition & Characteristics of algorithm, Examples of algorithms, Flow charts with examples, Top-down design

Problem solving using Arithmetic Statements, Conditional Statement & Iterative Statements such as Addition/Multiplication, check number is positive/negative, Maximum of 2 numbers & 3 numbers, sum of first n numbers, sum of given n numbers, reverse digits of a number, check whether the number is palindrome, check number is prime, factorial of number, factors of number, GCD, LCM of numbers etc.

Unit II	**C Fundamentals**	**07 Hrs**

Introduction to C, Features of C, Structure of C Program, C Character Set, Identifiers and Keywords, Variables and constants
Data types- Basic data types, Enumerated types, Type casting, Declarations, Expressions, Operators and Expressions Unary and Binary arithmetic operators, Increment Decrement operators, Relational and logical operators, Bit wise operators, Assignment operators, Comma operator, size of operator, Ternary conditional operator, Precedence and associativity
Input Output Statements: printf, scanf functions, getchar, putchar, getch functions, gets, puts functions, Escape sequence characters, Format specifiers

Unit III	**Control & Iterative Structures**	**05 Hrs**

If, If- Else Statements, Nested If Statements, Conditional Branching – switch statement,

Loop (while, do…while, for), break, continue, goto statements

Unit IV	**Functions**	**06 Hrs**

Introduction to Functions, Function Arguments, Library & User defined functions,

Methods for parameter passing, Recursion, Storage Classes – Auto, Static, Global and Register

Unit V	**Arrays**	**06 Hrs**

Introduction, Array Declarations, Bounds Checking, Single dimension Arrays, Two dimension Arrays, Arrays & Function

Reference Books:

1. Cormen, Leiserson, Rivest, Stein, "Introduction to algorithms"
2. Brian W. Kernighan, Dennis M. Ritchie , "The C Programming Language", ISBN:9788120305960, PHI Learning
3. R.G. Dromey, "How to Solve it by Computer", ISBN: 9788131705629, Pearson Education
4. Behrouz A. Forouzan, RichardF. Gilberg, "A Structured Programming Approach Using C", ISBN:9788131500941, Cengage Learning India
5. E. Balaguruswamy, "Programming in ANSI C", ISBN: 9781259004612, Tata Mc-Graw Hill Publishing Co Ltd.-New Delhi
6. Maureen Spankle, "Problem Solving and Programming Concepts", ISBN: 81-317-0711-3
7. Y S Kanetkar, "Let Us C", BPB Publications

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

Course Objectives:
- To learn formulation of algorithm for a given problem
- To study various data types, arrays and functions in C
- To understand input-output and, control and iterative statements in C

Course Outcomes: On completion of the course, students will be able to–
- Formulate an algorithm and draw flowchart for the given problem
- Implement the given algorithm in C
- Write programs using appropriate data types and control structures in C

Guidelines for Instructor's Manual

The instructor shall frame at least 14 assignments. Instructor's manual consisting of University syllabus, conduction & Assessment guidelines is to be developed.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up for each assignment. Write-up shall include Title, Problem Statement, software and Hardware requirements, Date of Completion.
Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be retained with program prints.

Guidelines for Assessment

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

Sr. No.	Assignment List
1	Assignment on use of data types, simple operators (expressions)
2	Assignment on decision making statements (if and if-else, nested structures)
3	Assignment on decision making statements (switch case)
4	Assignment on use of while loops
5	Assignment on use of for loops
6	Assignment on nested loops
7	Assignment on exit, goto, continue, break
8	Assignment on menu driven programs.
9	Assignment on writing C programs in modular way (use of user defined functions)
10	Assignment on call by value
11	Assignment on call by reference
12	Assignment on recursive functions
13	Assignment on use of arrays (1-D array) and functions
14	Assignment on use of multidimensional array (2-D arrays) and functions
15	Assignment on Standard Library Function

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Savitribai Phule Pune University
First Year of B. Sc. (Computer Applications) - (2024 Course)
CA – 103 – T : Computer Organization and Architecture

</td></tr>
</table>

Teaching Scheme: Theory: 02 Hrs/Week	Credits 02	Examination Scheme: Continuous Evaluation: 15 Marks End-Semester : 30 Marks

Course Objectives:
- To study number system, logic gates
- To understand combinational and sequential circuits
- To provide a broad overview of architecture and functioning of computer systems
- To learn the basic concepts behind the architecture and organization of computers.

Course Outcomes: On completion of the course, student will be able to–
- Design of combinational circuits
- Design of sequential circuits
- Describe block diagram of CPU, Memory and types of I/O transfers

Course Contents

Unit I	Data representation and Computer Arithmetic	04 Hrs

Review of Decimal, Binary, Octal, Hexadecimal Number systems and their inter-conversion, BCD code, Gray code, Excess-3 code, ASCII , EBCDIC, Unicode, Signed and Unsigned numbers, 1's and 2's complements, Binary arithmetic.

Unit II	Boolean Algebra & Logic Gates	07 Hrs

Boolean theorems, Boolean Laws, De Morgan's Theorem, Reduction of Logic expression using Boolean Algebra, Introduction to Logic (AND, OR, NOT), Classification of Logic gates, Universal Logic gates, Implementation of other gates using universal gates. Basic concepts of Karnaugh map, minterm and maxterm.

Unit III	Combinational Circuits	07 Hrs

Definition of combinational circuits, Detail study of Half adder, Full adder, Half subtractor, Full subtractor, Multiplexer(4:1) & Demultiplexer(1:4), Encoder (8-line-to-3-line) and Decoder (3-line-to-8-line), Parity generator and checker, Block diagram of ALU.

Unit IV	Sequential circuits	07 Hrs

Definition of sequential circuits, Detail study of Flip Flops and truth tables: S-R FF, J-K FF, T and D type FFs, Flip flop as memory device.

Counters: Asynchronous-Mod16, Mod-10, Mod-8, up down counter, Synchronous-Ring counter, Event counter.

Shift Registers and their types, serial to parallel and parallel to serial converters using shift registers.

Unit V	CPU, Memory and I/O Organization	05 Hrs

Block diagram of CPU, functions of CPU, general register organization, flags, Concept of RISC and CISC

Memory System hierarchy, Cache Memory, Internal Memory, External Memory, Concept of Virtual Memory.

Basics of I/O organisation: types of I/O data transfers.

Reference Books:

1. R.P. Jain, "Modern Digital Electronics", McGraw-Hill Publications

2. Flod and Jain, "Digital Fundamentals", Pearson Publication.

3. Morris Mano, "Computer System Architecture" Prentice-Hall.

Savitribai Phule Pune University		
First Year of Bachelor of Computer Applications (2024 Course)		
CA-104-P: Lab Course on CA-103-T		
Teaching Scheme: **Practical: 04 Hours/Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester : 35 Marks**

Course Objectives:

- To study number system, logic gates
- To understand combinational and sequential circuits
- To provide a broad overview of architecture and functioning of computer systems
- To learn the basic concepts behind the architecture and organization of computers.

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

- Design of combinational circuits
- Design of sequential circuits
- Describe block diagram of CPU, Memory and types of I/O transfers

Guidelines for Instructor's Manual

The instructor shall frame at least 12 assignments. Instructor's manual consisting of University syllabus, conduction & Assessment guidelines is to be developed.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up for each assignment. Write-up shall include Title, Problem Statement, Date of Completion etc. For reference one or two journals may be retained.

Guidelines for Assessment

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

List of Assignments

1. To Study and verify the Truth Tables of Logic Gates.

2. To Study De-morgan's theorems.

3. Code Converters using K-Map.

4. Half Adder and Full Adder.

5. Decimal to BCD Encoder

6. Multiplexer (2:1) and De-multiplexers (1:2)

7. Flip-flops (SR, D and JK-FF)

8. 4-bit binary asynchronous counter using IC 7493.

9. Shift Registers.

10. Study of 4-bit ALU (IC 74181)

11. Study of 3-bit Synchronous Up-Down counter.

12. Parity generator and checker

Savitribai Phule Pune University First Year of B. Sc. (Computer Applications) - (2024 Course) CA – 105 – T : Discrete Mathematics and Statistics		
Teaching Scheme: Theory: 02 Hrs/Week	Credits 02	Examination Scheme: Continuous Evaluation: 15 Marks End-Semester : 30

Course Objectives:
- Learn basic terminology formal logic, proofs, sets, relations, functions and perform the operations associated with same
- Use formal logic proof and logical reasoning to solve problems
- To understand significance of statistical measures
- To study Correlation and Probability

Course Outcomes: On completion of the course, students will be able to–
- Relate and apply techniques for constructing mathematical proofs and make use of appropriate set operations, propositional logic to solve problems
- Use function or relation models to interpret associated relationships
- Apply basic counting techniques and use principles of probability
- Given a data, compute various statistical measures of central tendency
- Use appropriate Sampling techniques

Course Contents		
Unit I	**Set Theory and Logic**	**06 Hrs**

Sets– Set Theory, Need for Sets, Representation of Sets, Set Operations, cardinality of set, **Types of Sets** – Bounded and Unbounded Sets, Countable and Uncountable Sets, Finite and Infinite Sets, Countably Infinite and Uncountably Infinite Sets, power set, **Propositional Logic-** logic, Propositional Equivalences, Application of Propositional Logic-Translating English Sentences, Proof by Mathematical Induction and Strong Mathematical Induction.

Unit II	**Relations and Functions**	**06 Hrs**

Relations: Properties, n-ary Relations and Applications, Representing Relations , Closures of Relations, Equivalence Relations, Partial Orderings, partitions, Hasse Diagram, Lattices, Chains and Anti-Chains, Transitive Closure and Warshall's Algorithm

Functions- Surjective, Injective and Bijective functions, Inverse Functions and Compositions of Functions.

Unit III	**Counting and Probability**	**06 Hrs**

The Basics of Counting, rule of Sum and Product, Permutations and Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, The Pigeonhole Principle.

Probability: Basic Concepts, Definition, Addition and Multiplication Theorems, Conditional probability and Bayes' Theorem

Unit IV	**Data Presentation and Aggregation**	**06 Hrs**

Data Types: attribute, variable, discrete and continuous variable, **Data presentation:** frequency distribution, histogram, ogive, box-plot, bar plots

Measures of Central Tendency: Arithmetic Mean (AM), Weighted Arithmetic Mean, Arithmetic Mean Computed from Grouped Data, Concept of Median, Mode, Geometric Mean (GM), Harmonic Mean (HM), Quartiles, Deciles, and Percentiles

Measures of Dispersion: Standard Deviation, Root Mean Square, Variance, Absolute and Relative Dispersion

Unit V	Correlation Theory and Sampling	06 Hrs

Correlation: Bivariate data, scatter plots, Linear Correlation, Correlation of Attributes, Coefficient of correlation

Regression: Concept, Linear Regression, Prection

Elementary Sampling Theory : Sampling Theory, Random Samples, Sampling With and Without Replacement, Stratified Sampling

Reference Books:

1. Kenneth H. Rosen, Discrete Mathematics And Its Applications, Tata Mcgraw-Hill, Isbn 978-0-07-288008-3, 7th Edition.
2. Trivedi, K.S., " Probability, Statistics, Design Of Experiments And Queuing Theory, With Applications Of Computer Science", Prentice Hall Of India, New Delhi
3. C L Liu, "Elements Of Discrete Mathematics", Tata Mcgraw-Hill, Isbn 10:0-07-066913-9.
4. Kulkarni, M.B., Ghatpande, S.B. And Gore, S.D., "Common Statistical Tests" Satyajeet Prakashan, Pune
5. J.N. Kapur And H.C. Saxena, "Mathematical Statistics", S. Chand Publications, 20th Ed.
6. John P. D'angelo & Douglas B. West, "Mathematical Thinking–Problem Solving And Proofs" Prentice Hall, 2nd Ed.

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

Course Objectives:
- To learn to apply theoretical concepts of discrete mathematics and statistics to solve problems.
- To provide hands-on experience on R software.

Course Outcomes: On completion of the course, student will be able to
- Demonstrate understanding of fundamental mathematical concepts.
- Apply mathematical and statistical concepts to solve problems.
- Use R software to perform statistical operations and data visualization.

Guidelines for Instructor's Manual
The instructor shall frame at least 12 assignments. Instructor's manual consisting of University syllabus, conduction & Assessment guidelines is to be developed.

Guidelines for Student Journal
The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up for each assignment. Write-up shall include Title, Problem Statement, Date of Completion etc.
For reference one or two journals may be retained.

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

Suggested List of Laboratory Assignments

Applied Mathematics: Assignment based on following topics

1. Set Theory
2. Logic
3. Relations
4. Functions
5. Counting

Statistics (To be performed using R software)
1. Download and Install R, understand IDE
2. Using R execute the basic commands, array, list and frames.
3. Using R Execute the statistical functions: mean, median, mode, quartiles, range.
4. Using R import the data from Excel / .CSV file and calculate the standard deviation.
5. Import the data from Excel / .CSV and perform the Statistical distribution: Normal Distribution.

References: Richard Cotton, "Learning R", SPD O'Reilly Publications

Savitribai Phule Pune University First Year of Bachelor of Computer Applications (2024 Course) SEC-101-CA: HTML and Webpage Designing		
Teaching Scheme: **Practical: 04 Hours/Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester : 35 Marks**

Course Objectives:
- To understand web based application development process.
- To study basics of HTML elements and tag.
- To know usage of CSS in HTML.
- To design and create simple websites.
- To apply JavaScript to websites.

Course Outcomes: After successful completion of this course, learner will be able to
- Enlist various HTML elements and tags
- Use HTML elements and tags
- Apply CSS and Java script features.
- Design a website using HTML, CSS and JavaScript.

Guidelines for Instructor's Manual

The instructor shall frame at least 14 assignments. Instructor's manual consisting of University syllabus, conduction & Assessment guidelines is to be developed.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up for each assignment. Write-up shall include Title, Problem Statement, software and Hardware requirements, Date of Completion.

Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be retained with program prints.

Guidelines for Assessment

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

List of Assignments

Assignment 01: Using basic HTML elements (headings, paragraphs, line break, colour, fonts, links, Images, etc)

Assignment 02: Creating Lists using HTML Tags

Assignment 03: Creating Tables using HTML Tags

Assignment 04: Creating Frames in HTML

Assignment 05: Creating Forms using HTML

Assignment 06: Designing of HTML screens using CSS

Assignment 07: Using Functions in JavaScript

Assignment 08: Carryout Validation using JavaScript

Assignment 09: Using Event Handling.

Assignment 10: Designing website using basic elements of HTML, CSS and JavaScript.
Assignment 11: Designing website using HTML, CSS and advanced JavaScript elements and event handling

Reference Books:

1. Steven Holzner, HTML Black Book, Dremtech press.
2. Web Applications : Concepts and Real World Design, Knuckles, Wiley-India
3. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel Pearson Education
4. Programming the World Wide Web , Robert W Sebesta (3rd Edition)
5. Learn HTML and CSS faster by Mark Myer

E-Resources:

1. https://www.coursera.org/learn/html-css-javascript-for-web-developers
2. https://www.coursera.org/learn/introduction-to-web-development-with-html-css-javacript?action=enroll#modules
3. https://www.scribd.com/doc/41532231/CSS-HTML-JavaScript-LAB-Good-Practical-Programs
4. https://www.udemy.com/course/web-development-learn-by-doing-html5-css3-from-scratch-introductory/
5. https://www.udemy.com/course/javascriptfundamentals/

Detailed Drafts SEMESTER II

Savitribai Phule Pune University First Year of B. Sc. Computer Applications (2024 Course) CA – 151 - T: Advanced C Programming		
Teaching Scheme: **Theory: 02 Hrs/Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester : 35 Marks**

Course Objectives:

- To learn advanced features in C Programming
- To study advanced data types
- To understand built-in library functions

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

- Write programs using pointers and structures
- Use Pre-processor directives
- Manipulate strings using library functions
- Write programs to perform operations on Files

Course Contents		
Unit I	**Preprocessor**	**06 Hrs**
Concept, Format of preprocessor directives, File inclusion directives (#include), Macro substitution directives (#define), nested macros, parameterized macros, Macros versus functions, #error / #pragma directives, Conditional compilation (#if/#ifdef/#else/#elif/#endif), Predefined macros (_DATE_ / _TIME_ /_FILE_ /_LINE_/ _STDC_)		
Unit II	**Pointers**	**07 Hrs**
Concept – reference & dereference, Declaration, definition, initialization & use, Types of pointers, Pointer Arithmetic, Multiple indirection, parameter passing – call by value and call by reference Arrays & Pointers - Pointer to array, Array of pointers, Functions & pointers - Passing pointer to function, Returning pointer from function, Function pointer, Pointers &const Dynamic memory management, Allocation, Resizing, Releasing, Memory leak / dangling pointers		
Unit III	**Strings**	**05 Hrs**
Concept, Declaration, definition, initialization, format specifiers, String literals/ constants & variables – reading & writing from & to console, Importance of terminating NULL character, Strings & pointers Array of strings & array of character pointers, User defined functions, predefined functions in string.h - strlen , strcpy , strcat , strcmp , strcmpi , strrev , strlwr , strupr , strset , strchr , strrchr , strstr , strncpy , strncat , strncmp , strncmpi , strnset , strtok, Command line arguments – argc and argv		
Unit IV	**Structures**	**06 Hrs**

Concept, Declaration, definition, initialization, accessing structure members (. operator), Array of structures, Pointers to structures, Declaring pointer to structure
Accessing structure members via pointer to structure, Structures & functions,
Passing each member of structure as a separate argument, Passing structure by value / address
Nested structures, typedef & structures, Concept of Union

Unit V	File Handling	06 Hrs

Concept of streams, need, Types of files, Operations on text & binary files, Random access file, library functions for file handling – fopen, fclose, fgetc, fseek, fgets, fputc etc

Reference Books:

1. The C Programming Language (Second Edition) – By B. W. Kerninghan& D. M. Ritchie
2. Programming in C – A Practical Approach – By Ajay Mittal (Pearson Publications)
3. Programming with C – By Byron S Gottfried (Schaum's Outlines)
4. A structural Programming Approach using C – By BehrouzForouzan& Richard Gilberg
5. Y S Kanetkar, "Let Us C", BPB Publications

<table>
<tr><td colspan="3">Savitribai Phule Pune University
First Year of B. Sc. (Computer Applications) (2024 Course)
CA – 152 – P : Lab Course on CA – 151 - T</td></tr>
</table>

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

Course Objectives:

- To learn advanced features in C Programming
- To study advanced data types
- To understand built-in library functions

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

- Write programs using pointers and structures
- Use Pre-processor directives
- Manipulate strings using library functions
- Write programs to perform operations on Files

Guidelines for Instructor's Manual

The instructor shall frame at least 12 assignments. Instructor's manual consisting of University syllabus, conduction & Assessment guidelines is to be developed.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up for each assignment. Write-up shall include Title, Problem Statement, software and Hardware requirements, Date of Completion.
Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints.

Guidelines for Assessment

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

Sr. No.	Assignment
1	To demonstrate use of preprocessor directives
2	To demonstrate use of pointers
3	To demonstrate advanced use of pointers
4	To demonstrate concept of strings, array of strings
5	To demonstrate string operations using pointers
6	To demonstrate command line arguments
7	To demonstrate structures (using array and functions)
8	To demonstrate nested structures
9	To demonstrate use of bitwise operators.
10	To demonstrate file handling

<table>
<tr><td colspan="4" align="center">Savitribai Phule Pune University
First Year of B. Sc. (Computer Applications) - (2024 Course)
CA – 153 – T : Introduction to Microcontrollers</td></tr>
</table>

Teaching Scheme: Theory: 02 Hrs/Week	Credits 02	Examination Scheme: Continuous Evaluation: 15 Marks End-Semester : 30 Marks

Course Objectives:

- To study the basics of microcontroller.
- To learn 8051 Programming.
- To understand interfacing techniques of 8051microcontroller.
- To learn to design simple applications using 8051microcontroller.

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

- Write programs using instruction set of 8051 microcontroller.
- Interface I/O peripherals to 8051 microcontroller.
- Design simple microcontroller-based applications.

Course Contents		
Unit I	**Introduction**	**04 Hrs**

Introduction of microcontroller and microprocessor, difference between microcontroller and microprocessor, classification of microcontrollers, Applications of microcontrollers.

Unit II	**8051 microcontroller**	**04 Hrs**

Features of 8051 microcontrollers, block diagram & Architecture of 8051, Internal Memory organization, SFRS, PSW register, pin functions of 8051, Structure of I/O ports and its Operation, External Memory Interface.

Unit III	**8051: Programmer's Model**	**09 Hrs**

Introduction to Assembly programming, Compilers. Assemblers, Instruction classification, Instruction set, Addressing Modes: Immediate, register, direct, indirect and relative, assembler directives (ORG, END), features with examples.
Introduction to 8051 programming in C.

Unit IV	**Timers and Counters**	**07 Hrs**

Timer / counter: TMOD, TCON, SCON, SBUF, PCON Registers, Timer modes, programming for time delay using mode 1 and mode 2.

Unit V	**Interrupts and Interfacing**	**06 Hrs**

Interrupts: Introduction to interrupt, Interrupt types and their vector addresses, Interrupt enable register and interrupt priority register (IE, IP).
Basics of Interfacing: ADC, DAC, LCD, stepper motor.

Reference Books:

1. 8051 microcontroller and Embedded system using assembly and C : Mazidi and McKinley, Pearson publications.
2. The 8051 microcontroller – Architecture, programming and applications: K.Uma Rao and Andhe Pallavi, Pearson publications.

Savitribai Phule Pune University
First Year of Bachelor of Computer Applications (2024 Course)
CA-154-P: Lab Course on CA-153-T

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

Course Objectives:
- To study the basics of microcontroller.
- To learn 8051 Programming.
- To understand interfacing techniques of 8051microcontroller.
- To learn to design simple applications using 8051microcontroller.

Course Outcomes: On completion of the course, student will be able to–
- Write programs using instruction set of 8051 microcontroller.
- Interface I/O peripherals to 8051 microcontroller.
- Design simple microcontroller-based applications.

Guidelines for Instructor's Manual

The instructor shall frame at least 12 assignments. Instructor's manual consisting of University syllabus, conduction & Assessment guidelines is to be developed.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up for each assignment. Write-up shall include Title, Problem Statement, software and Hardware requirements, Date of Completion etc.

Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be retained with program prints.

Guidelines for Assessment

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

List of Assignments

1. Study of 8051 microcontroller chip, keil µvision-5.

2. Study of proteus simulator for 8051 simulation.

3. Program to find Largest/smallest from a series.

4. Program to perform Addition / subtraction / multiplication/division of 8/16 bit data.

5. Program to perform Arithmetic, logical & code conversion problems

6. Program to perform data transfer/exchange between specified memories locations.

7. Interfacing of LED/LEDs to 8051 microcontroller.

8. Interfacing of switch & LED to 8051 microcontroller.

9. Waveform generation using DAC Interface to 8051 Microcontroller.

10. Traffic light controller using 8051 microcontroller.

11. Interfacing LCD to 8051Microcontroller.

12. Interfacing with IR sensor to 8051 microcontroller and LCD.

13. ADC interfacing to 8051 Microcontroller.

14. Stepper motor interfacing to 8051 microcontroller.

15. DC motor interfacing to 8051 microcontroller.

Savitribai Phule Pune University		
First Year of B. Sc. (Computer Applications) - (2024 Course)		
CA – 155 – T : Linear Algebra		
Teaching Scheme: **Theory: 02 Hrs/Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester : 30**

Course Objectives:
- To offer the learner the relevant Linear Algebra concepts through Computer Science applications.
- To interpret existence and analyse the solution set of a system of linear equations.
- To formulate, solve, apply, and interpret properties of linear systems.
- To learn about the concept of linear independence of vectors and the dimension of a vector space.
- To interpret basic concepts of linear transformations, dimension, matrix representation of a linear transformation.

Course Outcomes: On completion of the course, students will be able to–
- Appreciate the relevance and applications of Linear Algebra in the field of Computer Science.
- Instill a computational thinking while learning linear algebra.
- Express clear understanding of the concept of a solution to a system of equations.
- Find eigenvalues and corresponding eigenvectors for a square matrix.
- Represent linear transformations using matrices.

Course Contents		
Unit I	**Systems of Linear Equations and Matrices**	**06 Hrs**

1.1 Row echelon form of a matrix, reduced row echelon form of a matrix.
1.2 Definition of rank of a matrix using row echelon or row reduced echelon form.
1.3 System of linear equations- Introduction, matrix form of linear system, definition of row equivalent matrices.
1.4 Consistency of homogeneous and non-homogeneous system of linear equations using rank, condition for consistency
1.5 Solution of System of Equations: Gauss elimination and Gauss-Jordan elimination method, examples.

Unit II	**Vector Spaces - I**	**06 Hrs**

2.1 Definition and examples
2.2 Subspaces
2.3 Linear Dependence and Independence (Statement and examples only)
2.4 Basis of vector space

Unit III	**Vector Spaces - II**	**06 Hrs**

3.1 Dimension of a vector space
3.2 Row Space, Column Space, and Null Space of a matrix
3.3 Definition: Rank and Nullity

Unit IV	**Eigen values and Eigen vectors**	**06 Hrs**

4.1 Eigen values
4.2 Eigen vectors
4.3 Diagonalization

Unit V	Linear Transformations	06 Hrs

5.1 Definition and Examples, Properties, Equality
5.2 Kernel and range of a linear Transformation
5.3 Rank-Nullity theorem (Statement only)
5.4 Matrix representation of Linear Transformation

Books:

Text Book :

1. Howard Anton, Chris Rorres, Elementary Linear Algebra, Application Version, Ninth Edition, Wiley, 11th edition.

Reference Books:

1. K. Hoffman and R. Kunze, Linear Algebra, 2nd edition(2014), Prentice Hall of India, New Delhi
2. Steven J. Leon, Linear Algebra with Applications, 4th edition(1994), Prentice Hall of India. New Delhi
3. Vivek Sahai, Vikas Bist, Linear Algebra, 4th Reprint 2017, Narosa Publishing House, New Delhi.

Savitribai Phule Pune University First Year of B. Sc. (Computer Applications) (2024 Course) CA-156 - P: Laboratory Course Based on CA-155 - T		
Teaching Scheme: Theory: 04 Hours/Week	Credits 02	Examination Scheme: Continuous Evaluation:15 Marks End-Semester :35 Marks

Course Objectives:
- To learn to apply theoretical concepts of discrete mathematics and statistics to solve problems.
- To provide hands-on experience on R software.

Course Outcomes: On completion of the course, student will be able to
- Demonstrate understanding of fundamental mathematical concepts.
- Apply mathematical and statistical concepts to solve problems.
- Use R software to perform statistical operations and data visualization.

Guidelines for Instructor's Manual

The instructor shall frame at least 12 assignments. Instructor's manual consisting of University syllabus, conduction & Assessment guidelines is to be developed.

Guidelines for Student Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up for each assignment. Write-up shall include Title, Problem Statement, Date of Completion, etc. For reference one or two journals may be maintained with program prints.

Guidelines for Assessment

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

Suggested List of Laboratory Assignments

Assignments based on following topics

1. Practical 1: Problems on Unit 1 based on Systems of Linear Equations-I (Written).
2. Practical 2: Problems on Unit 1 based on Systems of Linear Equations-II (Written).
3. Practical 3: Problems on Unit 2 (Written).
4. Practical 4: Problems on Unit 3 (Written).
5. Practical 5: Problems on Unit 4 (Written).
6. Practical 6: Problems on Unit 5 (Written).

Assignments To be performed using Scilab Software

7. Practical 7: Introduction to Scilab software.
8. Practical 8: Problems on Unit 1 using Scilab software
9. Practical 9: Problems on Unit 2 using Scilab software..
10. Practical 10: Problems on Unit 3 using Scilab software.
11. Practical 11: Problems on Unit 4 using Scilab software.
12. Practical 12: Problems on Unit 5 using Scilab software

References:

- Richard Cotton, "Learning R", SPD O'Reilly Publications

Savitribai Phule Pune University
First Year of Bachelor of Computer Applications (2024 Course)
SEC-151: Software Tools for Business Communication

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

Course Objectives:
- To study word processing, spreadsheets and presentation tools
- To learn G-suit
- To be familiar with tools for Electronic communications

Course Outcomes: At the end of the course, students will be able to
- Perform various word processing tasks
- Prepare spreadsheets and presentations
- Collect feedbacks and make surveys
- Communicate and collaborate through electronic communications

Guidelines for Instructor's Manual
The instructor shall frame at least 14 assignments. Instructor's manual consisting of University syllabus, conduction & Assessment guidelines is to be developed.

Guidelines for Student Journal
The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up for each assignment. Write-up shall include Title, Problem Statement, software and Hardware requirements, Date of Completion.
Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints.

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

Topics for Lab Assignments

Unit No	Topics	Number of Assignments
Unit I	**Word processing and Google DOCs**	04 Nos
	Create, Save, Open and Edit Documents, Text Alignments, Enhancements, and Effects Basic Document Formatting and Editing, Additional Document Formatting and Editing Work with Multiple-Page Documents and Multiple Documents, Work with Columns and Tables Work with Objects, Lines, and Text Boxes, Drawing Tools, Add Special Effects Create and manipulate Google DOC using various features	
Unit II	**Spreadsheets and Google Sheets**	04 Nos
	Create, Save, and Print a Worksheet, Use Formulas; Copy a Formula; Format and Enhance Use Functions, Additional Formatting, and Editing, Create and Edit Charts, Integrate Worksheets with Other Applications Create and manipulate Google Sheets using various features	

Unit III	Presentations and Google Slides	02 Nos
	Create, Save, and Print a Presentation, Enhance Slides; Work with Text and Objects, Work with Slide Shows; Integrate Presentations with Other Applications Create and manipulate Google Slides using various features	
Unit IV	Google Forms, Drives and Calendar	03 Nos
	Create, Save, Open and Edit Google form using essential features Google Drive: Create folders and subfolders, upload documents, share drive files and folders, Google Calendar: essential features	
Unit V	Emails, Groups and Generative AI Tools	04 Nos
	Create and send, receive emails, email folders and fields, attach documents, address book, email signatures and other essential settings, Email etiquettes Create, join email groups, send and receive emails on groups Using Generative AI tools such as ChatGPT	
Reference Books:		
	1. Office 2019 in Easy Steps, Michael Price, BPB Publications 2. The Ridiculously Simple Guide to Google Apps (G Suite): A Practical Guide to Google Drive Google Docs, Google Sheets, Google Slides, and Google Forms, Scott La Counte, SL Editions	

List of Open Elective (OE) Courses offered by BOS in Computer Applications to other Disciplines / Faculty

Sr. No.	Semester	Course Code	Course Name	Credits		
				TH	PR	Total
1.	I	OE-101-CA	Introduction to Data Science	02	00	02
2.	II	OE-151-CA	Data Science Using Spreadsheet Software	00	02	02
3.	III	OE-201-CA	Introduction to Artificial Intelligence	02	00	02
4.	IV	OE-251-CA	Software Tools for Office Administration	00	02	02

List of MINOR Courses offered by BOS in Computer Applications to other Disciplines / Faculty

Sr. No.	Semester	Course Code	Course Name	Credits		
				TH	PR	Total
1	III	CA-241-MN	Programming with Python	02	00	02
2	III	CA-242-MN	Lab course on Programming with Python	00	02	02
3	IV	CA-291-MN	Introduction to Artificial Intelligence and Machine Learning	02	00	02
4	IV	CA-292-MN	Lab course on Artificial Intelligence and Machine Learning	00	02	02
5	V	CA-341-MN	Introduction to AR-VR	02	00	02

Detailed Drafts Of

Open Elective Courses offered

by BOS (Computer

Applications)

to

other disciplines/ faculties

for

SEMESTER I and II only

Savitribai Phule Pune University Open Elective offered by BOS in Computer Applications for UG Programs from Faculties other than Faculty of Science & Technology for SEM I ONLY OE-101-CA: Introduction to Data Science (2024 Pattern)		
Teaching Scheme: Theory:02 Hrs/Week	Credits 02	Examination Scheme: Continuous Evaluation: 15 Marks End-Semester : 35 Marks

Course Objectives:
- To understand need of Data Science
- To Know role of Statistics in Data Science
- To know Data Science Models and Tasks

Course Outcomes: At the end of the course, students will be able to
- Define Data Science Tasks and Models and Lifecycle
- Apply Prep-processing and visualization Techniques

Course Contents

Unit I	Introduction	06 Hrs

What and why Why learn Data Science?, Types of Data -structured, semi-structured, unstructured Data
Applications of Data Science, The Data Science Lifecycle, Role of Data Scientists
Data sources-Open Data, Social Media Data, Multimodal Data, standard datasets

Unit II	Statistics for Data Science	06 Hrs

Data Objects and Attributes, Attribute Types: Nominal, Binary, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes, Role of statistics in Data Science
Descriptive statistics - Measuring the Frequency, Measuring the Central Tendency: Mean, Median, and Mode, Measuring the Dispersion: Range, Standard deviation, Variance, Inter quartile Range

Unit III	Data science Models and Tasks	06 Hrs

Predictive and Descriptive Models, Introduction to Data Science Tasks – Classification, Prediction, Association, Clustering, Performing simple Data Science Tasks using WEKA / R

Unit IV	Data Quality and Pre-processing	06 Hrs

Data Quality: Why Preprocess the Data?, Data munging/wrangling operations
Data Cleaning - Missing Values, Noisy Data
Data Transformation – Rescaling, Normalizing,
Data reduction and Data discretization

Unit V	Data Visualization	06 Hrs

Introduction to Exploratory Data Analysis (EDA), Data visualization,
Basic data visualization tools –Box Plots, Histograms, Bar charts/graphs, Scatter plots, Line charts, Area plots, Pie charts

Reference Books:
1. Data Science Fundamentals and Practical Approaches, Gypsy Nandi, Rupam Sharma, BPB Publications, 2020.

2. Data Mining Concepts and Techniques, Third Edition, Jiawei Han, Micheline Kamber, Jian Pei, Morgan Kaufmann, 2012.
3. A Hands-On Introduction to Data Science, Chirag Shah, University of Washington Cambridge University Press

Course Objectives:
- To know spreadsheet concepts
- To learn functions and formulas.
- To understand charts and graphics.
- To be familiar with filters and sorting of table data.

Course Outcomes: After successful completion of this course, learner will be able to
- Perform computations on data using formulas.
- Present the data in graphical form.
- Analyze data by applying various functions and filters

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Guidelines for Assessment

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List of Assignments

Assignment 1: To explore interface and basic features of Excel. Make a Start with Excel from simple to complex spreadsheet. Creating templates in Excel.

Assignment 2: Using Autocomplete and formatting features. Data entry in Excel with different data types and formatting. Formatting Cells with Number formats, Font formats, Alignment, Borders, etc.

Assignment 3: Printing Workbooks - Setting Up Print Area, Print Titles –Repeat Rows / Columns, Designing the structure of a template, Customizing Headers & Footers.

Assignment 4: Filtering and Sorting - Filtering on Text, Numbers & Colours, Sorting Options, Sorting and Filtering Lists.

Assignment 5: Calculations in MS-Excel using Basic Functions (Sum, Average, Max, Min, Count, etc). Use of Text Functions (Upper, Lower, Proper, Left, Mid, Right , Trim, Len, Exact, Concatenate, Find, Substitute). Use of Arithmetic Functions (SumIf, SumIfs CountIf, CountIfs ,AverageIf, AverageIfs).

Assignment 6: What-If Analysis - Goal Seek, Data Tables, Solver Tool, Scenario Analysis.
Assignment 7: Data Validation- Number, Date & Time Validation, Dynamic Dropdown List Creation using Data Validation – Dependency List, Custom validations based on a formula for a cell, Text and List Validation.
Assignment 8: Generating different types of charts.   Using SLICERS, Filter data with Slicers, Various Charts i.e. Bar Charts / Pie Charts / Line Charts,   Manage Primary and Secondary Axis.
Assignment 9: Use of conditional functions. Applying IF functions. Conditional formatting in MS-Excel. Use of OFFSET function.
Assignment 10: Recording macros and buttons. Protecting Excel- Excel Security (File Level Protection Workbook, Worksheet Protection).
Assignment 11: Excel Dashboard, Planning a Dashboard,   Adding Dynamic Contents to Dashboard, Adding Tables and Charts to Dashboard.
Assignment 12: Use of Lookup functions. (Vlookup / HLookup), Creating Smooth User Interface Using Lookup, Reverse Lookup using Choose Function.
Assignment 13: Creating Simple Pivot Tables, Classic Pivot table, Basic and Advanced Value Field Setting, Calculated Field & Calculated Items, Grouping based on numbers and Dates.
Assignment 14: Arrays Functions - What are the Array Formulas, Use of the Array Formulas? Array with if, len, and mid functions formulas, Basic Examples of Arrays (Advanced Use of formulas with Array, Array with Lookup functions).

Reference Books

1. Beginning Excel 2019, Authors: Noreen Brown, Barbara Lave, Julie Romey, Open Oregon Educational Resources
2. Excel Step by Step (Office 2021 and Microsoft 365) Published with the authorization of Microsoft Corporation by: Pearson Education, Inc.
3. Excel Bible: The Comprehensive Tutorial Resource
4. Excel: Quick Start Guide from Beginner to Expert (Excel, Microsoft Office)
5. Building Financial Models with Excel: A Guide for Business Professionals, (MISL-WILEY)
6. Predictive Analytics: Excel
7. Excel from Scratch: Excel course with demos and exercises

E-Resources:

1. https://www.udemy.com/course/microsoft-excel-2013-from-beginner-to-advanced-and-beyond/
2. https://edu.gcfglobal.org/en/excel/
3. https://support.microsoft.com/en-us/excel
4. https://www.coursera.org/projects/introduction-microsoft-excel
5. https://www.coursera.org/learn/microsoft-excel-work-smarter
6. https://www.udemy.com/course/excel-for-analysts/