Faculty of Science & Technology

Savitribai Phule Pune University, Pune

Syllabus for
First year of
Bachelor of Computer Applications
(BCA)
(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 Computer Applications (BCA) with Multidisciplinary Minor** having 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 i) **BCA Hon. with research and Multidisciplinary Minor** or ii) **BCA Hon. and Multidisciplinary Minor** or iii) **BCA with Double Minor** degrees, 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 – Basic Science (BSC), Program Core (PCC), program Elective (PEC), Open Electives (OE), Multidisciplinary Minor (MN), Ability Enhancement (AEC), Value education (VEC), Vocational Skill enhancement (VSEC), Indian Knowledge System (IKS), Co-curricular (CC) courses as well as courses such as Entrepreneurship, Economics and Management (EEM), On-job Training (OJT), Field Project (FP) / Community Engagement Programmes (CEP), Research Methodology (RM) and Research Project (RP) etc.

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

Program Outcomes (POs)

Graduates will be able to:

1. **Scientific Knowledge:** Apply the knowledge of mathematics, science fundamentals, and specialization to the solution of complex problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and sciences.

3. **Design/development of solutions:** Design solutions for complex problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern IT tools including prediction and modelling to complex activities with an understanding of the limitations.

6. **The Graduate and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional practice.

7. **Environment and sustainability:** Understand the impact of the professional solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the professional practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex activities with the professional community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the science and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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	BSC	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	BSC	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**
VSEC-101-CA	VSEC	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	BSC	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	BSC	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**
VSEC-151-CA	VSEC	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 Bachelor of Computer Application (BCA) with 44 credits and an additional 08 credits (for either courses by Microsoft/CCNA/Salesforce/Google/AWS/Oracle/ RedHat etc or Swayam/ NPTEL/MKCL 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 – PCC	PCC	Data Structures	04	--	--	30	70	**100**	04	--	--	04
CA-202 – PCCP		Lab course on CA-201 – PCC	--	--	04	15	35	**50**	--	--	02	**02**
CA-221 – VSEC	VSEC	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**
CA - 221 – EEM	EEM	Banking, Finance and Insurance	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-PCC	PCC	Database Management Systems	04	--	--	30	70	**100**	04	--	--	04
CA-252-PCCP		Lab course on CA-251 – PCC	--	--	04	15	35	**50**	--	--	02	**02**
CA-271-VSEC	VSEC	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**
CA-271-EEM	EEM	Startup and Entrepreneurship	--	--	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 Bachelor of Computer Application (BCA) with 88 credits and an additional 08 credits (for either courses by Microsoft/CCNA/Salesforce/Google/AWS/Oracle/ RedHat etc or Swayam/ NPTEL/MKCL equivalent to core NSQF courses 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 - PCC	PCC	Software Engineering and Testing	04	--	--	30	70	**100**	04	--	--	**04**
CA-302 - PCC		Fundamentals of Artificial Intelligence	02	--	--	15	35	**50**	02	--	--	**02**
CA-303 - PCCP		Lab course on CA-302-PCC	--	--	04	15	35	**50**	--	--	02	**02**
CA-304 - PCC		Fundamentals of Data Science	02	--	--	15	35	**50**	02	--	--	**02**
CA-305 – PCCP		Lab course on CA-304-PCC	--	--	04	15	35	**50**	--	--	02	**02**
CA-310-PEC	PEC	User Interface and User Experience (UI-UX) Design	02	--	--	15	35	**50**	02	--	--	**02**
CA-311-PCCP		Lab course on CA - 310- PEC	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-312-PEC		Cloud Computing	02	--	--	15	35	**50**	02	--	--	**02**
CA-313-PECP		Lab course on CA-312 - PEC	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-314-PEC		Cyber Security	02	--	--	15	35	**50**	02	--	--	**02**
CA-315-PECP		Lab course on CA-314-PEC	--	--	04	15	35	**50**	--	--	02	**02**
CA-321 VSEC	VSEC	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-PCC	PCC	Software Project Management	02	--	--	15	35	**50**	02	--	--	**02**
CA-352-PCC		Web Programming	02	--	--	15	35	**50**	02	--	--	**02**
CA-353-PCCP		Lab course on CA-352-PCC	--	--	04	15	35	**50**	--	--	02	**02**
CA-354-PCC		Operating system Design	04	--	--	30	70	**100**	04	--	--	**04**
CA-355-PCCP		Lab course on CA-354-PCC	--	--	04	15	35	**50**	--	--	02	**02**
CA-360-PEC	PEC	Prompt & Generative AI	02	--	--	15	35	**50**	02	--	--	**02**
CA-361-PECP		Lab course on CA-360 - PEC	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-362-PEC		Big Data and Analytics	02	--	--	15	35	**50**	02	--	--	**02**
CA-363-PECP		Lab course on CA-362 - PEC	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-364-PEC		Mobile Application Development	02	--	--	15	35	**50**	02	--	--	**02**
CA-365-PECP		Lab course on CA-364 - PEC	--	--	04	15	35	**50**	--	--	02	**02**
CA-371-VSC	VSEC	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 Bachelor of Computer Application (BCA) with multidisciplinary minor with 132 credits OR else Continue with Major and Minor

Level 6.0 BCA Hon. with Research and Multidisciplinary Minor 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-PCC	PCC	Object-oriented Modeling and Design	04	--	--	30	70	**100**	04	--	--	**04**
CA402-PCC		Operations Research	02	--	--	15	35	**50**	02	--	--	**02**
CA403-PCCP		Lab course on CA-401-PCC	--	--	04	15	35	**50**	--	--	02	**02**
CA404-PCCP		Lab course on CA-402-PCC	--	--	04	15	35	**50**	--	--	02	**02**
CA410-PEC	PEC	Natural Language Processing	02	--	--	15	35	**50**	02	--	--	**02**
CA411-PECP		Lab course on CA-410-PEC	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA412-PEC		Machine Learning	02	--	--	15	35	**50**	02	--	--	**02**
CA413-PECP		Lab course on CA-412-PEC	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA414-PEC		Full Stack	02	--	--	15	35	**50**	02	--	--	**02**
CA415-PECP		Lab course on CA-414-PEC	--	--	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 BCA Hon. with Research and Multidisciplinary Minor 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-PCC	PCC	Deep Learning	04	--	--	30	70	**100**	04	--	--	**04**
CA-452-PCC		Design and Analysis of Algorithms	02	--	--	15	35	**50**	02	--	--	**02**
CA-453-PCCP		Lab course on CA-451-PCC	--	--	04	15	35	**50**	--	--	02	**02**
CA-454-PCCP		Lab course on CA-452-PCC	--	--	04	15	35	**50**	--	--	02	**02**
CA-460-PEC	PEC	Design Thinking	02	--	--	15	35	**50**	02	--	--	**02**
CA-461-PECP		Lab course on CA-460-PEC	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-462-PEC		Data Mining Techniques	02	--	--	15	35	**50**	02	--	--	**02**
CA-463-PECP		Lab course on CA-462-PEC	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-464-PEC		Block Chain	02	--	--	15	35	**50**	02	--	--	**02**
CA-465-PECP		Lab course on CA-464-PEC	--	--	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 BCA Hon. with Research and Multidisciplinary Minor **with 176 credits**

Level 6.0 BCA Hon. and Multidisciplinary Minor 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-PCC	PCC	High Performance Databases	04	--	--	30	70	**100**	04	--	--	**04**
CA-402-PCC		Computer Graphics	04	--	--	30	70	**100**	04	--	--	**04**
CA-403-PCCP		Lab course on CA-401-PCC	--	--	04	15	35	**50**	--	--	02	**02**
CA-404-PCCP		Lab course on CA-402-PCC	--	--	04	15	35	**50**	--	--	02	**02**
CA-405-PCC		DevOps	02	--	--	15	35	**50**	02	--	--	**02**
CA-410-PEC	PEC	Mobile Web Programming	02	--	--	15	35	**50**	02	--	--	**02**
CA-411-PECP		Lab course on CA-410-PEC	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-412-PEC		ERP	02	--	--	15	35	**50**	02	--	--	**02**
CA-413-PECP		Lab course on CA-412-PEC	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-414-PEC		Full Stack	02	--	--	15	35	**50**	02	--	--	**02**
CA-415-PECP		Lab course on CA-414-PEC	--	--	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 Level 6.0 BCA Hon. and Multidisciplinary Minor 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-PCC	PCC	Deep Learning	04	--	--	30	70	**100**	04	--	--	**04**
CA-452-PCC		Design and Analysis of Algorithm	02	--	--	15	35	**50**	02	--	--	**02**
CA-453-PCC		Management Information System	04	--	--	30	70	**100**	04	--	--	**04**
CA-454-PCCP		Lab course on CA-451-PCC	--	--	04	15	35	**50**	--	--	02	**02**
CA-455-PCCP		Lab course on CA-452-PCC	--	--	04	15	35	**50**	--	--	02	**02**
CA-460-PEC	PEC	Design Thinking	02	--	--	15	35	**50**	02	--	--	**02**
CA-461-PECP		Lab course on CA-460-PEC	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-462-PEC		GO Programming	02	--	--	15	35	**50**	02	--	--	**02**
CA-463-PECP		Lab course on CA-462-PEC	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-464-PEC		Block Chain	02	--	--	15	35	**50**	02	--	--	**02**
CA-465-PECP		Lab course on CA-464-PEC	--	--	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 BCA Hon. and Multidisciplinary Minor with 176 credits

Level 6.0 BCA with Double Minor 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-MN	MN	Minor Course from University Basket	04	--	--	30	70	**100**	04	--	--	**04**
CA-402-MN		Minor Course from University Basket	04	--	--	30	70	**100**	04	--	--	**04**
CA-403-MNP		Lab course on CA-401-MN	--	--	04	15	35	**50**	--	--	02	**02**
CA-404-MNP		Lab course on CA-402-MN	--	--	04	15	35	**50**	--	--	02	**02**
CA-405-MN		Minor Course from University Basket	02	--	--	15	35	**50**	02	--	--	**02**
CA-410-MNE	MNE	Minor Elective Course from University Basket	02	--	--	15	35	**50**	02	--	--	**02**
CA-411-MNEP		Lab course on CA-410-MNE	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-412-MNE		Minor Elective Course from University Basket	02	--	--	15	35	**50**	02	--	--	**02**
CA-413-MNEP		CA-412-MNE	--	--	04	15	35	**50**	--	--	02	**02**
		OR										
CA-414-MNE		Minor Elective Course from University Basket	02	--	--	15	35	**50**	02	--	--	**02**
CA-415-MNEP		Lab course on CA-414-MNE	--	--	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 Level 6.0 BCA with Double Minor 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-MNE	MNE	Minor Course from University Basket	04	--	--	30	70	**100**	04	--	--	**04**
CA-452-MNE		Minor Course from University Basket	02	--	--	15	35	**50**	02	--	--	**02**
CA-453-MNE		Minor Course from University Basket	04	--	--	30	70	**100**	04	--	--	**04**
CA-454-MNEP		Lab course on CA-451-MNE	--	--	04	15	35	**50**	--	--	02	**02**
CA-455-MNEP		Lab course on CA-452-MNE	--	--	04	15	35	**50**	--	--	02	**02**
CA-460-MNE	ME	Minor Elective Course from University Basket	02	--	--	15	35	**50**	02	--	--	**02**
CA-461-MNEP		Lab course on CA-460-MNE	--	--	04	15	35	**50**	--	--	02	**02**
OR												
CA-462-MNE		Minor Elective Course from University Basket	02	--	--	15	35	**50**	02	--	--	**02**
CA-463-MNEP		Lab course on CA-462-MNE	--	--	04	15	35	**50**	--	--	02	**02**
OR												
CA-464-MNE		Minor Elective Course from University Basket	02	--	--	15	35	**50**	02	--	--	**02**
CA-465-MNEP		Lab course on CA-464-MNE	--	--	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 BCA with Double Minor **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

Savitribai Phule Pune University
First Year of B. Sc. (Computer Applications) - (2024 Course)
CA – 102 – P : Lab Course on CA – 101 - T

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

<table>
<tr><td colspan="3">Savitribai Phule Pune University
First Year of B. Sc. (Computer Applications) - (2024 Course)
CA – 103 – T : Computer Organization and Architecture</td></tr>
<tr><td>Teaching Scheme:
Theory: 02 Hrs/Week</td><td>Credits
02</td><td>Examination Scheme:
Continuous Evaluation: 15 Marks
End-Semester : 30 Marks</td></tr>
</table>

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

<table>
<tr><td colspan="3" align="center">Course Contents</td></tr>
<tr><td>Unit I</td><td align="center">Data representation and Computer Arithmetic</td><td>04 Hrs</td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td>Unit II</td><td align="center">Boolean Algebra & Logic Gates</td><td>07 Hrs</td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td>Unit III</td><td align="center">Combinational Circuits</td><td>07 Hrs</td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td>Unit IV</td><td align="center">Sequential circuits</td><td>07 Hrs</td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td>Unit V</td><td align="center">CPU, Memory and I/O Organization</td><td>05 Hrs</td></tr>
</table>

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.

Savitribai Phule Pune University		
First Year of B. Sc. (Computer Applications) (2024 Course)		
CA-106 - P: Laboratory Course Based on CA-105 - 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 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) VSEC-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

Savitribai Phule Pune University First Year of B. Sc. (Computer Applications) (2024 Course) CA – 152 – P : Lab Course on CA – 151 - T		
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.

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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)		
VSEC-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

<table>
<tr><td colspan="3">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 II ONLY
OE-151-CA: Data Science using Spreadsheet Software (2024 Pattern)</td></tr>
<tr><td>Teaching Scheme:
Practical: 04 Hrs/Week</td><td>Credits
02</td><td>Examination Scheme:
Continuous Evaluation: 15 Marks
End-Semester : 35 Marks</td></tr>
</table>

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

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.

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/

Faculty of Science and Technology

Savitribai Phule Pune University, Pune

NEP – 2020 Complaint Curriculum

Draft copy of Syllabus
for
S.Y. Bachelor of Computer Applications (BCA)
(2024 Pattern)

(with effect from A. Y. 2025-26)

Preamble

Dear Students, teachers and all stakeholders

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), B. Sc. (Computer Applications) and 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 detailed draft for FY BCA was implemented from June 2024. This document provides detailed draft for SY BCA which will be implemented from June 2025.

The Ad-hoc Board of Studies in Computer Applications has prepared a structure for BCA 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 include – 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. Pro-Vice Chancellor Prof. Dr. Parag Kalkar, Hon. Dean of FoS&T, Prof. Dr. P D Patil for their guidance. I am thankful to all board members Dr. A B Nimbalkar, Dr. Razak Sayyad, Prof. Dr. R M Sonar and Prof. Dr. Sachin A. Kadam and all members of previous BoS for their valuable inputs as well as the teachers from affiliated colleges for their active participation in preparing the draft syllabus for SY BCA.

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

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

Structure of SY Bachelor of Computer Applications
Level 5.0 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	--	--	04	15	35	**50**	--	--	02	**02**
CA-231-FP	FP	Field Work	--	--	04	15	35	**50**	--	--	02	**02**
ELS-241-MN	MN	Data Communications	02	--	--	15	35	**50**	02	--	--	**02**
ELS-242-MNP		Lab Course on CA -241 –MN	--	--	04	15	35	**50**	--	--	02	**02**
	GE/OE	Course from University Basket	02	--	--	15	35	**50**	02	--	--	**02**
CA-200-IKS	IKS	Indian Knowledge System for Computing	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			**14**	**00**	**16**	**165**	**385**	**550**	**14**	**00**	**08**	**22**

Structure of SY Bachelor of Computer Applications
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	--	--	04	15	35	**50**	--	--	02	**02**
CA-281 CEP	CEP	Community Services	--	--	04	15	35	**50**	--	--	02	**02**
ELS-291 - MN	MN	Communication Networks	02	--	--	15	35	**50**	02	--	--	**02**
ELS-292 - MNP		Lab course on CA -291 –MN	--	--	04	15	35	**50**	--	--	02	**02**
	GE/OE	Course from University Basket	--	--	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			10	00	24	165	385	550	10	00	12	22

Exit option: Award of UG Diploma in Bachelor of Computer Applications (BCA) 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 MOOC course equivalent to core NSQF course or an internship) or else Continue with Major and Minor

Detailed Drafts
For
Level 5.0 (SY)

SEMESTER III

Savitribai Phule Pune University Second Year Bachelor of Computer Applications CA – 201 - MJ: Data Structures		
Teaching Scheme: **Theory: 04 Hrs./Week**	**Credits** **04**	**Examination Scheme:** **Continuous Evaluation: 30 Marks** **End-Semester: 70 Marks**

Course Objectives:

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

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

CO1: Define various data structures and notations for algorithm analysis

CO2: Design algorithms using suitable data structure(s)

CO3: Compare various representations of a stack, queue, tree and graph

CO4: List real world applications of stacks, queues, trees and graphs

CO5: Apply appropriate data structure(s) to solve a given problem

CO6: Evaluate the time and space complexity of the given algorithm/program

Course Contents		
Unit I	**Introduction to Data Structure**	**10 Hrs.**
1.1	Introduction, Basic concepts, Data types and data objects.	
1.2	Abstract Data Types (ADT)	
1.3	Types of Data Structures: Linear and non -linear	
1.4	Algorithm analysis: Frequency counts, Space and Time complexity, Asymptotic notation: Big O, Omega (Ω) (With examples)	
Unit II	**Arrays**	**10 Hrs.**
2.1	Introduction	
2.2	Matrix representation using arrays: Row and column major, operations on matrices, Sparse Matrix	
2.3	Sorting techniques with time complexity: Bubble sort, Insertion sort, Merge sort, Quick sort	
2.4	Searching techniques with time Complexity: Linear search and Binary search	
Unit III	**Linked Lists**	**10 Hrs.**
3.1	Introduction	
3.2	Representation	
3.3	Types of linked lists: Singly, Doubly, Circular (Singly, Doubly)	
3.4	Operations on link list: Create, Display, Insert, Delete, Reverse, Search, Sort,	

Concatenation, Merge

3.5   Real world applications of Link list : Polynomial Representation, Addition of two polynomials

Unit IV	Stacks and Queues	10 Hrs.

4.1   Introduction

4.2   Representation of Stack: Using arrays and Linked Lists

4.3   Operations on stack: push, pop

4.4   Applications of Stack: Recursion, Expressions: Infix to postfix, postfix to infix

4.5   Representation of Queues: Static (Array) and Dynamic (Linked List)

4.6   Operations on queue: insert, delete

4.7   Types of queues: Circular queue and Priority queue

4.8   Real world Applications of queue (Implementation not expected)

Unit V	Trees	10 Hrs.

5.1   Introduction and terminologies

5.2   Types of Binary Trees -Rooted Binary Tree, Full Binary Tree, Complete Binary Tree and Skewed Binary Tree, Expression Tree

5.3   Representation of Trees using arrays and linked lists, traversals (In-order, pre-order, post-order) and operations (Create, Insert, delete, modify, counting nodes etc.)

5.5   Applications of Binary trees – Expression conversions and evaluation

5.6   Binary Search Tree (BST): Introduction and Definition, operations on BST (Create, insert node, delete node, search node) and applications

     5.5.2 AVL Tree: Concept, Rotation (LL, LR, RL, RR) with Examples

     5.5.3 Heap Sort Technique with Examples (Implementation not expected)

Unit VI	Graphs	10 Hrs.

6.1   Introduction and Graph terminologies

6.2   Representation of a Graph -

     6.2.1   Adjacency matrix

     6.2.2   Adjacency list

     6.2.3   Adjacency multi-list

6.3   Graph Traversals -

     6.3.1   DFS (Depth First Search)

     6.3.2   BFS (Breadth First Search)

6.4   Applications of graphs -

     6.4.1   Topological sort

6.5   Minimal Spanning Trees -

     6.5.1   Prim's Algorithm

     6.5.2   Kruskal's Algorithm

Books

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

Savitribai Phule Pune University
Second Year Bachelor of Computer Applications
CA - 202 - MJP: Lab course on CA – 201 - MJ

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

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

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

CO1: Apply appropriate data structures to solve the given problem

CO2: Design an efficient algorithm for the given problem and implement

CO3: Determine the time and space complexity of a given algorithm

Guidelines for Instructor's Manual

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

Guidelines for Student Journal

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

Guidelines for Assessment

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

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

Assignment Nos	List of Assignments	Number of Hrs.
1	Non-Recursive Sorting Techniques • Bubble Sort • Insertion Sort	4
2	Recursive Sorting Techniques • Quick Sort • Merge Sort	6
3	Searching Techniques • Linear search • Binary search	2
4	Linked List • Implementation of Linked List, Singly Circular Linked List, Doubly Linked List, Doubly Circular Linked List, operations	12
5	Stacks and Queues • Static Stack Implementation and operations • Dynamic Stack Implementation • Applications of Stack -Expression Conversions • Static Queue Implementation and operations • Dynamic Queue Implementation	12
6	Binary Trees and Binary Search Tree (Dynamic) • Operations on Binary trees – Traversing, level wise printing of nodes, counting total nodes, compute depth, Insert, Delete and search node • BST-create, traverse, count total nodes, Insert, Delete and search node	12
7	Graphs • Adjacency Matrix Representation • Adjacency List Representation • In-degree and Out-degree calculation • BFS, DFS Implementation	12

Savitribai Phule Pune University Second Year Bachelor of Computer Applications CA - 221 - VSC: C++ Programing		
Teaching Scheme: **Practical: 04 Hrs./ Week /** **Batch**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester: 35 Marks**

Course Objectives:

1. To understand Object Oriented Programming concepts using the C++.
2. To study principles of data abstraction, inheritance and polymorphism.
3. To learn Virtual functions and polymorphism.
4. To know Formatted I/O and unformatted I/O.

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

CO1: Compare the procedural and object-oriented paradigms

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

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

CO4: Apply exception handling

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

Guidelines for Instructor's Manual

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

Guidelines for Student Journal

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

Guidelines for Assessment

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

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

List of Assignments

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

Topic Name	Object Oriented Programming and functions in C++	20 Hrs.
Assignment No 1: Creation of classes, objects, methods, access specifiers, input-output Assignment No 2: Scope resolution operator, static members, call by reference Assignment No 3: Inline function, friend class and function.		
Topic Name	Inheritance and Polymorphism	20 Hrs.
Assignment No 4: Constructor and destructor Assignment No 5: Single inheritance and multiple inheritance Assignment No 6: Multilevel inheritance and Hierarchical Inheritance, Hybrid inheritance Assignment No 7: Polymorphism (Function overloading) Assignment No 8: Polymorphism (Operator overloading)		
Topic Name	File Handing and Exception Handling	20 Hrs.
Assignment No. 9: Operations on files (Read, Write, Open, Close), Random Access file functions Assignment No 10: Exception handling Assignment No.11: Hash tables and Dictionaries		
Books		
1. B. Stroutstrup, "The C++ Programming Language", 3rd Edition, Pearson Education, 2000. 2. T. Gaddis, J. Walters and G. Muganda, "OOP in C++", 7th Edition, Pearson Education, 2010. 3. R. Lafore, "Object Oriented Programming in C++", 3rd Edition, Galgotia Publications Pvt. Ltd, 2004. 4. Herbert Schildt, "The Complete Reference C++", 4th Edition, Tata McGraw Hill, 2014. 5. Walter Savitch, "Problem solving with C++: The Object of Programming, 4th Edition, Pearson Education, 2002.		

Savitribai Phule Pune University Second Year Bachelor of Computer Applications CA - 231 - FP: Field work		
Teaching Scheme: **Practical: 04 Hrs./ Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester: 35 Marks**

Course Objectives:

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

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

CO1: Apply methodology to perform field work

CO2: Identify and define real-world issues or problems

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

Guidelines for the faculty

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

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

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

Guidelines for Students

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

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

Each group shall carry out fieldwork during their free slots, or before/after college hours or on Sundays or holidays. The students shall maintain a diary giving details of tasks performed by them, observations/study notes etc.

The suggested timelines for the field work are

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

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

Guidelines for Assessment

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

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

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

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

BOOKS

1. Waterman, A. Service-Learning: A Guide to Planning, Implementing, and Assessing Student Projects. Routledge, 1997.

2. Beckman, M., and Long, J. F. Community-Based Research: Teaching for Community Impact. Stylus Publishing, 2016.

3. Design Thinking for Social Innovation. IDEO Press, 2015.

4. Dostilio, L. D., et al. The Community Engagement Professional's Guidebook: A Companion to The Community Engagement Professional in Higher Education. Stylus Publishing, 2017

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

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

Course Objectives:

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

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

CO1: List India's contributions to Computing

CO2: Apply Ancient Indian Mathematical concepts in Computing

CO3: Utilize Linguistic and Computational aspects of Sanskrit from IKS in Modern Computing

CO4: Describe Cryptographic techniques from IKS

CO5: Make use of Cybersecurity techniques from IKS

CO6: Illustrate the Role of IKS in Emerging Technologies

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

1.1 Introduction IKS

1.2 Defining Indian Knowledge System (IKS) and its components,

1.3 Contribution of Aryabhata and Brahmagupta, Buddhist logico-epistemology

1.4 The knowledge triangle

1.5 Prameya -A vaiśeṣikan approach to physical reality

1.6 Dravyas -the constituents of the physical reality

1.7 Attributes -the properties of substances and Action -the driver of conjunction and disjunction

1.8 sāmānya, viśēṣa, samavāya

1.9 Pramāṇa -the means of valid knowledge

1.10 Samsaya-ambiguities in existing knowledge.

Unit II	**Number Systems and Units of Measurement**	**12 Hrs.**

2.1 Number systems in India -Historical evidence

2.2 Salient Features of the Indian Numeral System

    2.2.1 Concept of zero and its importance,

    2.2.2 Large numbers and their representation

    2.2.3 Place Value of Numerals

    2.2.4 Decimal System

2.3 Unique approaches to represent Numbers

    2.3.1 Bhūta-Saṃkhyā system

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

Unit III	**Linguistics**	**08 Hrs.**

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

Unit IV	**Ancient Cryptography and Security Systems**	**05 Hrs.**

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

Books

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

Detailed Drafts
For
Level 5.0 (SY)

SEMESTER IV

Savitribai Phule Pune University Second Year Bachelor of Computer Applications CA - 251- MJ: Database Management Systems		
Teaching Scheme: **Theory: 04 Hrs./Week**	**Credits** **04**	**Examination Scheme:** **Continuous Evaluation: 30 Marks** **End-Semester: 70 Marks**

Course Objectives:

1. To understand the fundamental concepts of Relational database management systems
2. To study and understand systematic approaches for design of database systems
3. To learn SQL - the database Query language
4. To know about transaction management and data security

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

CO1: Solve real world problems using appropriate relational data model.

CO2: Construct E-R Model for given requirements and convert it into database tables.

CO3: Write efficient SQL queries and use PL/SQL

CO4: Apply database management operations

CO5: Describe mechanisms for transaction management

CO6: Demonstrate understanding of database security

Unit I	**Introduction**	**06 Hrs.**

1.1	Introduction to DBMS
1.2	File system Vs. DBMS
1.3	Data models -relational, hierarchical, network
1.4	Levels of abstraction
1.5	Data independence
1.6	Structure of DBMS
1.7	Users of DBMS
1.8	Advantages and disadvantages of DBMS

Unit II	**Conceptual and Relational Database Design**	**12 Hrs.**

2.1	Overview of DB design process.
2.2	Introduction to data models (E-R model, Relational model, Network model, Hierarchical model)
2.3	Conceptual design using ER data model (entities, attributes, entity sets, relations, relationship sets) and symbols. Extended ER Features, ER to Relational Mapping
2.4	Constraints (Key constraints, Integrity constraints, referential integrity, unique constraint, Null/Not Null Constraint, Domain Constraint, Check constraint, Mapping constraints, Column level and Table Level Constraint)
2.5	Keys in Database (primary key, foreign key, Candidate key, super key)
2.6	Extended features - Specialization, Aggregation, Generalization (Pictorial representation).
2.7	Structure of Relational Databases (concepts of a table)
2.8	Concept of Normalization -Normal forms (only definitions) with example (1NF,2NF,3N,

	BCNF, 4NF)	
2.9	Functional dependency - Concept, Closure of Attribute set, Armstrong axioms, Closure of relation(F^+)	
2.10	Decomposition - Concept, Properties of Decomposition (Lossless joins and Dependency preservation)	
Unit III	**Structured Query Language (SQL)**	**10 Hrs.**
3.1	Introduction to SQL.	
3.2	DDL commands with examples (Create, Drop, Alter)	
3.3	DML commands with examples (Insert, Update, Delete)	
3.4	Basic structure of SQL Select query	
3.5	SQL Operations (Aggregate functions, Set operations, Date, Time, String functions and Null values, Nested Sub queries)	
3.6	Join Queries (Cartesian Product, Inner joins, Outer - Left, Right, Full)	
3.7	Views (Create, Alter, Drop)	
3.8	Examples on SQL (case studies)	
Unit III	**Structured Query Language (SQL)**	**10 Hrs.**
3.1	Introduction to SQL.	
3.2	DDL commands with examples (Create, Drop, Alter)	
3.3	DML commands with examples (Insert, Update, Delete)	
3.4	Basic structure of SQL Select query	
3.5	SQL Operations (Aggregate functions, Set operations, Date, Time, String functions and Null values, Nested Sub queries)	
3.6	Join Queries (Cartesian Product, Inner joins, Outer - Left, Right, Full)	
3.7	Views (Create, Alter, Drop)	
3.8	Examples on SQL (case studies)	
Unit IV	**Introduction to PL/Postgres SQL**	**12 Hrs.**
4.1	PL/Postgres SQL: Language structure	
4.2	Control structures (Conditional Statements and loops)	
4.3	Stored Procedures.	
4.4	Functions	
4.5	Handling errors and exceptions	
4.6	Cursors	
4.7	Triggers	
Unit V	**Transaction Management**	**12 Hrs.**
5.1.	Transaction	
	5.1.1.1.1 Properties of transaction	
	5.1.1.1.2 States of transactions	
	5.1.1.1.3 Concurrent execution of transactions	
	5.1.1.1.4 Conflicting operations	
5.2	Schedules	
	5.2.1.1.1 Types of schedules	

5.3	Concept of serializability	
	5.3.1 Precedence graph for serializability	
5.4	Basic timestamp protocol for concurrency, Thomas Write Rule.	
5.5	Two-phase Locking protocol, Timestamps vs. Locking.	
5.6	Deadlock and Deadlock Handling - Deadlock Avoidance, Deadlock Detection and Deadlock Recovery	
5.7	Log Base Recovery Techniques - Deferred and Immediate Updates	
Unit VI	**Database Security**	**8 Hrs.**
6.1	Introduction to database security concepts	
6.2	Methods for database security	
6.3	Access Control Method	
	6.3.1 Discretionary access control method	
	6.3.2 Mandatory access control	
	6.3.3 Role based access control for multilevel security	
6.4	Use of views in security enforcement	
6.5	Overview of encryption technique for security	
6.6	Statistical database security.	
Books		
1. Silberschatz, Korth, and Sudarshan, "Database System Concepts", 6th Edition, McGraw-Hill, 2011		
2. Elmasri and Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson, 2017		
3. Ramakrishnan and Gerkhe,"Database Management Systems", 3rd Edition, Tata McGraw Hill, 2002		
4. Desai Bipin, "Introduction to Database Management System", 1st Edition, Galgotia Publication, 2008		
5. Date, C. J., Kannan and Swamynathan,"An Introduction to Database Systems", 8th Edition, Pearson, 2006		
6. Drake and Worsley, "Practical PostgreSQL", O'Reilly Publications, 2002		
7. Kahate, "Introduction to Database Management Systems", 1st Edition, Pearson Education, 2004		
8. Singh, S. K., "Database Systems: Concepts, Design and Application", 2nd Edition, Pearson, 2011		

<table>
<tr><td colspan="3">Savitribai Phule Pune University
Second Year Bachelor of Computer Applications
CA – 252 - MJP: Lab course on CA - 251 - MJ</td></tr>
<tr><td>Teaching Scheme
Lab: 04 Hrs./ Week/ Batch</td><td>Credits
02</td><td>Examination Scheme:
Continuous Evaluation: 15 Marks
End-Semester: 35 Marks</td></tr>
</table>

Course Objectives:
1. To study DDL and DML Queries
2. To understand SQL and PL/SQL

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

CO1: Design E-R Model for given requirements and convert the same into database tables.

CO2: Design and create relational database systems.

CO3: Use SQL DDL and DML commands

CO4: Apply constructs in PL/PGSQL

Guidelines for Instructor's Manual

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

Guidelines for Student Journal

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

Guidelines for Assessment

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

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

List of Assignments

<table>
<tr><td>Assignment No 1</td><td>Simple table design (DDL) Commands</td><td>4 Hrs.</td></tr>
</table>

Create simple tables including all data types.
- Primary key constraint (as a table level constraint and as a column level constraint)
- Check constraint (All types)
- Unique constraint, Null/Not null constraint

Assignment No 2	Simple tables using referential constraint (DDL) commands	4 Hrs.
• Create more than one table and access them using referential integrity constraint.		
Assignment No 3	DDL commands	4 Hrs.
• Drop a table, Alter schema of a table. • Insert / Update / Delete records using tables created in previous Assignments		
Assignment No 4	DML commands	8 Hrs.
• Write queries on the tables using SQL select query ➢ Select <field-list> from table [where <condition> order by <field list>], Select <field-list, aggregate functions> from table [where <condition> group by <> having <> order by <>] • To create views and retrieve data using the views		
Assignment No 5	DML commands	4 Hrs.
• Write queries using set operations (minus operation, union, union all, intersect, intersect all)		
Assignment No 6	Nested Queries	4 Hrs.
• Write nested queries using Except, Except all, Exists, Not exists etc.		
Assignment No 7	Stored Procedure	6 Hrs.
• Create a Simple Stored Procedure • Create a Stored Procedure with IN, OUT and IN/OUT parameter		
Assignment No 8	Function	6 Hrs.
• Create and use a Simple Stored Function • Create and use a simple Stored Function that returns • Create and use a simple Stored recursive Function		
Assignment No 9	Cursor	4 Hrs.
• Create and use a Simple Cursor • Create and use a Parameterized Cursor		
Assignment No 11	Exception Handling	4 Hrs.
• Create and use a Simple Exception-Raise Debug Level Messages • Create and use a Simple Exception-Raise Notice Level Messages • Create and use a Simple Exception-Raise Exception Level Messages		
Assignment No 12	Triggers	10 Hrs.
• Create and perform insert, update, delete using a Before Trigger & an After Trigger • Creating EER Diagram and schemas using MySQL- Workbench or any such tools • Store data in simple DBMS and retrieve it in spreadsheets using SQL query		

Savitribai Phule Pune University Second Year Bachelor of Computer Applications CA – 271 - VSC: Python Programming		
Teaching Scheme: **Practical: 04 Hrs./ Week/ Batch**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation:15 Marks** **End-Semester: 35 Marks**

Course Objectives:

1. To introduce programming concepts using Python
2. To understand various constructs in Python
3. To test and execute Python programs.

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

CO1: Write Python programs to solve a given problem

CO2: Choose appropriate data structures such as lists, dictionaries, tuples, and sets.

CO3: Develop Python programs to implement the given small applications.

Guidelines for Instructor's Manual

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

Guidelines for Student Journal

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

Guidelines for Assessment

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

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

Assignment No.	Topics for the Assignments	Number of Hrs.
	List of assignments	
	The instructor shall cover theoretical aspects such as Data types, declarations, input / output, control flow, Strings and Functions List, Tuples, Dictionary and Sets etc.	
1	Basic Python	06
2	Control structures and operators	08
3	Python Strings	08
4	Python Functions	08
5	Python Lists	08
6	Python Tuples	08
7	Python Dictionary	08
8	Python Sets	06
Total		**60**

BOOKS

1. Montojo, Jason, Campbell, Jennifer and Gries Paul, "Practical Programming: An Introduction to Computer Science using Python 3", 2nd Edition, O'Reilly, 2013
2. Payne James, "Beginning Python: Using Python and Python 3.1", 1st Edition, Wrox Publication, 2010
3. Dierbach Charles, "Introduction to Computer Science Using Python", 1st Edition, Wiley Publication, 2015
4. Balagurusamy E., "Introduction to Computing and Problem-Solving using Python, 1st Edition, Tata McGraw Hill publication, 2017
5. Mueller John P., "Beginning Programming with Python for Dummies", 1st Edition, Dummies, 2014

Savitribai Phule Pune University Second Year Bachelor of Computer Applications CA – 271 - CEP: Community services		
Teaching Scheme: **Practical: 04 Hrs./ Week**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester: 35 Marks**

Course Objectives:

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

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

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

CO2: Choose appropriate community engagement level to solve the problem

CO3: Analyze and propose possible solution to solve community problem

Guidelines for the faculty

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

The guide assigned for each group shall assist the assigned student group(s) for identifying topic/area (topic list is provided below for reference) for the community engagements, objectives and outcomes, preparation of questionnaire, resources/tools needed and guide the students for possible solutions and report preparation. The guide assigned for each group shall monitor, track and assess the progress of work carried out by students throughout the semester

Guidelines for Students

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

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

Each group shall carry out activities during their free slots, or before/after college hours or on Sundays or holidays. The students shall maintain a diary giving details of tasks performed by them, observations/study notes etc.

The suggested timelines for the field work are

- Formation of group – 1 week
- Selection of topic for community engagement – 2 Week
- Discussions and finalization of objectives, outcomes and methodology to be used – 3 Weeks
- Activities for community engagement - Conduction of survey / gathering data, Awareness programs, interviews, group discussions and meeting with guide — 4 Weeks
- Preparation of report and presentation – 2 weeks

Each group shall submit a report at the end of the semester consisting of Title, Abstract, Rational of the study, problem definition, objectives, outcomes, methodology used, details of activities undertaken, analysis, findings, details of proposed solution (paper design/prototype/mobile app etc.) and conclusions. Students should also submit photographs, audio-video clips etc.

Guidelines for Assessment

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

The end semester examination of 35 marks shall be based on group presentation and the reports of activities participated.

List of suggested topics/areas for Community Services (but not limited to)

1. Schools and colleges – Awareness about environment issues, cyber security, health and nutrition, new policies by government, Training programs for students and teachers, etc.
2. Agriculture - Awareness programs for farmers, in association with agriculture officers on Plantation and Soil protection, Bio-diversity, Organic farming, promotion of local crops, marketing, sales and logistics for agro products etc.
3. Old age homes and organizations working of differently abled people – Awareness programs for Senior Citizens and differently abled people and their interviews etc.
4. Organizations/NGOs working on food habits, nutrition, adulterations – Awareness programs for students staying in hostels
5. Urban Region - Smart Cities, Traffic Management, Renewable energy and Solar Systems - Interviews with officers and citizens, social and community leaders, Drives for waste collection and disposal, testing water quality Drives for River and garden Cleaning, etc.
6. Government offices and offices of Local Bodies (Corporation/Municipal Corporation/ Grampanchayat – Interviews with officers and devise mechanism for promotion of Schemes and services for citizens through websites, street plays etc.
7. Pollution control boards – Interviews with officers and arranging drives/awareness programs for Air/Sound/Water pollutions
8. Department of disaster Management – Arranging mock drills
9. Office of Local city bus transportation – Interviews with officers, employees and passengers and suggest solutions with optimised bus routes, frequency, stoppages and fairs
10. Prominent Local social events such as "Sinhasta Kumbhamela", "Pundharpur Vari" etc. – Crowd and traffic management, surveillance, security, Environmental issues etc.
11. Women education and empowerment – Training programs for house wives and Mahila Udyog and Bachat Gat
12. Community engagement platforms – Study / develop platform for community members to report issues, share ideas and collaborate on local issues.
    - Colleges to try adopting a village or a nearby community through conduction of workshops or awareness drives on topics such as digital literacy, environmental sustainability, mental health, career guidance and planning for local stakeholders

BOOKS

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

Savitribai Phule Pune University Second Year Bachelor of Computer Applications CA – 251 - SEC: Spreadsheet Applications		
Teaching Scheme **Practical: 04 Hrs./ Week /** **Batch**	**Credits** **02**	**Examination Scheme:** **Continuous Evaluation: 15 Marks** **End-Semester: 35 Marks**

Course Objectives:

1. To know Excel interface, basic and advanced Data Entry and Formatting
2. To understand Excel Formulas and Functions, Charts
3. To learn to automate tasks with Macros and VBA

Course Outcomes:

After successful completion of this course, the learners will be able to -

CO1: Navigate and utilize spreadsheet applications effectively for data organization and management

CO2: Apply formulas, functions and logical operations to automate tasks.

CO3: Analyze and visualize data using charts, pivot tables and conditional formatting

CO4: Implement data validation, sorting and filtering for efficient data handling

CO5: Develop practical spreadsheet solutions for business scenarios like financial planning, inventory management and project management.

Guidelines for Instructor's Manual

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

Guidelines for Student Journal

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

Guidelines for Assessment

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

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

List of Assignments

1. Create, Open, Save Spreadsheet, Basic Data Entry and Formatting and conditional formatting, Formula and function, Sorting, importing data from various formats (csv/text)

2. Lookup and Reference Functions - VLOOKUP, HLOOKUP, XLOOKUP
3. INDEX and MATCH (for dynamic lookups) - INDIRECT, OFFSET, CHOOSE
4. Logical Functions - IF, AND, OR, XOR, IFERROR, IFS
5. Text Functions - CONCAT, TEXTJOIN, PROPER, LEFT, RIGHT, MID
6. Date and Time Functions - TODAY, NOW, EOMONTH, NETWORKDAYS
7. Math and Statistical Functions - SUMIF, COUNTIF, AVERAGEIF RANK, LARGE, SMALL

8. Array Formulas and Dynamic Arrays
   a. Basic example of Arrays using ctrl + shift + enter
   b. Array with if, len function and mid function formula
   c. Advanced use of formula with Array.
9. Power Query for Data Cleaning
   a. Automates data cleaning and transformation.
   b. Can merge, split, remove duplicates, and reshape data.

10. Histogram, Waterfall, Gantt and Combo Charts
11. Pivot Tables
    a. Creating simple Pivot Tables
    b. Basic and Advanced value field
    c. Classic Pivot Tables
    d. Filtering Pivot Tables
    e. Modifying Pivot Tables
    f. Grouping data in pivot table based on numbers, category and Dates

12. VBA
    a. Creating a Macro, Procedures and Functions in VBA, Variables in VBA
    b. If statement and Select statement - if and Else if, Select case Statement
    c. Loops in VBA - For and Do loop, Exit Loop, Advanced Loop
    d. Mail Functions in VBA - Send automated mail, Merge multiple excel files into one sheet, Split worksheets using VBA filters

13. Micro Projects
    a. Financial Calculation and Budget Planning or
    b. Sales and Inventory Management or
    c. Project and Time Management

Books

1. Alexander, Michael and Kusleika, Dick, "Excel 365 Bible", 2nd Edition, John Wiley & Sons, 2022

2. Mc, Fedries and Greg Harvey, "Excel All-in-One for Dummies", 1st Edition, Dummies, 2021

3. Holler, James., "Office 365 Bible", James Publication, 2024

4. Global, Emenwa., "Excel in 7 Days", Independently, 2022

5. Hong, Bryan., "101 Excel Formulas Guide", Independently, 2019

List of MINOR Courses offered

by BOS in Computer Applications (FoS&T)

to any other BOS under FoS&T or any Faculty except FoS&T

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

List of Open Elective (OE) Courses offered

by BOS in Computer Applications

to any Faculty except FoS&T

Sr. No.	Semester	Course Code	Course Name	Credits		
				TH	PR	Total
1.	III	OE-201-CA	Introduction to Artificial Intelligence	02	00	02
2.	IV	OE-251-CA	Software Tools for Office Administration	00	02	02

Detailed Drafts Of

Minor Courses offered

by BOS (Computer Applications)

to

any other BOS under FoS&T or any
faculty except FoS&T

for

SEMESTER III and IV only

Savitribai Phule Pune University		
Minor Course offered by BOS (Computer Applications) to any other BOS under FoS&T or any faculty except FoS&T for SEMESTER III only		
CA – 241 – MN: Programming with Python		
Teaching Scheme: Theory: 02 Hrs./ Week	Credits 02	Examination Scheme: Continuous Evaluation: 15 Marks End-Semester: 35 Marks

Course Objectives:

1. To introduce programming concepts using Python
2. To understand various constructs in Python
3. To test and execute Python programs.

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

CO1: Write Python programs to solve the given problem

CO2: Utilize the data structures such as lists, dictionaries, tuples and sets.

CO3: Use built-in and user defined modules and packages.

CO4: Apply operations involving file systems and data handling.

Course Contents		
Unit I	**Introduction to Python**	**5 Hrs.**

1.1 Introduction

    1.1.1. Python identifiers and reserved words

    1.1.2. Lines and indentation, multi-line statements and Comments

    1.1.3. Input/output with print and input functions

    1.1.4. Command line arguments and processing command linear augments

1.2 Data Types

    1.2.1 Standard data types -basic, none, Boolean, numbers

    1.2.2. Data type conversion

1.3 Operators

    1.3.1: Basic operators (Arithmetic, comparison, assignment, bitwise, logical)

    1.3.2 Membership operators (in, not in)

    1.3.3. Identity operators (is, is not)

1.4 Control Statement

    1.4.1 Conditional/decision statements (if, if—else, elif,

    1.4.2. Loop Control Structure (while, Do--while, for)

    1.4.3 Selection Control Statement (Switch case, Pass, Continue, Break)

1.5 Basic Object-Oriented Programming Concepts in Python

    1.5.1 Creating classes, instance, objects, accessing members

    1.5.2 Data hiding (the double underscore prefix)

    1.5.3 Built-in class attributes

	1.5.4 Garbage collection	
	1.5.5 Constructor	
1.6	Applications of Python	

Unit II	**Functions and Strings**	**7 Hrs.**

2.1	Introduction to function
	2.1.1 Defining a function, calling a function
	2.1.2 Types of function (Built-in, function, user-defined function, lambda function /anonymous function, recursive function)
	2.1.3 Function arguments
	2.1.4 Global and Local variable, Examples
	2.1.5 Math Functions
	2.1.6 Functional programming tools -filter( ), map( ), and reduce( )
2.2	Introduction to string
	2.2.1 Declaration and String manipulation -Accessing String, String Slices.
	2.2.2 Documentation Strings-Single quotes, Double quotes, Triple quotes, Raw String
	2.2.3 Python string operators, escape character
	2.2.4 String formatting operator
	2.2.5 Built-in String functions / Methods

Unit III	**Tuple, Set and Dictionary**	**8 Hrs.**

3.1	Introduction to tuple
	3.1.1 Tuple definition, accessing tuple values, update and delete tuple elements
	3.1.2 Basic Tuple operations
	3.1.3 Tuple -Indexing and slicing
	3.1.4 Built in tuple functions
	3.1.5 Applications of tuple
3.2	Introduction to set
	3.2.1 Create, update and remove elements from set
	3.2.2 Set operations
	3.2.3 Set built-in functions
	3.2.4 Applications of set
3.3	Introduction to Dictionary
	3.3.1 Creating and accessing values in a dictionary
	3.3.2 Updating dictionary, delete dictionary elements
	3.3.3 Properties of dictionary keys
	3.3.4 Built-in dictionary functions and methods

Unit IV	**Modules and Packages**	**4 Hrs.**

4.1	Introduction to Module
4.2	Types of Module and Examples
	4.2.1 Built_in Module (Math module, Random module, Time module, regular expression)

	4.2.2 User Defined Module (creation and import)	
	4.2.3 External Module (Python libraries-NumPy, Pandas, Matplotlib, Seaborn)	
4.3	Introduction to Package	
	4.3.1 Importing and creating package	
	4.3.2 Example of packages	

Unit V	**File Handling, Data Handling using Data Frames**	**6 Hrs.**

5.1	Introduction to file
	5.1.1 Definition
	5.1.2 Types of files (Text, Binary and CSV file)
	5.1.3 File Opening Modes (r, r+, w, w+, a, a+)
	5.1.4 Creating files and Operations on files (open, close, read, write)
5.2	Data Manipulation
	5.2.1 Creating Data Frame -User define, using csv file
	5.2.2 View Data Frame
	5.2.3 Preprocessing on Data Frame -Null Values, Duplicate values
	5.2.4 Modify Data in Data Frame
	5.2.5 Grouping and Aggregating Data
5.3	Data Visualization (Histogram, Line chart, Bar chart, Scatter plot)

Books

1. Lubanovic Bill, "Introducing Python-Modern Computing in Simple Packages", 1st Edition, O'Reilly Publication, 2014

2. Montojo, Jason., Campbell, Jennifer and Gries, Paul, "Practical Programming: An Introduction to Computer Science using Python 3", 2nd Edition, O'Reilly, 2013

3. Dierbach Charles., "Introduction to Computer Science Using Python", 1st Edition, Wiley Publication, 2015

4. Mueller, John P., "Beginning Programming with Python for Dummies", 1st Edition, Dummies, 2014

5. A Beginner's Python Tutorial: http://en.wikibooks.org/wiki/ABeginner%27s

Savitribai Phule Pune University
Minor Course offered by BOS (Computer Applications) to any other BOS under FoS&T or any faculty except FoS&T for SEMESTER III only
CA – 242 - MNP: Lab Course on CA – 241 - MN

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

Course Objectives:

1. To introduce programming concepts using Python
2. To understand various constructs in Python
3. To test and execute Python programs.

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

CO1: Write Python programs to solve the given problem

CO2: Utilize the data structures such as lists, dictionaries, tuples and sets.

CO3: Use built-in and user defined modules and packages.

CO4: Apply operations involving file systems and data handling.

List of Assignments		
Unit 1	**Introduction to Python**	**12 Hrs.**
Assignment on various operator in Python Assignment on Loop and decision control statement Assignment on classes and built in functions		
Unit 2	**Strings and Functions**	**12 Hrs.**
Assignment on string operators and built-in string functions Assignment on user defined functions and math functions		
Unit 3	**Tuple, Set and Dictionary**	**12 Hrs.**
Assignment on Tuple Assignment on Sets Assignment on create dictionary Assignment on access and manipulates the elements from dictionary.		
Unit 4	**Modules and Packages**	**12 Hrs.**
Assignment on importing, Creating and exploring modules Assignment on Math module, Random module, Time module, Regular expression module. Assignment on importing package and creating package		
Unit 5	**File Handling, Data Handling using (3) Data Frames (3)**	**12 Hrs.**
Assignment on Creating files and Operations on file Assignment on Data Frame creation and preprocessing on data Assignment on Data Visualization		

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Savitribai Phule Pune University

Minor Course offered by BOS (Computer Applications) to any other BOS under FoS&T or any faculty except FoS&T for

SEMESTER IV only

CA - 291- MN: Introduction of Artificial Intelligence and Machine Learning
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Teaching Scheme: Theory: 02 Hrs./ Week	Credits 02	Examination Scheme: Continuous Evaluation: 15 Marks End-Semester: 35 Marks

Course Objectives:

1. To learn the core concepts of AI, evolution and different paradigms of AI
2. To understand expert systems and how they utilize knowledge bases and inference engines to solve problems.
3. To study the concepts in machine learning, including supervised, unsupervised, and reinforcement learning.
4. To know the basics of deep learning frameworks.

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

CO1: Describe basic concepts in AI

CO2: Compare different search algorithms used in AI

CO3: Demonstrate understanding of knowledge representation and logic

CO4: apply key machine learning concepts such as supervised, unsupervised, and reinforcement learning.

CO5: Develop the ability to use machine learning algorithms such as linear regression, logistic regression, decision trees.

Course Contents		
Unit I	**Introduction to Artificial Intelligence and Problem Space**	**07 Hrs.**

1.1   Introduction
1.2   Comparison of AI, Machine Learning, Deep Learning
1.3   AI Techniques and Application of AI
1.4   Agents
    1.4.1 definition and types of agents
    1.4.2 Agent and Environments
    1.4.3 Structure of Agents.
1.5   Defining problem as a State Space Search
1.6   Production System, Problem Characteristics
1.7   Problem Space
    1.7.1 Water Jug Problem
    1.7.2 Missionary Cannibal Problem
    1.7.3 Block Words Problem
    1.7.4 Monkey and Banana Problem

Unit II	**Search Algorithms**	**08 Hrs.**

2.1	Search Algorithms	
2.2	Uninformed Search Algorithm / Blind Search Techniques	
	2.2.1 Breadth-First Search	
	2.2.2 Depth-First Search	
2.3	Informed Search Techniques	
	2.3.1 Generate and Test	
	2.3.2 Simple Hill Climbing	
	2.3.3 Best First Search	
	2.3.4 Constraint Satisfaction	
	2.3.5 Mean End Analysis	
	2.3.6 A* and AO*	

Unit III	**Knowledge Representation and Reasoning**	**08 Hrs.**
3.1	Definition of Knowledge	
3.2	Types of Knowledge	
	3.2.1 Procedural Knowledge	
	3.2.2 Declarative Knowledge	
3.3	Approaches to Knowledge Representations	
3.4	Propositional and Predicate Logic	

Unit IV	**Introduction to Machine Learning**	**07 Hrs.**
4.1	Introduction to Machine Learning	
4.2	Key concept of Machine Learning (Data, Model, Training, Labels, Features)	
4.3	Types of Machine Learning (Supervised, Unsupervised and Reinforcement Learning)	
4.4	Deep Learning: Natural Language Processing, Computer Vision, Speech Recognition, Robotics, Generative AI.	
4.5	Applications	

Books

1. Norvig, Peter., and Russell, Stuart., "Artificial Intelligence: A Modern Approach", 3rd Edition, Pearson, 2009
2. Knight, Kelvin. and Rich, Elaine., "Artificial Intelligence", 3rd Edition, McGrawhill Publication, 2017
3. Geron, Aurelien., "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 3rd Edition, 2022
4. Goodfellow, Ian., Bengio, Yoshua and Courville, Aaron.,"Deep Learning", MIT press, 2016
5. Muller, Andreas., "Introduction to Machine Learning with Python: A Guide for Data Scientists", 1st Edition, Shroff Publisher, 2016
6. Howard, Jeremy and Gugger, Sylvain, "Deep Learning for Coders with Fastai and PyTorch: AI Applications Without a PhD", O'Reilly, 2020
7. Raschka, Sebastian., Liu, Yuxi and Mirjalili, Vahid, "Machine Learning with PyTorch and Scikit-Learn: Develop machine learning and deep learning models with Python", Packt Publication, 2022

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Savitribai Phule Pune University

Minor Course offered by BOS (Computer Applications) to any other BOS under FoS&T or any faculty except FoS&T for

SEMESTER IV only

CA – 292 – MNP: Lab Course on CA - 291 - MN

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Teaching Scheme:
Practical: 04 Hrs./ Week/ Batch

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Credits
02

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Examination Scheme:
Continuous Evaluation: 15 Marks
End-Semester: 35 Marks

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Course Objectives:
1. To learn to use algorithms in AI and machine learning
2. To understand various machine learning techniques, libraries and tools

Course Outcomes: After successful completion of this course, the learners will be able to
CO1: Apply the suitable AI algorithms to solve a given problem
CO2: preprocess real-world data, including handling missing values, outliers, and scaling
CO3: Use appropriate machine-learning libraries and tools
CO4: solve problems using machine learning techniques.

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List of Assignments

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Assignment 1

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Artificial Intelligence and Problem Space

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- Water Jug Problem
- Missionary Cannibal Problem

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Assignment 2

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Problem Space

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- Block Words Problem
- Monkey and Banana Problem

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Assignment 3

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Search Algorithms

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- Breadth-First Search
- Depth-First Search

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Assignment 4

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Search Algorithms

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- Constraint Satisfaction

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Assignment 5

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Generate and Test

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- Simple Hill Climbing
- Best First Search

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Assignment 6

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Testing and Analysis

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- Mean End Analysis
- A^* and AO^*

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Assignment 7

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Knowledge Representation

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- Procedural Knowledge
- Declarative Knowledge

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Assignment 8	Reasoning
- Propositional Logic - Predicate Logic	
Assignment 9	Machine Learning Libraries
- Scikit-learn, pandas, NumPy - Jupiter Notebook basics - Introduction to Google Collab	
Assignment 10	Data Cleaning
- User defined data frame creation - Missing data, noise removal	
Assignment 11	Data Visualization Techniques
Data visualization techniques using Matplotlib and Seaborn	
Assignment 12	GenAI
Use GenAI to acquire the knowledge in structured format like if then else rule.	

Detailed Drafts Of
Open Elective Courses offered
by BOS (Computer Applications)
to
any faculty except FoS&T
for
SEMESTER III and IV only

Savitribai Phule Pune University
Open Elective course offered by BOS (Computer Applications) to any faculty except FoS&T for SEMESTER III only
OE – 201 – CA: Introduction to Artificial Intelligence

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

Course Objectives:

1. To learn the core concepts of AI, evolution and different paradigms of AI
2. To understand expert systems and how they utilize knowledge bases and inference engines to solve problems.
3. To study the concepts in machine learning, including supervised, unsupervised, and reinforcement learning.
4. To know the basics of deep learning frameworks

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

CO1: Describe basic concepts in AI

CO2: Compare different search algorithms used in AI

CO3: Demonstrate understanding of knowledge representation and logic

CO4: Compare supervised, unsupervised, and reinforcement learning.

Course Contents		
Unit I	**Introduction to Artificial Intelligence**	**04 Hrs.**

1.1   Introduction
1.2   Comparison of AI, Machine Learning, Deep Learning
1.3   Applications of AI
1.4   AI Techniques
1.5   Agents and Types of Agents, Agents and Environments, Structure of Agents

Unit II	**Problems, Problem Spaces and search**	**04 Hrs.**

2.1   Defining problem as a State Space Search

2.2   Production System

2.3   Problem Characteristics

2.4   Search and Control Strategies

2.5   Problems- Water Jug problem, Missionary Cannibal Problem, Block words Problem, Monkey and Banana problem

Unit III	Knowledge Representation and Introduction to Searching Algorithms	12 Hrs.

3.1   Knowledge Representation

    3.1.1   Introduction

    3.1.2   Types of knowledge

    3.1.3   Approaches to Knowledge Representation

    3.1.4   Applications of Knowledge Representation

3.2   Search Algorithm

    3.2.1   Elements of AI search algorithms

    3.2.2   Importance of Search Algorithm

    3.2.3   Types of AI search algorithms (BFS, DFS, A^* and AO^*)

    3.2.4   Applications

Unit IV	Machine Learning	10 Hrs.

4.1   Introduction to Machine Learning

4.2   Key concept of Machine Learning (Data, Model, Training, Labels, Features)

4.3   Types of Machine Learning (Supervised, Unsupervised and Reinforcement Learning)

4.4   Deep Learning: Natural Language Processing, Computer Vision, Speech Recognition, Robotics, Generative AI.

4.5   Applications

Books

1. Knight, Kelvin. and Rich, Elaine., "Artificial Intelligence", 3rd Edition, Mc-Graw Hill Publication, 2017

2. Ertel, Wolfgang and Black Nathanael T., "Introduction to Artificial Intelligence", Springer,2011

3. Mitchell, Tom M., "Machine Learning", McGraw Hill, 1997

4. Nilsson Nils J., "Artificial Intelligence: A New Synthesis", Morgan Kaufman, 1998

5. Ethem, Alpaydin., "Introduction to Machine Learning",3rd Edition, PHI Publication, 2015

Open Elective course offered by BOS (Computer Applications) to any faculty except FoS&T for SEMESTER IV only

OE – 251 – CA: Software Tools for Office Administration

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

Course Objectives:

1. To be familiarize with office automation tools for efficient document management, data processing, and communication.
2. To understand tools for word processing, spreadsheets, presentations, and data collection to enhance office productivity.
3. To study tools for collaboration and management of files using cloud-based platforms like Google Drive and OneDrive securely.
4. To learn email etiquette, calendar scheduling, and cyber security for professional office administration.

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

CO1: Apply word processing techniques to create, format, and manage professional documents

CO2: Use spreadsheet tools for data entry, analysis, visualization, and decision-making.

CO3: Design and deliver interactive professional presentations using animations and multimedia integration.

CO4: Create and analyze Google Forms for data collection, surveys, and automated feedback management.

CO5: Implement email and cloud-based collaboration tools to enhance office communication, scheduling, and document security.

List of Assignments	
Document Creation and Communication Tools	**15 Hrs.**

Assignment 1: Understanding CV Formatting and Design: Create a Curriculum Vitae (CV) using Google Docs or MS Word. Apply proper formatting with headings, bold text, and bullet points. Upload the document to Google Drive and share it with your friends as viewers.

Assignment 2: Automating Personalized Communication with Mail Merge: Use Mail Merge in MS Word to send personalized invitation letters. Prepare an Excel sheet with at least 5 names and email addresses. Merge the data into a formal letter template. Save the final document as PDF, upload it to Google Drive

Assignment 3: Writing Formal Emails for Professional Communication: Compose a formal email to your professor requesting a meeting using Gmail or Outlook. Attach a Word file as an agenda.

Spreadsheets for Data Management and Analysis	15 Hrs.

Assignment 4: Data Visualization Using Charts and Conditional Formatting

Analyze sales data using charts in MS Excel or Google Sheets. Enter sample sales data (Product, Sales, Revenue, etc.). Create a Bar Chart and Pie Chart to visualize the data. Apply conditional formatting to highlight low sales.

Assignment 5: Financial Tracking with Google Sheets

Create a monthly expense tracker in Google Sheets. Include columns: Date, Category, Amount, and Total. Use the SUM formula to calculate total expenses. Format the sheet properly.

Presentations and Multimedia Integration	15 Hrs.

Assignment 6: Enhancing Presentations with Multimedia and Effects

Design a 5-slide presentation on "Future of Office Automation" using Google Slides or MS PowerPoint. Include images, animations, and transitions. Add a video or audio clip to enhance the content.

Online Collaboration and Cloud-Based Tools	15 Hrs.

Assignment 7: Creating and Analyzing Surveys Using Google Forms

Create a Google Form to collect event feedback. Include multiple-choice, rating scale, and short-answer questions. Collect at least 10 responses and analyze them in Google Sheets.

Assignment 8: Efficient Meeting Scheduling with Google Calendar

Schedule a team meeting using Google Calendar. Add title, date, time, and agenda. Invite at least 3 participants and set a reminder.

Assignment 9: File Management and Collaboration in Google Drive

Organize and share files in Google Drive. Create a folder named "Office Automation Project" and upload at least 3 different files (Doc, Sheet, Slide)

Books

1. Randy, Nordell, "Microsoft Office 365: In Practice",1st Edition, McGraw-Hill Publication, 2023
2. Steve Tudor, "Excel 2023: The Most Updated Guide to Master Microsoft Excel"
3. Richard Wilson, "Google Forms and Google Sheets for Beginners"
4. Poatsy, Mary Anne., and Davidson, Jason, "Microsoft Word 2021 and 365 for Beginners", 1st Edition, Pearson Publication, 2022

Abbreviations

AEC   Ability Enhancement Course

CEP   Community Engagement Project

FoS&T   Faculty of Science and Technology

FP   Field Project

GE / OE   General / Open Elective Course

IKS   Indian Knowledge System

MJ   Major Core Theory Course

MJP   Major Core Laboratory Course

MN   Multidisciplinary Minor Theory Course

MNP   Multidisciplinary Minor Laboratory Course

MOOC   Massive Open Online Course

NEP   National Educational Policy - 2020

NPTEL   National Programme on Technology Enhanced Learning

SEC   Skill enhancement Course

SPPU   Savitribai Phule Pune University

SWAYAM   Study Webs of Active-Learning for Young Aspiring Minds VEC   Value Education Course

VEC   Value Education Course

VSC   Vocational Skill Enhancement Course

Savitribai Phule Pune University, Pune

Maharashtra, India

Task Force for Curriculum Design and Development

Of

SY Bachelor of Computer Applications

Programme Coordinator

Dr. A B Nimbalkar - Member, Ad-hoc Board of Studies - Computer Applications

Team Members for Course Design

Data Structures	
Name of the Faculty	**Name of the College**
Dr. Patil Rahul	KRT Arts, BH Commerce and AM Science College (KTHM), Nashik
Mrs. Borase S P	KRT Arts, BH Commerce and AM Science College (KTHM), Nashik
Mrs. Ghorpade S J	KRT Arts, BH Commerce and AM Science College (KTHM), Nashik
Mrs. Jyoti P Malusare	Haribhai V. Desai College of Arts, Science and Commerce, Pune
Mrs. Shivarkar Sonali	S. M. Joshi College, Hadapsar, Pune

C++ Programming	
Name of the Faculty	**Name of the College**
Mrs. Kadam S. A.	Baburaoji Gholap College, Sangvi, Pune
Mrs Suvarna S Patil	BJS ASC College, Wagholi, Pune
Dr. Preeti Bharambe	MAEERs MIT Arts Commerce and Science College Alandi, Pune
Mrs. Sarita Somnath Raut	Pravara medical trust's Arts commerce and science college, Shevgaon

Programming with Python	
Name of the Faculty	**Name of the College**
Mrs. Dipali Meher	PES Modern College of Arts Science and commerce, Ganeshkhind, Pune
Mrs. Chandgude Vidya	MIT Arts Commerce & Science College, Alandi, Pune
Mrs. Saykar Sunita J.	Annasaheb Magar College, Pune
Mrs. Kamble Jayshree	Pratibha college of commerce and computer studies, Pune
Mr. Derle D R	KRT Arts, BH Commerce and AM Science College (KTHM), Nashik

Introduction to Artificial Intelligence	
Name of the Faculty	**Name of the College**
Mrs. Rohini Subhash Kapse	KRT Arts, BH Commerce and AM Science College (KTHM), Nashik
Mrs. Sonali Sagar Gholve	Sarhad College of ACS, Katraj, Pune
Mrs. Suvarna Sachin Pardeshi	Ahmednagar College, Ahilyanagar

Indian Knowledge System for Computing	
Name of the Faculty	**Name of the College**
Dr. Vikas Nana Mahandule	MAEERs MIT Arts Commerce and Science College Alandi, Pune
Mrs. Chavan Rutuja	Pratibha College of Commerce and Computer Studies, Pune

Database Management Systems	
Name of the Faculty	**Name of the College**
Dr. Reena Shinde	Sinhgad College of Science, Pune
Mrs. Kadlag Vinita	Annasaheb Magar College, Pune
Mrs. Vrunda P Chouthkanthiwar	JSPM'S JSIMR, Pune
Mrs. Gogte Suvarna	Pratibha College of Commerce and Computer Studies, Pune

Python Programming	
Name of the Faculty	**Name of the College**
Dr. Sanjay T Wani	Women's College of Home Science and BCA, Loni
Mrs. Dipali Deepak Mali	Annasaheb Magar Mahavidyalaya, Pune
Mrs. Dhadawe Priya Amit	Sarhad college of Arts, Commerce and Science, Katraj Pune
Mrs. Alka Baban Mhetre	RJSP Mandal's Arts commerce and science college, Bhosari, Pune

Introduction to Artificial Intelligence and Machine Learning	
Name of the Faculty	**Name of the College**
Dr Harshita Vachhani	Pratibha college of Commerce and Computer Studies, Pune
Mr. Sanjay S Manvatkar	BJS ASC College, Wagholi, Pune
Ms. Gadekar Manisha J	Annasaheb Magar College, Pune
Mrs. More K D	KRT Arts, BH Commerce and AM Science College (KTHM), Nashik

Software Tools for Office Administration	
Name of the Faculty	**Name of the College**
Dr. Vikas Nana Mahandule	MAEERs MIT Arts Commerce and Science College Alandi, Pune
Prof. More R.N.	Annasaheb Magar College, Pune
Mr. Amit Vilasrao Tale	MAEERs MIT Arts Commerce and Science College Alandi, Pune

Spreadsheet Applications	
Name of the Faculty	**Name of the College**
Mrs. Savita Bhujbal	Annasaheb Magar Mahavidyalaya Hadapsar, Pune
Mrs. Vijayshri Bava (Gosavi)	K. K. Wagh Arts, Commerce & Science College, Nashik

Members of Ad-hoc Board of Studies - Computer Applications	
Name	**Affiliation**
Dr. S S Sane	R H Sapat COE, Management Studies and Research Nashik
Dr. A B Nimbalkar	Annasaheb Magar Mahavidyalaya Hadapsar, Pune
Dr. Razzak Sayyad	Ahmednagar College, AhilyaNagar
Dr. R M Sonar	IIT, Powai, Mumbai
Dr. S A Kadam	Bharati Vidyapeeth, Pune

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

Course Objectives:

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

Course Outcomes:

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

Syllabus (from 2024-25)

Unit 1. Introduction to Indian Knowledge System   06

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

Unit 2. Development of Sciences   12

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

Unit 3. Development of Humanities   12

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

References:
English:

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

मराठी:

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

Examination Pattern:

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

Marks Scheme of Examination: Theory Paper

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

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

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

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

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

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

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

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

Internal Assessment

Total Marks: 15 =

10 Marks - Mid Semester Exam. –

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

SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE

NATIONAL CADET CORPS (NCC)

CC (Co-curricular Course NEP -2020)

(Syllabus and Guidelines for First Year and Second Semester

Under Graduate Students of All the Faculties)

Effective from Academic Year 2024 - 2025

<div align="center">

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

Title of the Paper :

National Cadet Corps (NCC)

</div>

Preamble :

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

OBJECTIVES :

1. Develop character, camaraderie, discipline, secular outlook, the spirit of adventure, sportsman spirit and ideals of selfless service amongst cadets by working in teams.

2. To create interest in cadets by including and laying emphasis on those aspects of institutional Training which attract young cadets into the NCC.

3. To inculcate defence Services work ethos that is characterized by hard work, sincerity of purpose, honesty, ideal of selfless service, dignity of labour, secular outlook, comradeship, spirit of adventure and sportsmanship.

4. To create a pool of organized, trained and motivated youth with leadership qualities in all walks of life, who will serve the Nation regardless of which career they choose.

5. To provide conducive environment to motivate young Indians to choose the Armed Forces as a career.

6. To teach and develop the qualities such as self-discipline, self-confidence, self-reliance and dignity of labour in the cadets.

Structure of the Course :

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

SEMESTER - II

Paper I : National Cadet Corps

Course code : NCC/CC/151

Course Objectives:

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

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

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

4. To develop the cadets as responsible citizens of India

5. To instill sense of selfless service among the cadets

6. To inculcate unity and discipline among the cadets

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

CO 1– develop a sense of comradeship

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

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

CO 4– behave as a responsible person

CO 5 – assist the society without any expectations

CO 6 –make oneself a disciplined human being

Course Content

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

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

Co-Curricular Activity:

Exposure visit to a place of national importance

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

References:

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

Cadets Handbook: Common Subjects. DGNCC

Cadets Handbook: Specialized Subject-Army. DGNCC

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SAVITRIBAI PHULE PUNE UNIVERSITY

PHYSICAL EDUCATION SCHEME

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

Effective from Academic Year 2024 - 2025

PHYSICAL EDUCATION SCHEME

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

Effective from Academic Year 2024 - 2025

PHYSICAL EDUCATION AND SPORTS (2 CREDITS)

OR

PHYSICAL EDUCATION AND YOGA (2 CREDITS)

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

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

PHYSICAL EDUCATION AND SPORTS

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

COURSE:

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

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

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

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

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

Credit 2: Fitness Assessment

- In order to improve the physical fitness standards of students, they should be given opportunity and facilities to participate in a game / sport from the list of Association of Indian Universities, New Delhi (List of events available on website **www.aiuweb.org**). The choice of game / sports will be according to the facilities available in the college.

- Fitness Assessment
    - Cardiovascular Endurance
    - Flexibility
    - Muscular Strength Endurance and
    - Body Composition (No marks)

REFERENCE BOOKS:

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

- Fahey, T., Insel, P., & Roth, W. (1997). Fit & Well. Mayfield, U.S.A,

- Hayward, V. (2006). Advanced Fitness Assessment and exercise prescription. Human Kinetics, USA.

- Hoeger, W.W. K., & Hoeger, S.A. (2007). Fitness and Wellness. Thomas learning. Wadsworth.

- Kamlesh, M. L. (2011). Fundamental Elements of Physical Education. KSK Publishers & Distributors. New Delhi

- Keech, P. (2010). First Aid Handbook. Hermes House. London.

- Rahl, R. V. (2010). Physical Activity and Health Gudelines. Human Kinetics. USA

- Singh, D. K. (2010). Principle and History of Physical Education and Sports. Sports Publication, New Delhi.

- Thapar, B. (2010). Principles of Physical Education. Rajat Publication, New Delhi.

- Williams (2005).Nutrition for Health, Fitness, & Sports (7th edn.) McGraw Hill Publication. Newyork.

- Hoffman, J. (2006) Norms for Fitness, Performance and Health. Human Kinetics. USA.

- Kansal, D. K. (2008). Textbook of Applied Measurement Evaluation & Sports Selection. Sports and Spiritual Science Publication, New Delhi.

- Lipman, H. A. (2009). Measurement and Evaluation in Physical Education. Friends Publication, New Delhi.

- Miller, T. (2012). NSCA's Guide to Test and Assessment, Human Kinetics, USA.

- Morrow, J., Jackson, A., Disch, J., & Mood, D. (2005). Measurement and Evaluation in Human Performance. Human Kinetics. USA.

- Scott, M. G., & French, E. (2009). Measurement and Evaluation in Physical Education. Sports Educational Technologies. New Delhi.

- Yobu, A. (2010). Test Measurement and Evaluation in Physical Education and Sports. Friends Publication. New Delhi.

- आहर, श. (२००९). शारीरिक शिक्षण मापन व मूःयमापन. डायमंड पब्लिके शःस. पुणे.

EVALUATION STRUCTURE

Table 1

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

***indicate first credit **indicate second credit**

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

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

Fitness Test:

Table 2

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

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

CRITERIA OF PASSING

Table 3

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

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

CONSIDERATIONS AND EXEMPTIONS:

Differently Able Students

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

Important Note:

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

Exemption

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

GRADING:

Grading will be done as follows.

Table 4

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

SAVITRIBAI PHULE PUNE UNIVERSITY

PHYSICAL EDUCATION AND SPORTS
Guidelines

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

Effective from Academic Year 2024 - 2025

ORGANIZATIONAL GUIDELINES :

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

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

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

2) **FACILITIES AND EQUIPMENT:**

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

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

3) **FINANCIAL PROVISION:**

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

GENERAL GUIDELINES TO IMPLEMENT THE COURSE

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

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

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

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

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

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

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

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

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

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

Achievement Card for

PHYSICAL EDUCATION AND SPORTS
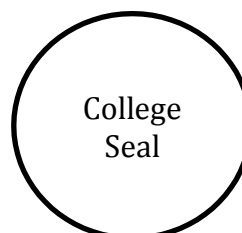
Fitness Test

Name of the Student :

College :

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

Signature of the Student

Signature of Teacher In- charge :

Signature of Principal :

Date :   /   /

College
Seal

Application Form

Paste latest passport size photograph

PHYSICAL EDUCATION AND SPORTS

Name of Student	
Address for Correspondence	
Class	

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

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

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

Signature of the Student

Date :   /   /
Place : ....

APPENDIX – III

Certificate of Appreciation

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

_____

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

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

_____

Date: /   /

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

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Exemption Form

(Sports Participation)

PHYSICAL EDUCATION AND SPORTS
(**Mandatory participation in selected game / sport for minimum 10 hours)**

Name of Student	
Address for Correspondence	
Class	

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

_____
Signature of the Student

Date :   /   /
Place : ....

Exemption Granted / Exemption Not Granted

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

APPENDIX – V

Exemption Form

(Differently Able Students)
PHYSICAL EDUCATION AND SPORTS

Name of Student	
Address for Correspondence	
Class	

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

_____
Signature of the Student

Date :   /   /
Place : ....

Exemption Granted / Exemption Not Granted

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

SPORTS / GAME PARTICIPATION LOG

PHYSICAL EDUCATION AND SPORTS

Name of Student	
Class	
Section	
Semester	
Sports/Game	

Date	Activity	Student Sign.	Student Leader Sign.

Signature of the Director of sports & PE

Date :   /   /
Place : ....

SAVITRIBAI PHULE PUNE UNIVERSITY

PHYSICAL EDUCATION AND SPORTS
PHYSICAL EDUCATION AND SPORTS

FITNESS TEST MANUAL

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

Effective from Academic Year 2024 - 2025

TEST DESCRIPTION

1. MODIFIED QUEENS COLLEGE STEP TEST :

OBJECTIVE :

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

VALIDITY :

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

RELIABILITY :

A reliability coefficient of .92 was reported

EQUIPMENT AND MATERIALS :

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

PROCEDURE :

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

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

SCORING :

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

NORMS :

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

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

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

OBJECTIVE :

To measure cardio-respiratory endurance.

VALIDITY :

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

RELIABILITY :

Reliability is 0.94 with test-retest method.

EQUIPMENT AND MATERIALS :

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

PROCEDURE :

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

SCORING :

Score is distance in meter covered in 12 minutes.

NORMS :

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

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

3. <u>SIT AND REACH :</u>

<u>OBJECTIVE :</u>

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

<u>VALIDITY :</u>

Face validity was accepted for this test.

<u>RELIABILITY :</u>

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

<u>EQUIPMENT AND MATERIAL :</u>

Flexomeasure case with yard stick and tape.

<u>PROCEDURE :</u>

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

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

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

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

<u>SCORING :</u>

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

NORMS :

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

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

4. BENT KNEE SIT UPS :

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

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

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

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

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

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

NORMS :

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

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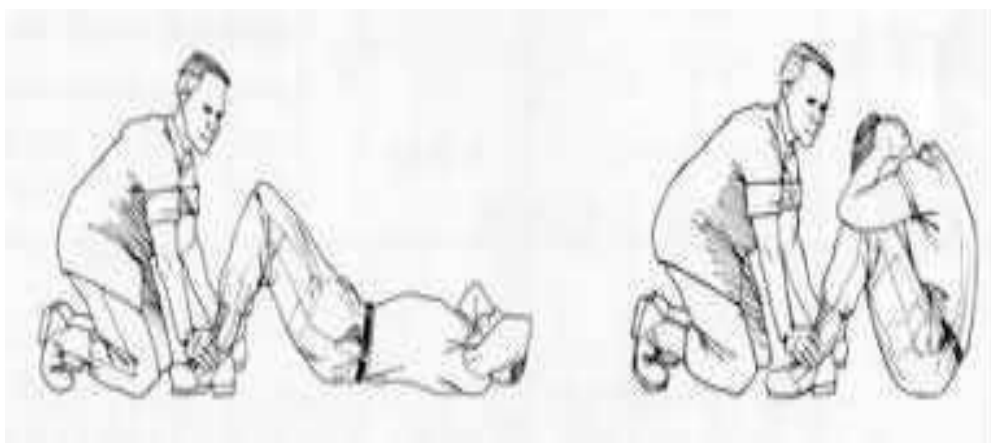
5. **PERCENTAGE BODY FAT :**

Bioelectrical Impedance (BI) :

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

SAVITRIBAI PHULE PUNE UNIVERSITY

PHYSICAL EDUCATION AND YOGA
Syllabus

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

Effective from Academic Year 2024 - 2025

PHYSICAL EDUCATION AND YOGA

PHYSICAL EDUCATION AND YOGA (2 CREDITS)

AIMS & OBJECTIVES OF THE COURSE:

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

COURSE CREDITS :

Semester - II

Physical Education and Yoga (02 Credits)

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

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

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

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

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

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

REFERENCE BOOKS:

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

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

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

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

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

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

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

- घरोटे ल. म. (२०१०) ‌ाणायाम – &ासाचे शाT. ‌द लोणावळा योग इि:३thूट. इंिडया.

EVALUATION STRUCTURE

Table 1

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

EVALUATION OF THE ASANAS :

Each Asana will be awarded from 0-10 Marks. The evaluation is further distributed as under :-

    a) Technical Execution (Presentation) 4 Marks

    b) Complete Posture 4 Marks

    c) Retention period 2 Marks

EXPLANATION :

a) Technical Execution (Presentation) 4 marks. It involves methodical approach in itspresentation which further depends on

    i) Arriving to the posture,

    ii)Alighting fromthe posture,

    iii) Expression,

    iv) Breathing

b) Complete Posture 4 marks. Attainment of the final posture and while being in thisposition certain aspects deem necessary to be taken into consideration to constitutea complete posture

    i) Stability in the posture,

    ii) Calmness & tranquillity,

    iii)Exactness and correctness,

    iv) Smoothness and degree of flexibility,

    v) Bodyalignment, its angles and beauty.

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

PASSING CRITERIA

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

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

GRADING:

Grading will be done as follows.

Table 3

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