

**Haribhai V Desai College
of Arts, Science & Commerce, Pune.
(Autonomous)**

Faculty of Science and Technology

B.C.A. Program



**Syllabus
For
F.Y B.C.A.**

**Choice Based Credit System (CBCS)
Syllabus Under National Education Policy (NEP)
with effect from Academic Year 2024-25**

Title of the Program: B.C.A.

Preamble:

The computing field is witnessing unprecedented growth and transformation, particularly over the last decade, due to the continuous emergence of disruptive technologies such as artificial intelligence, data science, cybersecurity, the Internet of Things, and robotics. The 21st century has seen rapid technological advancements in every sector, including computing, which have also spurred the creation of new job roles and abundant opportunities for emerging graduates.

An Institute has made significant contributions by updating its degree programs in tune with current trends.

Moreover, the institute has taken a proactive lead in designing and implementing programs aligned with the National Education Policy (NEP) 2020. These new UG and PG programs feature multiple entry/exit options, interdisciplinary education, a strong emphasis on skill development, on-job training, field projects, research initiatives, and the integration of the Indian Knowledge System for the holistic development of students. Specifically, the Board of Computer Studies has structured the Bachelor of Science (Computer Applications) program with the following key features:

- **NEP 2020 Alignment:** Designed in accordance with NEP 2020 and affiliated university guidelines.
- **Credit Structure:** A total of 132 credits over three years (six semesters), with 22 credits per semester; candidates have the option to extend to a fourth year for either an Honours with Research or an Honours degree, totalling 176 credits.
- **Multiple Entry/Exit:** Flexibility to exit after the first, second, third, or fourth year, with the corresponding award of an UG Certification, UG Diploma, Degree, or Honours Degree (with Research/Honours) respectively.
- **Diverse Course Types:** Inclusion of Major Core, Mandatory Elective, Open Electives(OE), Minor(MN), Ability Enhancement(AEC), Value Education(VEC), Vocational Skill(VSC), Skill Enhancement(SEC), Indian Knowledge System(IKS), Co-curricular courses(CC), along with On-job Training(OJT), Field Projects(FP), Community Engagement Programs(CEP), Research Methodology(RM), and Research Projects(RP).

This comprehensive approach not only meets current educational standards but also prepares students to thrive in a rapidly evolving technological landscape.

Objectives:

- **Enhance Problem-Solving Skills:** Develop strong computer-aided problem-solving abilities to effectively address real-world challenges.
- **Build Analytical Expertise:** Equip students with the essential skillset and analytical capabilities required to design computer-based solutions.
- **Foster Professional Skills:** Provide comprehensive training in professional competencies tailored to the software industry.
- **Strengthen Research Foundations:** Establish a robust knowledge base to support research and development in the field of computer applications.
- **Cultivate Career and Entrepreneurial Success:** Empower students to build successful careers in computer applications and inspire future entrepreneurs to innovate and create software products.

Eligibility:

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

Program Outcomes:

PO No.	Outcomes
PO1	Exhibit a thorough understanding of the foundational concepts in computing.
PO2	Design and implement computer-based applications effectively.
PO3	Critically analyze existing research as reported in academic literature.
PO4	Conduct research to propose innovative alternative solutions.
PO5	Develop code that is efficient, reliable, clear, and maintainable.
PO6	Demonstrate deep expertise in the selected domain of study.
PO7	Choose and apply the most suitable method or algorithm to solve given problems.
PO8	Communicate complex technical concepts clearly and effectively, both in writing and orally.
PO9	Collaborate productively with team members by valuing diverse perspectives and contributing effectively as a professional.
PO10	Uphold integrity and social responsibility in all professional endeavors.
PO11	Cultivate self-directed and lifelong learning skills.

Haribhai V. Desai College of Arts, Science and Commerce, Pune.**Structure of UG Program as per NEP-2020****Name of Program: B.C.A.****Major Course: Computer Applications****SEMESTER-I****Level: 4.5 (First Year)**

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hour/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CIE	SEE	Total
Subject-1	BCA-101-TH	Problem Solving and Programming in C	2		2		15	35	50
	BCA-102-PR	Lab Course on BCA-101 TH		2		4	15	35	50
Subject-2	BCA-103-TH	Computer Organization & Architecture	2		2		15	35	50
	BCA-104-PR	Lab Course on BCA-103 TH		2		4	15	35	50
Subject-3	BCA-105-TH	Discrete Mathematics and Statistics	2		2		15	35	50
	BCA-106-PR	Lab Course on CA-105 TH		2		4	15	35	50
IKS	IKS-101-TH	Introduction to Indian Knowledge System	2		2		15	35	50
GE/OE*	OE-101-BCA-TH	Introduction to Data Science (Offering to other stream students)	2		2		15	35	50
SEC	SEC-101-BCA-PR	HTML and Web Page Designing		2		4	15	35	50
AEC	AEC-104-ENG-TH	Professional Communication Skills-I	2		2		15	35	50
VEC	VEC-101-ENV-TH	Environmental Education	2		2		15	35	50
TOTAL			14	08	14	16	165	385	550

** The subjects offered to other faculty students under OE vertical are OE-101-BCA –TH
The students of B.C.A. will opt the subjects offered by other faculty given in College OE Basket.*

Haribhai V. Desai College of Arts, Science and Commerce, Pune.**Structure of UG Program as per NEP-2020****Name of Program: B.C.A.****Major Course: Computer Applications.****SEMESTER-II**

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hour/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CIE	SEE	Total
Subject-1	BCA-151-TH	Advanced C Programming	2		2		15	35	50
	BCA-152-PR	Lab Course Based on BCA-151-TH		2		4	15	35	50
Subject-2	BCA-153-TH	Introduction to Microcontrollers	2		2		15	35	50
	BCA-154-PR	Lab Course Based on BCA-153-TH		2		4	15	35	50
Subject-3	BCA-155-TH	Linear Algebra	2		2		15	35	50
	BCA-156-PR	Lab Course Based on BCA-155-TH		2		4	15	35	50
GE/OE*	OE-151-BCA -PR	Data Science using Spreadsheets (Offered to other stream students)		2		4	15	35	50
SEC	SEC-151-BCA-PR	Software Tools for Business Communications		2		4	15	35	50
AEC	AEC-151-ENG-TH	Professional Communication Skills-II	2		2		15	35	50
VEC	VEC-151-IC-TH	Indian Constitution	2		2		15	35	50
CC	CC-151-PR	From College CC Basket		2		4	15	35	50
TOTAL			10	12	10	24	165	385	550

Level: 4.5 (First Year)

** The subjects offered to other faculty students under OE vertical are OE-151-CA-PR
The students of B.C.A. will opt the subjects offered by other faculty given in College Basket.*

Exit Option:

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

Haribhai V. Desai College of Arts, Science and Commerce, Pune.**Structure of UG Program as per NEP-2020****Name of Program: B.C.A.****Major Course: Computer Applications.****SEMESTER-III****Level: 5.0 (Second Year)**

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hour/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CIE	SEE	Total
MJ	BCA-201-MJ-TH	Data Structure	4		4		30	70	100
	BCA-202-MJ-PR	Lab Course Based on BCA-201-TH		2		4	15	35	50
VSC	BCA-221-VSC-TP	C++ Programming	1	1	1	2	15	35	50
FP	BCA-231-FP	Field Project		2		4	15	35	50
MN	BCA-241-MN-TH	Programming with Python	2		2		15	35	50
	BCA-242-MN-TH	Introduction to AR-VR	2		2		15	35	50
	BCA-243-MN-PR	Lab Course on BCA-241-MN		2		4	15	35	50
OE	OE-201-BCA-TH	Introduction to Artificial Intelligence	2		2		15	35	50
AEC	AEC-201-XXX-TH	From College Basket	2		2		15	35	50
CC	CC-201-TP	From College Basket	2		2		15	35	50
TOTAL			15	07	14	14	165	385	550

** The subjects offered to other faculty students under OE vertical are OE-201-BCA-TH
The students of B.C.A. will opt the subjects offered by other faculty given in College Basket.*

Haribhai V. Desai College of Arts, Science and Commerce, Pune.**Structure of UG Program as per NEP-2020****Name of Program: B.C.A.****Major Course: Computer Applications.****SEMESTER-IV****Level:**

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hour/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CIE	SEE	Total
MJ	BCA-251-TH	Database Management Systems	4		4		30	70	100
	BCA-252-PR	Lab course on BCA-251-TH		2		4	15	35	50
VSC	BCA-271-VSC-TP	Python Programming	1	1	1	2	15	35	50
CEP	BCA-281 - PR	Community Project		2		4	15	35	50
MN	BCA-291-MN-TH	Introduction to Artificial Intelligence and Machine Learning	2		2		15	35	50
	BCA-292-MN-PR	Lab course on BCA-291-MN-TH		2		4	15	35	50
OE	OE-251-BCA-PR	Software Tools for Office Administration		2		4	15	35	50
SEC	SEC-251-BCA-PR	Spreadsheet Applications		2		4	15	35	50
AEC	AEC-251-XXX-TH	from College Basket	2		2		15	35	50
CC	CC-251-TP	from College Basket	2		2		15	35	50
TOTAL			11	11	11	22	165	385	550

** The subjects offered to other faculty students under OE vertical are OE-251-BCA-PR
The students of B.C.A. will opt the subjects offered by other faculty given in College Basket.*

Haribhai V. Desai College of Arts, Science and Commerce, Pune.**Structure of UG Program as per NEP-2020****Name of Program: B.C.A.****Major Course: Computer Applications.****SEMESTER-V****Level:**

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hour/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CIE	SEE	Total
MJ	BCA-301-TH	Software Engineering and Testing	4		4		30	70	100
	BCA-302-TH	Fundamentals of Artificial Intelligence	2		2		15	35	50
	BCA-303-PR	Lab course on BCA-302-MJ		2		4	15	35	50
	BCA-304 - TH	Fundamentals of Data Science	2		2		15	35	50
	BCA-305- PR	Lab course on CA-304-MJ		2		4	15	35	50
ME	BCA-310- TH	User Interface and User Experience (UI-UX)	2		2		15	35	50
	BCA-311-PR	Lab course on BCA - 310-MJ		2		4	15	35	50
	OR								
	BCA-312- TH	Cloud Computing	2		2		15	35	50
	BCA-313- PR	Lab course on CA-312 - TH		2		4	15	35	50
	OR								
	BCA-314- TH	Cyber Security	2		2		15	35	50
	BCA-315-PR	Lab course on CA-314		2		4	15	35	50
VSC	BCA-321-VSC-TH	Core JAVA Programming	1	1	1	2	15	35	50
FP	CA-331-FP	Field Project-PR		2		4	15	35	50
IKS	IKS-301-TH	Indian Knowledge for Computing Systems	2		2		15	35	50
TOTAL			13	09	13	18	165	385	550

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 The students of B.C.A. will opt the subjects offered by other faculty given in College Basket.

Exit option:

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

Haribhai V. Desai College of Arts, Science and Commerce, Pune.**Structure of UG Program as per NEP-2020****Name of Program: B.C.A.****Major Course: Computer Applications.****SEMESTER-VI****Level:**

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hour/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CIE	SEE	Total
MJ									
	BCA-351-MJ-TH	Software Project Management	2		2		15	35	50
	BCA-352-MJ-TH	Web Programming	2		2		15	35	50
	BCA-353-MJ-PR	Lab course on BCA-352-MJ		2		4	15	35	50
	BCA-354-MJ-TH	Operating system Design	4		4		30	70	100
	BCA-355-MJ-PR	Lab course on BCA-354-MJ		2		4	15	35	50
ME	BCA-360-MJ-TH	Prompt & Generative AI	2		2		15	35	50
	BCA-361-MJ-PR	Lab course on BCA-360 -MJ-TH		2		4	15	35	50
	OR								
	BCA-362-MJ-TH	Big Data and Analytics	2		2		15	35	50
	BCA-363-MJ-PR	Lab course on BCA-362- MJ		2		4	15	35	50
	OR								
	BCA-364-MJ-TH	Mobile Application Development	2		2		15	35	50
	BCA-365-MJ-PR	Lab course on BCA-364 -MJ		2		4	15	35	50
VSC	BCA-371-VSC-TP	Advanced JAVA Programming	1	1	1	2	15	35	50
OJT	BCA-381-OJT	On-Job Training / Internship		4		8	30	70	100
TOTAL			11	11	11	22	165	385	550

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 The students of B.C.A. will opt the subjects offered by other faculty given in College Basket.

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

Haribhai V. Desai College of Arts, Science and Commerce, Pune.**Structure of UG Program as per NEP-2020****Name of Program: B.C.A.****Major Course: Computer Applications.****SEMESTER-VII (Degree with Research)****Level:**

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hour/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CIE	SEE	Total
MJ	BCA-401-MJ-TH	Object-oriented Modeling and Design	4		4		30	70	100
	BCA-402-MJ-TH	Operations Research	2		2		15	35	50
	BCA-403-MJ-PR	Lab course on BCA-401-MJ-TH		2		4	15	35	50
	BCA-404-MJ-PR	Lab course on BCA-402-MJ-TH		2		4	15	35	50
ME	BCA-410-MJ-TH	Natural Language Processing	2		2		15	35	50
	BCA-411-MJ-PR	Lab course on BCA-410-MJ-TH		2		4	15	35	50
	OR								
	BCA-412-MJ-TH	Machine Learning	2			2	15	35	50
	BCA-413-MJ-PR	Lab course on BCA-412-MJ-TH		2		4	15	35	50
	OR								
	BCA-414-MJ-TH	Full Stack	2		2		15	35	50
	BCA-415-MJ-PR	Lab course on BCA-414-MJ-TH		2		4	15	35	50
RP	BCA-431-RP-PR	Course Work and Literature Review		4		8	30	70	100
RM	BCA-432-RP-TH	Fundamentals of Scientific Research	4		4		30	70	100
TOTAL			12	10	12	20	165	385	550

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The students of B.C.A. will opt the subjects offered by other faculty given in College Basket.*

Haribhai V. Desai College of Arts, Science and Commerce, Pune.**Structure of UG Program as per NEP-2020****Name of Program: B.C.A.****Major Course: Computer Applications.****SEMESTER-VIII (Degree with Research)****Level:**

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hour/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CIE	SEE	Total
MJ	BCA-451-MJ-TH	Deep Learning	4		4		30	70	100
	BCA-452-MJ-TH	Design and Analysis of Algorithm	2		2		15	35	50
	BCA-453-MJ-PR	Lab course on BCA-451 -MJ		2		4	15	35	50
	BCA-454-MJ-PR	Lab course on BCA-452 -MJ		2		4	15	35	50
ME	BCA - 460 -MJ - TH	Design Thinking	2		2		15	35	50
	BCA - 461 -MJ - PR	Lab course on BCA-460-MJ		2		4	15	35	50
	OR								
	BCA - 462 -MJ - TH	Data Mining Techniques	2		2		15	35	50
	BCA - 463 -MJ - PR	Lab course on BCA - 462-MJ		2		4	15	35	50
	OR								
	BCA - 464 -MJ - TH	Block Chain	2		2		15	35	50
	BCA- 465 -MJ - PR	Lab course on BCA- 464-MJ		2		4	15	35	50
RP	BCA-481-RP	Project Work		8		16	30	70	100
TOTAL			08	14	8	28	165	385	550

* The subjects offered to other faculty students under OE vertical are OE-151-CA-PR
 The students of B.C.A. will opt the subjects offered by other faculty given in College Basket.
Award of B.C.A. Hon. with Research with 176 credits

Haribhai V. Desai College of Arts, Science and Commerce, Pune.**Structure of UG Program as per NEP-2020****Name of Program: B.C.A.****Major Course: Computer Applications.****SEMESTER-VII (Degree with Honors)****Level:**

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hour/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CIE	SEE	Total
MJ	BCA-401-MJ-TH	High Performance Databases	4				30	70	100
	BCA-402-MJ-TH	Computer Graphics	4		4		30	70	100
	BCA403-MJ-PR	Lab course on CA-401-MJ-TH		2		4	15	35	50
	BCA404-MJ-PR	Lab course on CA-402-MJ-TH		2		4	15	35	50
	BCA405-MJ-TH	DevOps	2		2		15	35	50
ME	BCA-410-MJ-TH	Mobile Web Programming	2		2		15	35	50
	BCA-411-MJ-PR	Lab course on CA-410-MJ-TH		2		4	15	35	50
	OR								
	BCA-412-MJ-TH	ERP	2		2		15	35	50
	BCA-413-MJ-PR	Lab course on CA-412-MJ-TH		2		4	15	35	50
	OR								
	BCA-414-MJ-TH	Full Stack	2		2		15	35	50
	BCA-415-MJ-PR	Lab course on CA-414-MJ-TH		2		4	15	35	50
RM	BCA-432-RM-TH	Fundamentals of Research Methodology	4		4		30	70	100
TOTAL			16	06	16	12	165	385	550

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The students of B.C.A. will opt the subjects offered by other faculty given in College Basket.

Haribhai V. Desai College of Arts, Science and Commerce, Pune.**Structure of UG Program as per NEP-2020****Name of Program: B.C.A.****Major Course: Computer Applications.****SEMESTER-VIII (Degree with Honors)****Level: 4.5 (First Year)**

Course Type	Course Code	Course Title	Credits		Teaching Scheme Hour/Week		Evaluation Scheme and Max Marks		
			TH	PR	TH	PR	CIE	SEE	Total
MJ	BCA-451-MJ-TH	Deep Learning	4		4		30	70	100
	BCA-452-MJ-TH	Design and Analysis of Algorithm	2		2		15	35	50
	BCA-453-MJ-TH	Management Information System	4		4		30	70	100
	BCA-454-MJ-PR	Lab course on BCA-451-MJ-TH		2		4	15	35	50
	BCA-455-MJ-PR	Lab course on BCA-452-MJ-TH		2		4	15	35	50
ME	BCA-460-MJ-TH	Design Thinking	2		2		15	35	50
	BCA-461-MJ-PR	Lab course on BCA-460-MJ-TH		2		4	15	35	50
	OR								
	BCA-462-MJ-TH	GO Programming	2		2		15	35	50
	BCA-463-MJ-PR	Lab course on BCA-462-MJ-TH		2		4	15	35	50
	OR								
	BCA-464-MJ-TH	Block Chain	2		2		15	35	50
	BCA-465-MJ-PR	Lab course on BCA-464-MJ-TH		2		4	15	35	50
OJT	BCA-481-OJT-PR	On-job Training / Internship *		4		8	30	70	100
TOTAL			10	12	14	20	165	385	550

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The students of B.C.A. will opt the subjects offered by other faculty given in College Basket.

Award of B.C.A. Hon. with 176 credits

SEMESTER-I

Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. B.C.A. - Sem-I Course Type: Subject-1 Code: BCA-101-TH Course Title: Problem Solving and Programming in C		
Teaching Scheme 02 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
Prerequisites: <i>No prerequisites required</i>		
Course Objectives: <i>To provide a broad overview of problem-solving techniques.</i> <i>To learn C programming to solve problems.</i>		
Course Outcomes: <i>At the end of the course, students will be able to</i> <i>Define algorithms and explain their characteristics</i> <i>Formulate algorithm and draw flow chart to solve a given problem</i> <i>Explain use of appropriate data types, control statements</i> <i>Demonstrate ability to use top-down program design</i>		
Course Contents:		
Chapter-1	Chapter Name: Problem solving, algorithms and flowcharts	Hours: 06
- 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 etc.		
Chapter-2	Chapter Name: C Fundamentals	Hours: 07
- 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		
Chapter-3	Chapter Name: Control & Iterative Structures	Hours: 05
- If, If- Else Statements - Nested If Statements - Conditional Branching - switch statement - Loop statemets (while, do...while, for) - break, continue, goto statements		
Chapter-4	Chapter Name: Functions	Hours: 06
- Introduction to Functions - Function Arguments - Library & User defined functions, - Methods for parameter passing - Recursion - Storage Classes – Auto, Static, Global and Register		
Chapter-5	Chapter Name: Arrays	Hours: 06
- 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, Richard F. 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		

Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. B.C.A. - Sem-I Course Type: Subject-1 Code: BCA-102-PR Course Title: Lab Course based on BCA-101-TH		
Teaching Scheme 04 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
Prerequisites: Students must have learned a subject Problem Solving and Programming in C.		
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		
Practical Guidelines: <i>The instructor shall frame at least 08 assignments. Instructor's manual consisting of college syllabus, conduction & Assessment guidelines is to be developed.</i>		
Course Contents:		
Assignment-1	Assignment on use of data types, simple operators (expressions)	
Assignment-2	Assignment on control statements I (if , if-else, switch case, break, continue)	
Assignment-3	Assignment on control statements II (Loops – for, while, do-while)	
Assignment-4	Assignment on nested loops	
Assignment-5	Assignment on writing C programs in modular way (use of user defined functions)	
Assignment-6	Assignment on call by value, call by reference and recursive functions.	
Assignment-7	Assignment on use of arrays (1-D array) and functions	
Assignment-8	Assignment on use of multidimensional array (2-D arrays) and functions	

The Poona Gujarati Kelvani Mandal's Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y.B.C.A. Science Sem – I Course Type: Subject 2 Code: BCA-103-TH Course Title: Computer Organization and Architecture		
Teaching Scheme: 2 Hours /Week	No. of Credits: 2 Credits	Examination Scheme IE: 15 Marks EE: 35 Marks
Course Objective: • 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: - • Remember key concepts of number systems, digital codes, logic gates, Boolean algebra, and combinational circuits. • Understand the principles and characteristics of logic gates, digital components and block diagram of CPU, Memory and types of I/O transfers. • Apply knowledge to conversions, logic circuit design, and Boolean simplification. • Evaluate the functionality and applications of digital components or circuits.		
Course Content		
Chapter 1	Data representation and Computer Arithmetic	06 Hrs
Review of Decimal, Binary, Octal, Hexadecimal Number systems and their inter-conversion, BCD code, Gray code, Excess-3 code, ASCII, EBCDIC, Unicode, Signed and Unsigned numbers, 1's and 2's complements, Binary arithmetic.		
Chapter 2	Boolean Algebra & Logic Gates	06 Hrs
Boolean theorems, Boolean Laws, De Morgan's Theorem, Reduction of Logic expression using Boolean Algebra, Introduction to Logic (AND, OR, NOT), Classification of Logic gates, Universal Logic gates, Implementation of other gates using universal gates.		
Chapter 3	Combinational Circuits	06 Hrs

Definition of combinational circuits, Detail study of Half adder, Full adder, Half subtractor, Full subtractor, Multiplexer (4:1) & Demultiplexer (1:4), Encoder (8-line-to- 3-line) and Decoder (3-line-to-8-line), Parity generator and checker, Block diagram of ALU.		
Chapter 4	Sequential circuits	06 Hrs
Definition of sequential circuits, Detail study of Flip Flops and truth tables: S-R FF, J- K FF, T and D type FFs, Flip flop as memory device. Counters: Asynchronous-Up down counter, Synchronous- Ring counter, Event counter. Shift Registers and their types, serial to parallel and parallel to serial converters using shift registers.		
Chapter 5	CPU, Memory and I/O Organization	06 Hrs
Block diagram of CPU, functions of CPU, general register organization, flags, Concept of RISC and CISC Memory System hierarchy, Cache Memory, Internal Memory, External Memory, Concept of Virtual Memory. Basics of I/O organisation: types of I/O data transfers.		
Reference Books:		
1. R.P. Jain, “Modern Digital Electronics”, McGraw-Hill Publications 2. Flod and Jain, “Digital Fundamentals”, Pearson Publication. 3. Morris Mano, “Computer System Architecture” Prentice-Hall.		

The Poona Gujarati Kelavani Mandal's Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y.B.C.A (Science) Sem – I Course Type: Subject 2 Code: BCA-104-PR Course Title: Lab Course on CA-103-TH		
Teaching Scheme: 2 Hours /Week	No. of Credits: 2 Credits	Examination Scheme IE: 15 Marks EE: 35 Marks
Course Objective: - To study number system, logic gates - To understand combinational and sequential circuits - To provide a broad overview of architecture and the functioning of computer systems - To learn the basic concepts behind the architecture and organization of computers.		
Course Outcomes: - - Understand the design and build of digital circuits using logic gates. - Use breadboard / tag-board for building small electronic circuits. - Design digital circuits for different applications. - Validate observed outputs with expected theoretical outputs.		
Course Content		
Group A (Any 10)		
1.	Verification of logic gates by using digital ICs.	
2.	Verification of De Morgan's theorems.	
3.	Study of half adder and full adder using logic gates.	
4.	3-bit binary to Gray conversion using logic gates.	
5.	3-bit Gray to Binary conversion using logic gates.	
6.	Study of EX-OR gate as a 4-bit parity generator.	
7.	Study of EX-OR gate as a 4-bit parity checker.	
8.	Study of ALU using IC 74181.	
9.	Study of multiplexer and demultiplexer.	

10.	Study of Decimal to BCD encoder.
11.	Study of up-down counter
12.	Study of SR and JK flip flop
13.	Study of D and T flip
14.	Study of Serial In Parallel Out Shift register.
15.	Study of Parallel In Serial Out Shift register.
16.	Study of Diode matrix ROM
Group B: Activity (Any 1: Equivalent to 2 Practicals)	
1.	Perform any 2 experiments from Group A using circuit simulation software LTSPICE / Circuit Mod / Proteus etc. (Give preference to not performed experiments)
2.	Technical survey of 5 electronic digital appliances used in different fields.
Suggested Readings/Material:	
1. Digital Design - M. Morris Mano, PHI, New Delhi. 2. Digital Systems Principles and Applications - Ronald J. Tocci. 3. Digital electronics - G. K. Kharate, Oxford University Press. 4. Fundamentals of Digital Circuits - Anand Kumar. 5. Digital Principles and Applications - Malvino and Leach, TMG Hill Edition.	

The Poona Gujarati Kelavani Mandal's Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y.B.C.A. Science Sem – I Course Type: Subject 3 Code: BCA-105-TH Course Title: Discrete Mathematics and Statistics		
Teaching Scheme: 2 Hours /Week	No. of Credits: 2 Credits	Examination Scheme IE: 15 Marks EE: 35 Marks
Course Objective: - 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 - Give a data, compute various statistical measures of central tendency		
Course Content		
Unit	Title and content	No. of lectures in Clock Hours
1	Set Theory and Logic: 1.1 Sets – Set Theory, Need for Sets, Representation of Sets, Set Operations, cardinality of set, 1.2 Types of Sets – Bounded and Unbounded Sets, Countable and Uncountable Sets, Finite and Infinite Sets, Countable Infinite and Uncountable Infinite Sets, power set, 1.3 Propositional Logic - logic, Propositional Equivalences, Application of Propositional Logic-	06

	Translating English Sentences, Proof by Mathematical Induction and Strong Mathematical Induction.	
2	Relations and Functions: 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.	06
3	Counting and Probability: 3.1 The Basics of Counting, rule of Sum and Product, Permutations and Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, The Pigeonhole Principle. 3.2 Probability: Basic Concepts, Definition, Addition and Multiplication Theorems, Conditional probability and Bayes' Theorem	06
4	Data Presentation and Aggregation: 4.1Data Types: attribute, variable, discrete and continuous variable, 4.2Data presentation: frequency distribution, histogram, ogive, box-plot, bar plots 4.3Measures 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 4.4Measures of Dispersion: Standard Deviation, Root Mean Square, Variance, Absolute and Relative Dispersion	06
5	Correlation Theory and Sampling: 5.1Correlation: Bivariate data, scatter plots, Linear Correlation, Correlation of Attributes, Coefficient of correlation	06

	5.2 Regression: Concept, Linear Regression, Prediction 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, 20thEd. 6. John P. D’ angelo & Douglas B. West, “Mathematical Thinking–Problem Solving And Proofs” Prentice Hall, 2nd Ed.		

The Poona Gujarati Kelvani Mandal's Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y.B.C.A. Science Sem – I Course Type: Subject 3 Code: BCA-106-PR Course Title: Practical course on CA-105 - TH		
Teaching Scheme: 2 Hours /Week	No. of Credits: 2 Credits	Examination Scheme IE: 15 Marks EE: 35 Marks
Course Objective: - 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, students 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.		
Course Content		
Practical No.	Title and content	No. of lectures in Clock Hours
Applied Mathematics: Practical based on following topics		
1.	Set Theory	04
2.	Logic	04
3.	Mathematical Induction	04
4.	Relations	04
5.	Lattice	04
6.	Functions	04
7.	Counting principal, Permutation and Combination	04
8.	Probability	04

Statistics (To be performed using R software)		
9.	Download and Install R, understand IDE	04
10.	Using R executes the basic commands, array, list and frames	04
11.	Using R execute the basic commands, perform operations	04
12.	Using R execute the basic commands, draw different graphs	04
13	Using R Execute the statistical functions: mean, median, mode, quartiles, range.	04
14.	Using R imports the data from Excel / .CSV file and calculates the standard deviation.	04
15.	Import the data from Excel / .CSV and perform the Statistical distribution: Normal Distribution.	04
Reference Books:		
1. Richard Cotton, “Learning R”, SPD O’Reilly Publications		

Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. B.C.A. - Sem-I Course Type: SEC (2) Code: SEC-101-BCA-PR Course Title: HTML and Web Page Designing		
Teaching Scheme 04 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
Prerequisites: <i>No prerequisites required</i>		
Course Objectives: <i>To understand web based application development process.</i> <i>To study basics of HTML elements and tag.</i> <i>To know usage of CSS in HTML.</i> <i>To design and create simple websites.</i> <i>To apply JavaScript to websites.</i>		
Course Outcomes: <i>After successful completion of this course, learner will be able to</i> <i>Enlist various HTML elements and tags</i> <i>Use HTML elements and tags</i> <i>Apply CSS and Java script features.</i> <i>Design a website using HTML, CSS and JavaScript.</i>		
Practical Guidelines: <i>The instructor shall frame at least 08 assignments. Instructor's manual consisting of college syllabus, conduction & Assessment guidelines is to be developed.</i>		
Course Contents:		
Assignment-1	Using basic HTML elements (headings, paragraphs, line break, color, fonts, links, Images, etc.)	
Assignment-2	Creating Lists and Tables using HTML Tags	
Assignment-3	Creating Frames in HTML	
Assignment-4	Creating Forms using HTML	
Assignment-5	Designing of HTML screens using CSS	
Assignment-6	Using Functions in JavaScript	
Assignment-7	Carryout Validation and Event Handling using JavaScript	
Assignment-8	Designing website using basic elements of HTML, CSS and JavaScript.	

Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. B.C.A. - Sem-I Course Type: GE/OE* (2) Code: OE-151-BCA-PR Course Title: Introduction to Data Science		
Teaching Scheme 02 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
Prerequisites: <i>No prerequisites required</i>		
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: <i>At the end of the course, students will be able to</i> - Define Data Science Tasks and Models and Lifecycle - Apply Prep-processing and visualization Techniques		
Course Contents:		
Chapter-1	Chapter Name: Introduction	Hours: 06
- What is Data Science? - 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		
Chapter-2	Chapter Name: Statistics for Data Science	Hours: 06
- 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		
Chapter-3	Chapter Name: Data science Models and Tasks	Hours: 06
- Predictive and Descriptive Models - Introduction to Data Science Tasks – Classification, Prediction, Association, Clustering, - Performing simple Data Science Tasks using WEKA / R		
Chapter-4	Chapter Name: Data Quality and Pre-processing	Hours: 06
- 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		
Chapter-5	Chapter Name: Data Visualization	Hours: 06

- 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. Data Mining Concepts and Techniques, Third Edition, Jiawei Han, Micheline Kamber, Jian Pei, Morgan Kaufmann, 2012.

SEMESTER-II

Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. B.C.A. - Sem-II Course Type: Subject-1 Code : BCA-151-TH Course Title : Advanced C Programming		
Teaching Scheme 02 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
Prerequisites: <i>No prerequisites required</i>		
Course Objectives: • <i>To learn advanced features in C Programming</i> • <i>To study advanced data types</i> • <i>To understand built-in library functions</i>		
Course Outcomes: <i>On completion of the course, student will be able to–</i> • <i>Write programs using pointers and structures</i> • <i>Use Pre-processor directives</i> • <i>Manipulate strings using library functions</i> • <i>Write programs to perform operations on Files</i>		
Course Contents:		
Chapter-1	Chapter Name: Preprocessor	Hours: 06
• 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_)		
Chapter-2	Chapter Name: Pointers	Hours: 07
• 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, • Pointers & const		

Dynamic memory management, Allocation, Resizing, Releasing, Memory leak / dangling pointers Input Output Statements: printf, scanf functions, getchar, putchar, getch functions, gets, puts functions, Escape sequence characters, Format specifiers		
Chapter-3	Chapter Name: S	Hours: 05
- 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		
Chapter-4	Chapter Name: Structures	Hours: 06
- 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		
Chapter-5	Chapter Name: File Handling	Hours: 06
- 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: - The C Programming Language (Second Edition) – By B. W. Kerninghan& D. M. Ritchie - Programming in C – A Practical Approach – By Ajay Mittal (Pearson Publications) - Programming with C – By Byron S Gottfried (Schaum's Outlines) - A structural Programming Approach using C – By BehrouzForouzan& Richard Gilberg - Y S Kanetkar, "Let Us C", BPB PublicationsMaureen Spankle, "Problem Solving and Programming Concepts", ISBN: 81-317-0711- 3		

Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. B.C.A. - Sem-II Course Type: Subject-1 Code : BCA-152-PR Course Title : Lab Course based on BCA-151-TH		
Teaching Scheme 04 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
Prerequisites: Students must have learned a subject Advanced C Programming		
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, students 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		
Practical Guidelines: The instructor shall frame at least 08 assignments. Instructor's manual consisting of College syllabus, conduction & Assessment guidelines is to be developed.		
Course Contents:		
Assignment-1	To demonstrate use of preprocessor directives	
Assignment-2	To demonstrate use of pointers	
Assignment-3	To demonstrate advanced use of pointers	
Assignment-4	To demonstrate concept of strings, array of strings	
Assignment-5	To demonstrate string operations using pointers, command line arguments	
Assignment-6	To demonstrate structures (using array and functions)	
Assignment-7	To demonstrate nested structures	
Assignment-8	To demonstrate file handling	

The Poona Gujarati Kelvani Mandal's Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y.B.C.A. Science Sem – II Course Type: Subject 2 Code: BCA-153-TH Course Title: Introduction to Microcontrollers		
Teaching Scheme: 2 Hours /Week	No. of Credits: 2 Credits	Examination Scheme IE: 15 Marks EE: 35 Marks
Course Objective: - 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: - After completing the course, student will be able to - Recall microcontroller concepts and 8051 architecture components. - Explain the 8051-block diagram and SFR. - Write assembly programs and interface 8051 with external memory. - Debug assembly programs for I/O, timers, and interrupts. - Develop C programs for 8051 I/O operations and applications.		
Course Content		
Chapter 1	Introduction of 8051 Microcontroller	09 Hrs
Introduction of microcontrollers and microprocessors, difference between microcontrollers and microprocessors, classification of microcontrollers, Applications of microcontrollers. Features of 8051 microcontrollers, block diagram & Architecture of 8051, Internal Memory organization, SFRS, PSW register, pin functions of 8051, Structure of I/O ports, External Memory Interface.		
Chapter 2	8051 Programming Model	08 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.		
Chapter 3	Timers and Counters	06 Hrs

Timer / counter: TMOD, TCON, SCON, SBUF, PCON Registers, Timer modes, programming for time delay using mode 1 and mode 2.		
Chapter 4	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 andMcKinley, Pearson publications. 2. The 8051 microcontroller – Architecture, programming and applications: K.UmaRao and Andhe Pallavi, Pearson publications.		

The Poona Gujarati Kelvani Mandal's Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y.B.Sc. (Computer Science) Sem – II Course Type: Subject 2 Code: BCA-154-PR Course Title: Lab Course on CA-153-TH		
Teaching Scheme: 2 Hours /Week	No. of Credits: 2 Credits	Examination Scheme IE: 15 Marks EE: 35 Marks
Course Objective: - 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 microcontrollers. - Interface I/O peripherals to 8051 microcontroller. - Design simple microcontroller-based applications.		
Course Content		
Group A (Any 9)		
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 memorieslocations.	
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.
Group B: Project (Equivalent to 3Practicals)	
1.	Develop a module based on microcontroller project
Suggested Readings/Material:	
1. 8051 microcontroller and Embedded system using assembly and C : Mazidi andMcKinley, Pearson publications. 2. The 8051 microcontroller – Architecture, programming and applications: K.UmaRao and Andhe Pallavi, Pearson publications.	

The Poona Gujarati Kelvani Mandal's Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y.B.C.A. Science Sem – II Course Type: Subject 3 Code: BCA-155-TH Course Title: Linear Algebra		
Teaching Scheme: 2 Hours /Week	No. of Credits: 2 Credits	Examination Scheme IE: 15 Marks EE: 35 Marks
Course Objective: - 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: - After completing the course, student 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		
Course Content		
Unit	Title and content	No. of lectures in Clock Hours
1	Systems of Linear Equations and Matrices 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	06

	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 Solution of System of Equations: Gauss elimination and Gauss-Jordan elimination method, examples.	
2	Vector Spaces - I 2.1 Definition and examples 2.2 Basis of vector space 2.3 Subspaces 2.4 Linear Dependence and Independence (Statement and examples only)	06
3	Vector Spaces - II 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	06
4	Eigen values and Eigen vectors 4.1 Eigen values 4.2 Eigen vectors 4.3 Diagonalization	06
5	Linear Transformations 5.1 Definition and Examples, Properties, Equality 5.2 Kernel and range of linear Transformation 5.3 Rank-Nullity theorem (Statement only) 5.4 Matrix representation of Linear Transformation	06
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.		

The Poona Gujarati Kelvani Mandal's Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y.B.C.A. Science Sem – II Course Type: Subject 3 Code: BCA-156-PR Course Title: Practical course on CA-155 - TH		
Teaching Scheme: 2 Hours /Week	No. of Credits: 2 Credits	Examination Scheme IE: 15 Marks EE: 35 Marks
Course Objective: - To learn to apply theoretical concepts of discrete mathematics and statistics to solve problems. - To provide hands-on experience on R software.		
Course Outcomes: - After completing the course, students 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.		
Course Content		
Practical No	Title and content	No. of lectures in Clock Hours
Applied Mathematics: Practical based on following topics		
1.	Row echelon or Row reduced echelon form	04
2.	System of linear equations using rank, condition for consistency (homogeneous and non-homogeneous)	04
3.	Gauss elimination and Gauss-Jordan elimination method	04
4.	Vector Space and Subspace	04
5.	Linear Dependence and Independence	04
6.	Row Space, Column Space, and Null Space of a matrix and Rank and Nullity	04

7.	Eigen value, eigenvectors and diagonalizable	04
8.	Linear Transformation	04
Statistics (To be performed using R software)		
9.	Download and Install Scialb software	04
10.	Using Scialb software execute the basic commands, Basic math operations: Arithmetic, Trigonometric, Rational and logical.	04
11.	Using Scialb software execute the basic commands. Vector operations and Matrix operations and Row echelon or Row reduced echelon form	04
12.	Using Scialb software to solve system of linear equations	04
13	Using Scialb software creates vector and perform the operations	04
14.	Using Scialb software Execute the Row Space, Column Space, and Null Space of a matrix and Rank and Nullity	04
15.	Using Scialb software Execute the: Rank ,Eigen value ,Eigen vector and diagonalizable	04

Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. B.C.A. - Sem-II Course Type: SEC (2) Code : SEC-151-BCA-PR Course Title : Software Tools for Business Communications		
Teaching Scheme 04 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
Prerequisites: <i>No prerequisites required</i>		
Course Objectives: • <i>To study word processing, spreadsheets and presentation tools</i> • <i>To learn G-suite</i> • <i>To be familiar with tools for Electronic communications</i>		
Course Outcomes: <i>At the end of the course, students will be able to</i> • <i>Perform various word processing tasks</i> • <i>Prepare spreadsheets and presentations</i> • <i>Collect feedbacks and make surveys</i> • <i>Communicate and collaborate through electronic communications</i>		
Practical Guidelines: <i>The instructor shall frame at least 08 assignments. Instructor's manual consisting of college syllabus, conduction & Assessment guidelines is to be developed.</i>		
Course Contents:		
Chapter-1	Chapter Name: Word processing and Google DOCs	No of Assignments: 02
• 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		
Chapter-2	Chapter Name: Spreadsheets and Google Sheets	No of Assignments: 02
• 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		
Chapter-3	Chapter Name: Presentations and Google Slides	No of Assignments: 01
• 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		
Chapter-4	Chapter Name: Google Forms, Drives and Calendar	No of Assignments: 01
• 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		
Chapter-5	Chapter Name: Emails, Groups and Generative AI Tools	No of Assignments: 02
• 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)		

Haribhai V. Desai College of Arts, Science and Commerce, Pune. (Autonomous) F.Y. B.C.A. - Sem-II Course Type: GE/OE* (2) Code : OE-151-BCA -PR Course Title : Data Science using Spreadsheets		
Teaching Scheme 02 Hours/Week	No. of Credits 02	Examination Scheme CIE : 15 Marks SEE : 35 Marks
Prerequisites: <i>No prerequisites required</i>		
Course Objectives: • <i>To know spreadsheet concepts</i> • <i>To learn functions and formulas.</i> • <i>To understand charts and graphics.</i> • <i>To be familiar with filters and sorting of table data</i>		
Course Outcomes: <i>After successful completion of this course, learner will be able to</i> • <i>Perform computations on data using formulas.</i> • <i>Present the data in graphical form.</i> • <i>Analyze data by applying various functions and filters</i>		
Practical Guidelines: <i>The instructor shall frame at least 08 assignments. Instructor's manual consisting of College syllabus, conduction & Assessment guidelines is to be developed.</i>		
Course Contents:		
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 ,AveragIf, AveragIfs).
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: - Beginning Excel 2019, Authors: Noreen Brown, Barbara Lave, Julie Romey, Open Oregon Educational Resources - Excel Step by Step (Office 2021 and Microsoft 365) Published with the authorization of Microsoft Corporation by: Pearson Education, Inc. - Excel Bible: The Comprehensive Tutorial Resource	

7. Excel: Quick Start Guide from Beginner to Expert (Excel, Microsoft Office)
8. Building Financial Models with Excel: A Guide for Business Professionals, (MISL- WILEY)
9. Predictive Analytics: Excel
10. 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/>

Haribhai V. Desai College of Arts, Science and Commerce, Pune.**Structure of UG Program as per NEP-2020****Name of Program: B.C.A.****Major Course: Computer Applications.**

Eligibility:

H.S.C. (10 + 2) Science stream

OR

Three years diploma course after S.S.C. (10th std.) of Board of Technical Education conducted by Government of Maharashtra or its equivalent.

Objectives:

- **Enhance Problem-Solving Skills:** Develop strong computer-aided problem-solving abilities to effectively address real-world challenges.
- **Build Analytical Expertise:** Equip students with the essential skillset and analytical capabilities required to design computer-based solutions.
- **Foster Professional Skills:** Provide comprehensive training in professional competencies tailored to the software industry.
- **Strengthen Research Foundations:** Establish a robust knowledge base to support research and development in the field of computer applications.
- **Cultivate Career and Entrepreneurial Success:** Empower students to build successful careers in computer applications and inspire future entrepreneurs to innovate and create software products.

Haribhai V. Desai College of Arts, Science and Commerce, Pune.**Structure of UG Program as per NEP-2020****Name of Program: B.C.A.****Major Course: Computer Applications.**

Workload

1. Each theory credit is equivalent to 15 clock hours of teaching (i.e. for 2 Credits – 30 Clock Hours) and each practical credit is equivalent to 30 clock hours (i.e. for 2 Credits – 60 Clock Hours) of teaching in a semester.
2. There is 15 weeks of teacher-student interaction during the semester.
3. The 15 week is divided into 12 weeks teaching and 3 weeks for continuous assessment including preparation time to students during the semester.
4. The workload will be calculated based on 12 weeks teaching only.
5. For the purpose of computation of work-load the following mechanism may be adopted as per UGC guidelines.
6. Workload as per credit is as follows:
 - i. 1 Credit = 1 Theory period of one hour duration per week.
 - ii. 1 Credit = 1 Tutorial period of one hour duration per week.
 - iii. 1 Credit = 1 Practical period of two-hour duration per week.
7. Each theory Lecture time for FY, SY, TY is 60 min. (3 Lectures per week for 2 credit courses)
8. Each practical session time for FY/ SY /TY is 4 hours i.e. 240 min.

Haribhai V. Desai College of Arts, Science and Commerce, Pune.

Structure of UG Program as per NEP-2020

Name of Program: B.C.A.

Major Course: Computer Applications.

Credit Framework

Level	Sem	Subject-				Subject-	Subject-	GE/	SEC	IKS	AEC	VEC	CC	Total
4.5/100	I	2(T)+2(P)				2(T)+2(P)	2(T)+2(P)	2(T)	2(T/P)	2(T)	2(T)	2	-	22
	II	2(T)+2(P)				2(T)+2(P)	2(T)+2(P)	2(P)	2(T/P)	-	2(T)	2	2	22
Exit Option: Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF Course/Internship OR Continue with Major and Minor Continue Option: Student will select one subject among the (Subject-1, Subject-2, and Subject-3) as major and another as minor and third subject will be dropped.														
Level /Difficulty	Sem	Credits related to major				Minor		GE/ OE	SEC	IKS	AEC	VEC	CC	Total
		Discipline Specific Core	Discipline Specific Elective (DSE)	VSC	FP/ OJT /CEP									
5.0/200	III	4(T)+2(P)	-	2(T/P)	2 (FP)	4(T)+2(P)	-	2(T)	-	-	2(T)	-	2	22
	IV	4(T)+2(P)	-	2(T/P)	2(CEP)	2(T)+2(P)	-	2(P)	2(T/P)	-	2(T)	-	2	22
Exit Option: Award of UG Diploma in Major and Minor with 88 credits and an additional 4 credits core NSQF Course/Internship OR Continue with Major and Minor.														
5.5/300	V	8(T)+4(P)	2(T)+2(P)	2(T/P)	(FP/ CEP)	-	-	-	-	2(T)	-	-	-	22
	VI	8(T)+4(P)	2(T)+2(P)	2(T/P)	4(OJT)	-	-	-	-	-	-	-	-	22
Total 3 Years		44	8	8	10	18	8	8	6	4	8	4	6	132
Exit Option: Award of UG degree in Major with 132 credits OR Continue with Major and Minor.														
6.0/400	VII	6(T)+4(P)	2(T)+2(P)	-	4(RP)	4(T)(RM)	-	-	-	-	-	-	-	22
	VIII	6(T)+4(P)	2(T)+2(P)	-	8(RP)	-	-	-	-	-	-	-	-	22
Total 4 Years		64	16	8	22	22	8	8	6	4	8	4	6	176
Exit Option: Award of UG Honors with Research Degree in Major and Minor with 176 credits.														
6.0/400	VII	10(T)+4(P)	2(T)+2(P)	-	-	4(T)(RM)	-	-	-	-	-	-	-	22
	VIII	10(T)+4(P)	2(T)+2(P)	-	4(OJT)	-	-	-	-	-	-	-	-	22
Total 4 Years		72	16	8	14	22	8	8	6	4	8	4	6	176
Exit Option: Award of UG Honors Degree in Major and Minor with 176 credits.														

Haribhai V. Desai College of Arts, Science and Commerce, Pune.**Structure of UG Program as per NEP-2020****Name of Program: B.C.A.****Major Course: Computer Applications.**

Reference Books**Computer Application:**

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, Richard F. 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 Spangle, "Problem Solving and Programming Concepts", ISBN: 81-317-0711- 3 7. Y S Kanetkar, "Let Us C", BPB Publications

Electronics:

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.
4. Digital Design - M. Morris Mano, PHI, New Delhi.
5. Digital Systems Principles and Applications - Ronald J. Tocci.
6. Digital electronics - G. K. Kharate, Oxford University Press.
7. Fundamentals of Digital Circuits - Anand Kumar.
8. Digital Principles and Applications - Malvino and Leach, TMG Hill Edition.
9. 8051 microcontroller and Embedded system using assembly and C : Mazidi and McKinley, Pearson publications.
10. The 8051 microcontroller – Architecture, programming and applications: K.Uma Rao and Andhe Pallavi, Pearson publications.

Mathematics:

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, 20thEd.
6. John P. D’angelo & Douglas B. West, “Mathematical Thinking–Problem Solving And Proofs” Prentice Hall, 2nd Ed.
7. K. Hoffman and R. Kunze, Linear Algebra, 2nd edition (2014), Prentice Hall of India, New Delhi
8. Steven J. Leon, Linear Algebra with Applications, 4th edition (1994), Prentice Hall of India. New Delhi
9. Vivek Sahai, Vikas Bist, Linear Algebra, 4th Reprint 2017, Narosa Publishing House, New Delhi.
10. Richard Cotton, “Learning R”, SPD O’Reilly Publications

Haribhai V. Desai College of Arts, Science and Commerce, Pune.**Structure of UG Program as per NEP-2020****Name of Program: B.C.A.****Major Course: Computer Applications.**

Examination Pattern

1. Examination pattern is 70-30 i.e. Semester End Examination (SEE) is of 70 % and Continuous Internal Assessment is of 30 %.

Theory, Practical/Project: -**Continuous Internal Assessment (CIA): 30 % [15 Marks]**

1. Written Test- 33.33 % [5 Marks]
2. Presentation/Assignment: - 33.33 % [5 Marks]
3. Project/Activity Oriented Learning: -33.34 % [5 Marks]

Semester End Examination (SEE): - 70 % [35 Marks]

2. For Internal examination, written test should be conducted of 15 marks for 2 credits.

Haribhai V. Desai College of Arts, Science and Commerce, Pune.**Structure of UG Program as per NEP-2020****Name of Program: B.C.A.****Major Course: Computer Applications.**

Paper Pattern**Internal Examination***(15 Marks Examination converted into 5 Marks for final assessment)***Que-1:** Choose correct option (MCQs) (10-MCQs with Multiple Options) – **5 Marks.****Que-2:** Answer the following questions (Short answer questions) (any 3 out of 5)- **6 Marks****Que-3:** Answer the following questions (Short answer Definition/Problems/Diagram) (any 1 out of 2)–
4 Marks.**External Examination****Que-1:** [5 Marks]

Answer the following questions (Short answer/Definition/Problems/Diagram, etc.) (Any 5 out of 7)

Que-2: [10 Marks]**A]** Answer the following questions (Short answer questions- 2 Que out of 3) [6 Marks]**B]** Answer the following questions (Long answer questions/Problems- 1 Que out of 2) [4 Marks]**Que-3:** [10 Marks]**A]** Answer the following questions (Short answer questions- 2 Que out of 3) [6 Marks]**B]** Answer the following questions (Long answer questions/Problems- 1 Que out of 2) [4 Marks]**Que-4:** [10 Marks]

Write a short notes on following (4 out of 6)

Haribhai V. Desai College of Arts, Science and Commerce, Pune.

Structure of UG Program as per NEP-2020

Name of Program: B.C.A.

Major Course: Computer Applications.

Completion of Degree

1. A student who earns 44 credits at First year with additional 4 credits core NSQF Course/Internship shall be eligible for the award of UG Certificate in Major subject. OR May continues with Major and Minor.
2. A student who earns 88 credits at Second year with additional 4 credits core NSQF Course/Internship shall be eligible for the award of UG Diploma in Major subject with Minor (Selected at SY). OR May continues with Major and Minor.
3. A student who earns 132 credits at Third year shall be eligible for the award of UG Degree in Major subject with Minor (Selected at SY). OR May continues with Major and Minor.
4. A student who earns 176 credits in Four years shall be eligible for the award of UG Honors or Honors with Research in Major subject with Minor (Selected at SY).

Award of Degree:

CGPA will be calculated for students who completed 132/176 credits, grades are given as per the following table.

Sr. No.	Grade Letter	Grade Point	Marks
1.	O (Outstanding)	10	90<= Marks <= 100
2.	A+ (Excellent)	9	75<= Marks <= 89
3.	A (Very Good)	8	60<= Marks <= 74
4.	B+ (Good)	7	55<= Marks <= 59
5.	B (Above Average)	6	50<= Marks <= 54
6.	C (Average)	5	45<= Marks <= 49
7.	D (Pass)	4	40<= Marks <= 40
8.	F (Fail)	0	Marks <40
9.	AB (Absent)	0	-
