Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science & Commerce, Baramati

(Empowered Autonomous)

Three/Four Year Honours/Honours with Research BCA Degree

Program in BCA

(Faculty of Commerce and Management)

CBCS Syllabus

SYBCA

For Department of BCA

NEP-2.0

Choice Based Credit System Syllabus

(2024 Pattern)

(As Per NEP-2020)

To be implemented from Academic Year 2025-2026

Title of the Programme: SYBCA

Preamble

AES's Tuljaram Chaturchand College has decided to change the syllabus of various faculties from June, 2023 by taking into consideration the guidelines and provisions given in the National Education Policy (NEP), 2020. The NEP envisions making education more holistic and effective and to lay emphasis on the integration of general (academic) education, vocational education and experiential learning. The NEP introduces holistic and multidisciplinary education that would help to develop intellectual, scientific, social, physical, emotional, ethical and moral capacities of the students. The NEP 2020 envisages flexible curricular structures and learning based outcomes for the development of the students. The credit structure and the courses framework provided in the NEP are nationally accepted and internationally comparable.

In response to the rapid advancements in science and technology and the evolving approaches in various domains of Computer Science and related subjects, Board of Studies in BCA of Tuljaram Chaturchand College, Baramati - Pune has prepared the syllabus of SYBCA Semester - III under the Choice Based Credit System (CBCS) by following the guidelines of NEP 2020, NCrF, NHEQF, Prof. R.D. Kulkarni's Report, GR of Gov. of Maharashtra dated 20th April, 16th May 2023 and 13th March, 2024 and Circular of SPPU, Pune dated 31st May 2023 and 2nd May, 2024.

BCA is Undergraduate Degree Program with Computer Applications. This program provides sound knowledge of theory and practical's. The different subjects helps the students to design, develop and implement software Applications, to learn emerging computer technologies and produce skilled human resource to face the professional challenges.

Overall, revising the BCA syllabus in accordance with the NEP 2020 ensures that students receive an education that is relevant, comprehensive, and prepares them to navigate the dynamic and interconnected world of today. It equips them with the knowledge, skills, and competencies needed to contribute meaningfully to society and pursue their academic and professional goals in a rapidly changing global landscape.

Programme Outcome for NEP 2020
(With Effect from June 2025-26)
Commerce and Management (Under Graduate Programme)

PO1: Comprehensive Knowledge and Understanding:

Graduates will possess a profound understanding of their field of study, including foundational theories, principles, methodologies, and key concepts, within a broader multidisciplinary context.

PO2: Practical, Professional, and Procedural Knowledge:

Graduates will acquire practical skills and expertise essential for professional tasks within their field. This includes knowledge of industry standards, best practices, regulations, and ethical considerations, with the ability to apply this knowledge effectively in real-world scenarios.

PO3: Entrepreneurial Mindset and Knowledge:

Graduates will cultivate an entrepreneurial mindset, identifying opportunities, fostering innovation, and understanding business principles, market dynamics, and risk management strategies.

PO4: Specialized Skills and Competencies:

Graduates will demonstrate proficiency in technical skills, analytical abilities, problem-solving, effective communication, and leadership, relevant to their field of study. They will also adapt and innovate in response to changing circumstances.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning:

Graduates will possess the capacity to apply learned concepts in practical settings, solve complex problems, and analyze data effectively. This requires critical thinking, creativity, adaptability, and a readiness to learn and take calculated risks.

PO6: Communication Skills and Collaboration:

Graduates will effectively communicate complex information, both orally and in writing, using appropriate media and language. They will also collaborate effectively in diverse teams, demonstrating leadership qualities and facilitating cooperative efforts toward common goals.

PO7: Research-related Skills:

Graduates will demonstrate observational and inquiry skills, formulate research questions, and utilize appropriate methodologies for data collection and analysis. They will also adhere to research ethics and effectively report research findings.

PO8: Learning How to Learn Skills:

Graduates will acquire new knowledge and skills through self-directed learning, adapt to changing demands, and set and achieve goals independently.

PO9: Digital and Technological Skills:

Graduates will demonstrate proficiency in using ICT, accessing information sources, and analyzing data using appropriate software.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy:

Graduates will engage effectively in multicultural settings, respecting diverse perspectives, leading diverse teams, and demonstrating empathy and understanding of others' perspectives and emotions.

PO11: Value Inculcation and Environmental Awareness:

Graduates will embrace ethical and moral values, practice responsible citizenship, recognize and address ethical issues, and take appropriate actions to promote sustainability and environmental conservation.

PO12: Autonomy, Responsibility, and Accountability:

Graduates will apply knowledge and skills independently, manage projects effectively, and demonstrate responsibility and accountability in work and learning contexts.

PO13: Community Engagement and Service:

Graduates will actively participate in community-engaged services and activities, promoting societal well-being.

Programme Specific Outcomes (PSOs)

PSO1. **Knowledge:** To understand and apply the fundamental principles, concepts, and methods in diverse areas of computer science, computer applications, mathematics, statistics, etc.

PSO2. **Problem Analysis:** Identify, analyze and formulate complex real-life computing problems. Attain substantiated conclusions to solve the problems using fundamental principles of computer science and application domains by using various tools and emerging technologies.

PSO3. **Design and Development:** Design and develop efficient solutions for complex real-world computing problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety and the cultural, societal, and environmental considerations.

PSO4. **Conduct investigations of complex problems:** Ability to research, analyze and Investigate complex computing problems through the design of experiments, analysis, and interpretation of data, and synthesis of the information to arrive at valid conclusions.

PSO5. **Modern Tool Usage:** Create, identify and apply appropriate techniques, skills, and modern computing tools to computing activities.

***PSO6*.** **Ethics and Social Responsibility:** Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.

PSO7. **Individual and Team Work:** Ability to work effectively as an individual, and as a member or leader as per need in, multidisciplinary teams.

PSO8. **Life-Long Learning:** Recognize the need and have the ability to engage in Independent continuous reflective learning in the context of technological advancement.

PSO9. **Project Management:** Understand and apply computing, management principles to manage projects.

***PSO10*. Communication:** Able to use interpersonal skills and communicate effectively with the professionals and with society to convey technical information effectively and accurately and able to comprehend and write effective reports, design documentation, and make effective presentations.

***PSO11*. Innovation, employability, and Entrepreneurial skills:** Identify opportunities, and pursue those opportunities to create value and wealth for the betterment of the individual and society at large.

Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Empowered Autonomous)

Board of Studies in B.C.A.

(Academic Year 2025-26 to 2027-28)

Sr. No.	Name of Member	Designation
1.	Mr. Shah Vishal V.	Chairperson
2.	Mr. Shah Rahul A.	Member
3.	Ms. Kulkarni Prajakta P.	Member
4.	Mrs. Bhagat Asmita A.	Member
5.	Ms. Londhe Kalyani W.	Member
6.	Mrs. Swami Poornima C.	Member
7.	Mr. Chemte Swapnil P.	Member
8.	Ms. Saste Madhuri R.	Member
9.	Dr. Ponde Poonam	Member (Expert from SPPU, Pune)
10.	Dr. Dongardive Jyotshna	Member (Expert from Other University)
11.	Dr. Magre Ritesh	Member (Expert from Other University)
12.	Mr. Jain Abhishek	Member (Expert from industry)
13.	Mr. Mane Sandip M.	UG Student

Credit distribution Structure of B.C.A. (2024 Pattern)

Level	Sem.	Core Courses				Minor	GE/OE	AEC	IKS Gen.	VEC	SEC	CC	Total
4.5	I	6(T)+6(P)				-	2 (T)	2(T)	2(T)	2(T)	2(P)	-	22
	II	6(T)+6(P)				-	2 (P)	2(T)	-	2(T)	2(P)	2	22
Exit Option : Award of **UG Certificate** in Major With **Total Credits 44**													
Continue option: Student will select Computer as major and one as Minor.													
Level	**Sem.**	**Credit Related to Major**				**Minor**	**GE/OE**	**AEC**	**IKS Gen.**	**VEC**	**SEC**	**CC**	**Total**
		Major Core	**Major Elective**	**VSC**	**FP/OJT/ CEP/RP**								
5.0	III	4(T) + 2(P)	-	2 (T/P)	2(FP)	2(T)+2(P)	2(T)	2(T)	2(T)	-	-	2(T)	22
	IV	4(T) + 2(P)	-	2 (T/P)	2(CEP)	2(T)+2(P)	2(P)	2(T)	-	-	2(T/P)	2(T)	22
Exit Option: Award of **UG Diploma** in Major and Minor With **Total Credits 88** OR Continue with Major and Minor.													
5.5	V	8(T) + 4(P)	2(T) + 2(P)	2 (T/P)	2(FP/CEP)	2(T)	-	-	-	-	-	-	22
	VI	8(T) + 4(P)	2(T) + 2(P)	2 (T/P)	4(OJT)	-	-	-	-	-	-	-	22
Total 3 Years		86				10	08	08	04	04	06	06	132
Exit Option: Award of **UG Degree** in Major and Minor With **Total Credits 132** OR Continue with Major and Minor.													
6.0	VII	6(T) + 4(P)	2(T) +2(T/P)	-	4(RP)	4(RM)(T)	-	-	-	-	-	-	22
	VIII	6(T) + 4(P)	2(T) +2(T/P)	-	8(RP)	-	-	-	-	-	-	-	22
Total 4 Years		126				14	08	08	04	04	06	06	176
Four Year **UG Honours with Research Degree** in Major and Minor with **Total credits 176**													
6.0	VII	10(T) + 4(P)	2(T) +2(T/P)	-	-	4(RM)(T)	-	-	-	-	-	-	22
	VIII	10(T) + 4(P)	2(T) +2(T/P)	-	4(OJT)	-	-	-	-	-	-	-	22
Total 4 Years		126				14	08	08	04	04	06	06	176
Four Year **UG Honours Degree** in Major and Minor with **Total credits 176**													

T = Theory, **P** = Practical, **DSC** = Discipline Specific Course, **OE** = Open Elective, **SEC** = Skill Enhancement Course, **IKS** = Indian Knowledge System, **AEC** = Ability Enhancement Course, **VEC** = Value Education

Course Structure of F.Y. BCA (2024 Pattern)
(As Per NEP-2020)

FY BCA – Semester –I							
Course Type	**Course Code**	**Paper Title**	**Hours/ Week**	**Credits**	**Internal**	**External**	**Total**
Major Mandatory	BCA-101 GEN	Problem Solving Techniques and Basic C Programming	02 (T)	02	20	30	50
	BCA-102 GEN	Lab Course on BCA-101 GEN	04(P)	02	25	25	50
	BCA-103 GEN	Computer Architecture	02(T)	02	20	30	50
	BCA-104 GEN	Lab Course on BCA-103 GEN	04(P)	02	25	25	50
	BCA-105 GEN	Foundation of Mathematics for Computer Science	02(T)	02	20	30	50
	BCA-106 GEN	Lab Course on BCA-105 GEN	04(P)	02	25	25	50
Open Elective (OE)	BBA-104 OE	Introduction to Data Science	02(T)	02	20	30	50
Skill Enhancement Course (SEC)	BCA-101 SEC	HTML & Web Page Designing	04(P)	02	25	25	50
IKS Generic	GEN-106-IKS	Indian Knowledge System	02(T)	02	20	30	50
Ability Enhancement Course (AEC)	ENG-101 AEC	General English – I	02(T)	02	20	30	50
Value Education Course (VEC)	ENV-105 VEC	Environmental Awareness	02(T)	02	20	30	50
Total				**22**	**240**	**310**	**550**

FY BCA – Semester -II							
Course Type	**Course Code**	**Paper Title**	**Hours/ Week**	**Credits**	**Internal**	**External**	**Total**
Major Mandatory	BCA-151 GEN	Advanced C Programming	02 (T)	02	20	30	50
	BCA-152 GEN	Lab Course on BCA-151 GEN	04(P)	02	25	25	50
	BCA-153 GEN	Introduction to Microcontroller	02(T)	02	20	30	50
	BCA-154 GEN	Lab Course on BCA-153 GEN	04(P)	02	25	25	50
	BCA-155 GEN	Linear Algebra	02(T)	02	20	30	50
	BCA-156 GEN	Lab Course on BCA-155 GEN	04(P)	02	25	25	50
Open Elective (OE)	BBA-154 OE	Data Science Using Spread Sheet	04(P)	02	25	25	50
Skill Enhancement Course (SEC)	BCA-151 SEC	Software Tools for Business Communication	04(P)	02	25	25	50
Ability Enhancement Course (AEC)	ENG-151 AEC	General English – II	02(T)	02	20	30	50
Value Education Course (VEC)	COS-155 VEC	Digital Technological Solution	02(T)	02	20	30	50
Co-curricular Course (CC)	PES-156 CC	Physical Education	02	02	20	30	50
Total				**22**	**245**	**305**	**550**

Course Structure of S.Y. BCA (2024 Pattern)
(As Per NEP-2020)

SY BCA – Semester -III				
Course Type	**Course Code**	**Course Title**	**Theory/ Practical**	**Credits**
Major Mandatory	BCA-201-MRM	Algorithms & Data Structures	Theory	02
Major Mandatory	BCA-202-MRM	Database Management Systems	Theory	02
Major Mandatory	BCA-203-MRM	Practical Lab on Algorithms & Data Structures	Practical	02
Vocational Skill Course (VSC)	BCA-204-VSC	Practical Lab on Database Management Systems	Practical	02
Field Project(FP)	BCA-205-FP	Field Project	Practical	02
Minor	BCA-206-MN	Fundamentals of ICT	Theory	02
Minor	BCA-207-MN	Practical Lab on Advanced Excel	Practical	02
Open Elective (OE)	BCA-208-OE	Informatics and Cyber laws	Theory	02
Subject Specific Indian Knowledge System (IKS)	BCA-209-IKS	Ancient Indian Foundations of Computing	Theory	02
Ability Enhancement Course (AEC)	MAR-210-AEC/ HIN-210-AEC/SAN-210-AEC	Selected from AEC Basket	Theory (Any One)	02
Co-curricular Course (CC)	YOG/PES/CUL/NSS/NCC-211-CC	To be continued from the Semester – II		02
			Total Credits of Semester - III	**22**

SY BCA – Semester –IV				
Course Type	**Course Code**	**Course Title**	**Theory/ Practical**	**Credits**
Major Mandatory	BCA-251-MRM	Advanced Data Structures	Theory	02
Major Mandatory	BCA-252-MRM	Relational Database Management System	Theory	02
Major Mandatory	BCA-253-MRM	Practical Lab on Advanced Data Structures	Practical	02
Vocational Skill Course (VSC)	BCA-254-VSC	Object Oriented Programming using Java	Theory	02
Community Engagement Project (CEP)	BCA-255-CEP	Community Engagement Project	Practical	02
Minor	BCA-256-MN	Digital Marketing	Theory	02
Minor	BCA-257-MN	Practical Lab on Digital Marketing	Practical	02
Open Elective (OE)	BBA-257-OE	Hands on Google Apps	Practical	02
Skill Enhancement Course (SEC)	BCA-259-SEC	Practical Lab on RDBMS	Practical	02
Ability Enhancement Course (AEC)	MAR-260-AEC/ HIN-260-AEC/ SAN-260-AEC	To be continued from the Semester – III	Theory (Any One)	02
Co-curricular Course (CC)	YOG/PES/CUL/ NSS/NCC-261-CC	To be continued from the Semester – III		02
			Total Credits of Semester - IV	**22**
			Total Credits Semester – III + IV	**44**

SEMESTER –III

CBCS Syllabus as per NEP 2020 for S.Y.B.C.A (2024 Pattern)

Name of the Programme : B.C.A.

Programme Code : BCA

Class : S.Y.B.C.A.

Semester : III

Course Type : Major Mandatory [Theory]

Course Code : BCA-201-MRM

Course Title : Algorithm & Data Structures

No. of Credits : 02

No. of Teaching Hours : 30

Prerequisites:

1. Basic knowledge of algorithms and problem solving.
2. Knowledge of C Programming Language.

Course Objectives:

1. To understand the basic techniques of algorithm analysis.
2. To understand the different methods of organizing large amount of data
3. To efficiently implement the different data structures
4. To efficiently implement solutions for specific problems
5. To understand various algorithmic strategies to approach the problem solution.
6. To understand the memory requirement for various data structures.
7. To understand various data searching and sorting methods with pros and cons

Course Outcomes:

By the end of the course, students will be able to:

CO1: Use well-organized data structures in solving various problems.

CO2: Differentiate the usage of various structures in problem solution.

CO3: Understand data structures such as arrays, lists, and queues.

CO4: Study the basic operations on arrays, lists, and queues.

CO5: Analyze and study various algorithms/ techniques.

CO6: Understand basics of memory allocation and how it used.

CO7: To efficiently implement the different data structures.

Topics and Learning Points

Unit	Title and Contents	No. of Lectures
1	**Introduction to Data Structures** 1.1 Data type, Data object 1.2 ADT - Definition, Operation 1.3 Need & Types of Data Structure 1.4 Types of Data Structure 1.5 Algorithm analysis 1.5.1 Algorithm – definition, characteristics 1.5.2 Space complexity, time complexity 1.5.3 Asymptotic notation (Big O, Omega Ω, Theta Notation Θ)	**04**
2	**Linear Data Structures** 2.1 Introduction to Arrays - array representation 2.2 Sorting algorithms with efficiency – Bubble sort, Insertion sort, Merge sort, Quick Sort 2.3 Searching techniques –Linear Search, Binary search	**08**
3	**Linked List** 3.1 Introduction to Linked List 3.2 Implementation of Linked List – Static & Dynamic representation, 3.3 Types of Linked List 3.4 Operations on Linked List - create, display, insert, delete, reverse, search, sort, concatenate &merge 3.5 Applications of Linked List – polynomial manipulation	**10**
4	**Stacks** 4.1 Introduction 4.2 Representation- Static & Dynamic 4.3 Operations – Create , Init , Push , Pop & Display 4.4 Application – Expression Conversion & Evaluation 4.5 Simulating recursion using stack	**08**

Reference Books:

1. Fundamentals of Data Structures ---- By Horowitz Sahani (Galgotia)
2. Data Structures using C and C++ --- By Yedidyah Langsam, Aaron M. Tenenbaum, Moshe J. Augenstein
3. Introduction to Data Structures using C---By Ashok Kamthane
4. Data Structures using C --- Bandopadhyay & Dey (Pearson)
5. Data Structures using C ---By Srivastav

Course Outcomes	Programme Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	3	2	3	3	2	2	3	3	2	2	3	2
CO2	3	3	2	3	3	2	2	3	3	2	2	3	2
CO3	3	3	1	2	3	1	1	2	2	1	1	2	1
CO4	3	3	1	2	2	1	1	2	2	1	1	2	1
CO5	3	3	1	2	2	1	1	2	2	1	1	2	1
CO6	2	2	1	2	2	1	1	2	1	1	1	2	1
CO7	3	3	2	3	3	2	2	3	3	2	2	3	2

Mapping- 3= strongly relates 2= Moderately Related 1= Partially Related

Course Objectives (CO) and Program Outcomes (PO) Mapping:

1. Justification of PO1 to All COs :

CO1:PO1- As proficiency in using data structures demonstrates a profound understanding of foundational theories and principles within the field of study, essential for problem-solving in a multidisciplinary context.

CO2:PO1- As the ability to differentiate between different data structures and their appropriate usage showcases a deep understanding of methodologies and key concepts, contributing to a broader multidisciplinary perspective.

CO3:PO1- As understanding discrete structures is foundational to grasping the theoretical underpinnings of computer science, enhancing knowledge within a broader multidisciplinary context.

CO4:PO1- As studying propositional logic and Boolean algebra provides a theoretical framework that is crucial for understanding foundational theories and principles within the field of study, contributing to a broader multidisciplinary perspective.

CO5:PO1- As the ability to analyze proof techniques demonstrates proficiency in applying methodologies and key concepts within the field of study, essential for understanding foundational theories and principles in a broader multidisciplinary context.

CO6:PO1- As understanding memory allocation contributes to a practical understanding of computer science concepts, although it may be less directly related to multidisciplinary contexts covered in PO1.

CO7:PO1- As the ability to efficiently implement data structures demonstrates practical application of foundational theories and principles, essential for problem-solving within a broader multidisciplinary context.

2. Justification of PO2 to All COs :

CO1:PO2- As practical skills in utilizing data structures are essential for professional tasks in problem-solving within real-world scenarios, aligning with industry standards and best practices.

CO2:PO2- As the ability to differentiate between different data structures and select the appropriate one for problem-solving reflects expertise and practical skills needed in professional tasks, adhering to industry standards and best practices.

CO3:PO2 - As understanding discrete structures is fundamental for applying knowledge in real-world scenarios, ensuring adherence to industry standards and best practices in problem-solving tasks.

CO4:PO2- As studying propositional logic and Boolean algebra provides a theoretical foundation essential for understanding industry standards, regulations, and ethical considerations in real-world scenarios.

CO5:PO2- As the ability to analyze proof techniques enhances problem-solving skills in professional tasks, aligning with industry standards and best practices.

CO6:PO2- As understanding memory allocation is practical knowledge applicable to professional tasks, although it may be less directly related to industry standards and regulations.

CO7:PO2- As the ability to efficiently implement data structures demonstrates practical expertise essential for professional tasks, aligning with industry standards and best practices.

3. Justification of PO3 to All COs :

CO1:PO3- As the ability to use data structures can contribute to problem-solving skills, which are important in identifying opportunities and fostering innovation, although it may not directly address business principles, market dynamics, and risk management strategies.

CO2:PO3- As the ability to differentiate between different data structures can enhance problem-solving abilities, which can indirectly contribute to fostering innovation and understanding market dynamics.

CO3:PO3- As understanding discrete structures may have limited direct relevance to cultivating an entrepreneurial mindset and understanding business principles, market dynamics, and risk management strategies.

CO4:PO3- As studying propositional logic and Boolean algebra may have limited direct relevance to entrepreneurial mindset or business principles, although it may indirectly enhance analytical skills important for risk management.

CO5:PO3- As studying proof techniques may have limited direct relevance to entrepreneurship or business principles, although it may indirectly enhance critical thinking skills important for identifying opportunities and fostering innovation.

CO6:PO3- As understanding memory allocation may have limited direct relevance to entrepreneurial mind set or business principles, although it may indirectly contribute to problem-solving abilities.

CO7:PO3- As the ability to efficiently implement data structures can contribute to problem-solving skills, which are important in identifying opportunities and fostering innovation, although it may not directly address business principles, market dynamics, and risk management strategies.

4. Justification of PO4 to All COs :

CO1:PO4- As proficiency in utilizing data structures demonstrates technical skills, analytical abilities, and problem-solving capabilities, essential for adapting and innovating in response to changing circumstances.

CO2:PO4- As the ability to differentiate between different data structures showcases analytical abilities and problem-solving skills, crucial for adapting and innovating in response to changing circumstances.

CO3:PO4- As understanding discrete structures enhances analytical abilities and problem-solving skills, although its direct impact on technical proficiency and effective communication may be limited.

CO4:PO4- As studying propositional logic and Boolean algebra develops analytical abilities and problem-solving skills, although its direct impact on technical proficiency and effective communication may be limited.

CO5:PO4- As analyzing proof techniques enhances analytical abilities and problem- solving skills, although its direct impact on technical proficiency and effective communication may be limited.

CO6:PO4- As understanding memory allocation contributes to technical proficiency and problem-solving skills, although its direct impact on effective communication and leadership may be limited.

CO7:PO4- As efficiently implementing data structures demonstrates technical proficiency, problem-solving abilities, and leadership qualities, crucial for adapting and innovating in response to changing circumstances.

5. Justification of PO5 to All COs :

CO1:PO5- As the ability to use data structures effectively in problem-solving requires critical thinking, creativity, adaptability, and readiness to learn, essential for applying learned concepts in practical settings and solving complex problems.

CO2:PO5- As the ability to differentiate between different data structures demonstrates critical thinking and adaptability, crucial for analyzing data effectively and solving complex problems in practical settings.

CO3:PO5- As understanding discrete structures enhances critical thinking and problem-solving abilities, essential for analyzing data effectively and solving complex problems in practical settings.

CO4:PO5- As studying propositional logic and Boolean algebra develops analytical skills and critical thinking, although its direct impact on creativity, adaptability, and readiness to take calculated risks may be limited.

CO5:PO5- As analyzing proof techniques requires critical thinking and creativity, essential for solving complex problems and taking calculated risks in practical settings.

CO6:PO5- As understanding memory allocation contributes to problem-solving abilities, although its direct impact on critical thinking and adaptability may be limited.

CO7:PO5- As efficiently implementing data structures requires critical thinking, creativity, adaptability, and a readiness to learn, essential for applying learned concepts in practical settings and solving complex problems.

6. Justification of PO6 to All COs :

CO1:PO6- As effectively communicating complex information and collaborating in diverse teams may require the ability to articulate the usage of data structures in problem- solving, but it may not directly address communication skills or teamwork.

CO2:PO6- As the ability to differentiate between different data structures may indirectly contribute to effective communication and collaboration by facilitating clear explanations and discussions within teams.

CO3:PO6- As understanding discrete structures may not directly address communication skills or teamwork but may indirectly contribute to problem-solving abilities within teams.

CO4:PO6- As studying propositional logic and Boolean algebra may enhance analytical skills but may not directly contribute to effective communication or teamwork.

CO5:PO6- As studying proof techniques may improve critical thinking skills but may not directly address communication skills or teamwork.

CO6:PO6 - As understanding memory allocation may not directly contribute to communication skills or teamwork but may indirectly support problem-solving abilities within teams.

CO7:PO6 - As efficiently implementing data structures may indirectly support effective communication and collaboration by ensuring that team members understand and utilize appropriate structures in problem-solving tasks.

7. Justification of PO7 to All COs :

CO1:PO7- As the ability to use data structures effectively may indirectly support observational and inquiry skills by providing a structured approach to problem-solving, although it may not directly address research methodologies or ethics.

CO2:PO7- As the ability to differentiate between different data structures may indirectly contribute to observational and inquiry skills by fostering critical thinking and analytical abilities, although it may not directly address research methodologies or ethics.

CO3:PO7- As understanding discrete structures may enhance analytical skills but may not directly contribute to observational and inquiry skills, research methodologies, or ethics.

CO4:PO7- As studying propositional logic and Boolean algebra may improve analytical skills but may not directly address observational and inquiry skills, research methodologies, or ethics.

CO5:PO7- As studying proof techniques may enhance critical thinking skills but may not directly contribute to observational and inquiry skills, research methodologies, or ethics.

CO6:PO7- As understanding memory allocation may support problem-solving abilities but may not directly address observational and inquiry skills, research methodologies, or ethics.

CO7:PO7- As efficiently implementing data structures may indirectly support observational and inquiry skills by providing practical experience with structured problem- solving, although it may not directly address research methodologies or ethics.

8. Justification of PO8 to All COs :

CO1:PO8- As the ability to utilize data structures effectively demonstrates self-directed learning by acquiring new knowledge and skills, adapting to changing demands, and setting and achieving goals independently through problem-solving.

CO2:PO8- As the ability to differentiate between different data structures reflects self-directed learning by acquiring a deeper understanding of their functionalities, adapting to changing demands, and setting and achieving goals independently in problem-solving tasks.

CO3:PO8- As understanding discrete structures enhances problem-solving abilities and reflects self-directed learning, although its direct impact on adaptability to changing demands and goal achievement may be limited.

CO4:PO8- As studying propositional logic and Boolean algebra enhances analytical skills and reflects self-directed learning, although its direct impact on adaptability and goal achievement may be limited.

CO5:PO8- As analyzing proof techniques develops critical thinking skills and reflects self-directed learning, although its direct impact on adaptability and goal achievement may be limited.

CO6:PO8- As understanding memory allocation contributes to problem-solving abilities and reflects self-directed learning, although its direct impact on adaptability and goal achievement may be limited.

CO7:PO8- As efficiently implementing data structures demonstrates self-directed learning by acquiring practical skills, adapting to changing demands, and setting and achieving goals independently in problem-solving tasks.

9. Justification of PO9 to All COs :

CO1:PO9- As proficiency in using data structures is essential for effectively organizing and analyzing data using appropriate software, aligning with the demonstration of proficiency in ICT and data analysis.

CO2:PO9- As the ability to differentiate between different data structures reflects proficiency in understanding and utilizing appropriate software for data analysis, accessing information sources, and utilizing ICT effectively.

CO3:PO9- As understanding discrete structures contributes to analytical skills, although its direct impact on using ICT and accessing information sources may be limited.

CO4:PO9- As studying logic and algebra enhances analytical abilities, although its direct impact on using ICT and accessing information sources may be limited.

CO5:PO9- As analyzing proof techniques enhances critical thinking skills, although its direct impact on using ICT and accessing information sources may be limited.

CO6:PO9- As understanding memory allocation contributes to technical skills but may have limited direct relevance to using ICT and accessing information sources.

CO7:PO9- As efficiently implementing data structures demonstrates proficiency in utilizing appropriate software for data analysis, accessing information sources, and using ICT effectively.

10. Justification of PO10 to All COs :

CO1:PO10- As the ability to utilize data structures effectively may indirectly contribute to engaging effectively in multicultural settings by fostering problem-solving skills and analytical thinking, although its direct impact on leading diverse teams and demonstrating empathy may be limited.

CO2:PO10- As the ability to differentiate between different data structures may indirectly support engaging effectively in multicultural settings by promoting critical thinking and adaptability, although its direct impact on leading diverse teams and demonstrating empathy may be limited.

CO3:PO10- As understanding discrete structures may enhance analytical skills but may not directly address engagement in multicultural settings or leading diverse teams.

CO4:PO10- As studying logic and algebra may improve analytical skills but may not directly contribute to engaging in multicultural settings or leading diverse teams.

CO5:PO10- As analyzing proof techniques may enhance critical thinking skills but may not directly address engagement in multicultural settings or leading diverse teams.

CO6:PO10- As understanding memory allocation contributes to technical skills but may not directly impact engagement in multicultural settings or leading diverse teams.

CO7:PO10- As efficiently implementing data structures may indirectly support engagement in multicultural settings by fostering problem-solving skills and adaptability, although its direct impact on leading diverse teams and demonstrating empathy may be limited.

11. Justification of PO11 to All COs :

CO1:PO11- As the ability to use data structures effectively may indirectly contribute to addressing ethical issues by promoting structured problem-solving and decision-making, although its direct impact on embracing ethical values and promoting sustainability may be limited.

CO2:PO11- As the ability to differentiate between different data structures may indirectly support recognizing and addressing ethical issues by enhancing analytical skills and critical thinking, although its direct impact on ethical values and environmental conservation may be limited.

CO3:PO11- As understanding discrete structures may enhance problem-solving abilities but may not directly address ethical values or environmental conservation.

CO4:PO11- As studying logic and algebra may improve analytical skills but may not directly contribute to embracing ethical values or promoting sustainability.

CO5:PO11- As analyzing proof techniques may enhance critical thinking skills but may not directly address ethical values or environmental conservation.

CO6:PO11- As understanding memory allocation contributes to technical skills but may not directly impact ethical values or environmental conservation.

CO7:PO11- As efficiently implementing data structures may indirectly support responsible citizenship by promoting effective use of resources and decision-making, although its direct impact on ethical values and environmental conservation may be limited.

12. Justification of PO12 to All COs :

CO1:PO12- As the ability to use data structures effectively is essential for independent application of knowledge and skills, effective project management, and demonstrating responsibility and accountability in work and learning contexts.

CO2:PO12- As the ability to differentiate between different data structures reflects analytical skills and contributes to effective project management and responsibility in work contexts.

CO3:PO12- As understanding discrete structures enhances problem-solving abilities, which are crucial for managing projects effectively and demonstrating accountability in work contexts.

CO4:PO12- As studying logic and algebra enhances analytical skills, which are important for independent application of knowledge, and skills and effective project management.

CO5:PO12- As analyzing proof techniques fosters critical thinking and problem- solving abilities, which are relevant for managing projects effectively and demonstrating responsibility in work contexts.

CO6:PO12- As understanding memory allocation contributes to technical skills necessary for independent application of knowledge and skills and effective project management.

CO7:PO12: As efficiently implementing data structures demonstrates proficiency in applying knowledge and skills independently, managing projects effectively, and showing responsibility and accountability in work and learning contexts.

13. Justification of PO13 to All COs:

CO1:PO13- As the ability to use data structures effectively can indirectly support community-engaged services by facilitating problem-solving skills, although its direct impact on promoting societal well-being may be limited.

CO2:PO13- As the ability to differentiate between different data structures reflects analytical skills, which can indirectly contribute to community-engaged services by fostering critical thinking, although its direct impact on promoting societal well-being may be limited.

CO3:PO13- As understanding discrete structures may enhance problem-solving abilities but may not directly contribute to community-engaged services or promoting societal well-being.

CO4:PO13- As studying logic and algebra enhances analytical skills but may not directly impact community-engaged services or societal well-being.

CO5:PO13- As analyzing proof techniques fosters critical thinking skills but may not directly contribute to community-engaged services or promoting societal well-being.

CO6:PO13- As understanding memory allocation contributes to technical skills but may not directly impact community-engaged services or societal well-being.

CO7:PO13- As efficiently implementing data structures demonstrates proficiency in problem-solving, which can indirectly support community-engaged services by facilitating effective solutions, although its direct impact on promoting societal well-being may be limited.

CBCS Syllabus as per NEP 2020 for S.Y.B.C.A (2024 Pattern)

Name of the Programme : B.C.A.

Programme Code : BCA

Class : S.Y.B.C.A.

Semester : III

Course Type : Major Mandatory [Theory]

Course Code : BCA-202-MRM

Course Title : Database Management System

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

1. To know the basic concepts of Databases.
2. To understand how to use Databases real life Applications.
3. Apply SQL to find solutions to a broad range of queries.
4. To familiarize the students with a good formal foundation on the relational model.
5. Improve the database design by normalization.
6. Teach design concepts and creation of relational databases.
7. Provide overview of database programming and procedural languages.

Course Outcomes:

By the end of the course, students will be able to:

CO1: Understand the basic concepts of database management systems.

CO2: Apply normalization constraints to design the database.

CO3: Analyze database application use case model to use ER model for conceptual design of the database.

CO4: Identify the data models for relevant problems.

CO5: Understand and apply the concepts of procedural languages.

CO6: To implement the logic by using tools like ERD.

CO7: Ability to define a problem at the view level & ability to understand the physical structure of the database to handle data.

Topics and Learning Points

No of Lectures

UNIT I - File organization & Introduction to DBMS **[06]**

1.1 Introduction
1.2 Types of file organization
1.3 File system vs. DBMS
1.4 Data models
1.5 Levels of abstraction
1.6 Data independence
1.7 Structure of DBMS
1.8 Users of DBMS
1.9 Advantages and disadvantages of DBMS

UNIT II - Conceptual Design (E-R model) **[08]**

2.1 Overview of Database design
2.2 ER data model (entities, attributes, entity sets, relations, relationship sets)
2.3 Additional constraints (Key constraints, Mapping constraints)
2.4 Entity Relationship Diagram (ERD)
2.5 Extended features of ERD.

UNIT III - Relational data model **[10]**

3.1 Structure of Relational Databases
- Relation
- Tuple
- Attribute
- Cardinality
- Degree
- Domain

3.2 Keys
- Super key
- Candidate key
- Primary key
- Foreign key

3.3 Conversion of ER to Relational model
3.4 SQL (Structured Query Language)
- Basic structure
- DDL commands
- DML commands
- Simple queries
- Nested queries
- Aggregate functions

UNIT IV-Relational Database design **[06]**

4.1 Introduction
4.2 Anomalies of un normalized database
4.3 Normalization
4.4 Normal form (1NF,2NF)
4.5 Relational algebra (selection, projection set operations, renaming, joins, division)

Reference Books:

1. Shamkant B. Navathe, Ramez Elmasri, Database Systems, ISBN:9780132144988, Pearson Higher Education
2. Richard Stones, Neil Matthew, Beginning Databases with PostgreSQL: From Novice to Professional, ISBN:9781590594780, Apress
3. Korry Douglas,PostgreSQL, ISBN:9780672327568, Sams
4. JohnWorsley, Joshua Drake, Practical PostgreSQL (BCD), ISBN:9788173663925 Shroff/O'reilly
5. Joshua D. Drake, John C Worsley, Practical Postgresql, (O'Reilly publications)
6. Bipin C Desai, "An introduction to Database systems", Galgotia Publications
7. Henrey Korth, Sudarshan, Silberschatz "Database System Concepts" (4th Ed), McGraw Hill.

CO-PO Mapping Table

Course Outcomes	Programme Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	3	2	3	3	2	2	3	3	2	1	2	2
CO2	3	3	2	3	3	2	2	3	3	1	1	3	2
CO3	3	3	3	3	3	3	3	3	3	2	2	3	3
CO4	3	2	3	2	3	2	3	2	3	2	2	2	2
CO5	2	3	2	3	2	1	2	3	2	1	1	2	1
CO6	3	3	3	3	3	3	3	2	3	3	2	3	3
CO7	2	2	3	3	2	3	3	3	2	3	3	3	3

Mapping- 3= strongly relates 2= Moderately Related 1= Partially Related

Course Objectives (CO) and Program Outcomes (PO) Mapping:

1. Justification of PO1 to All COs:

CO1:PO1- Fundamental understanding of DBMS is crucial for comprehensive knowledge.
CO2:PO1- Normalization is a core concept for database design, requiring deep understanding.
CO3:PO1- ER modelling requires strong analytical skills and conceptual knowledge.
CO4:PO1- Identifying data models is essential for problem-solving in databases.
CO5:PO1- Procedural languages contribute to database operations but are not the primary focus.
CO6:PO1- ERD tools are crucial for conceptualizing and designing databases.
CO7:PO1- Understanding view-level problems and physical structures strengthen knowledge but are more application-oriented.

2. Justification of PO2 to All COs:

CO1:PO2- Strongly related as understanding DBMS concepts is fundamental to procedural knowledge.
CO2:PO2- Strongly related since normalization requires applying procedural and professional knowledge.
CO3:PO2- Strongly related because analyzing use cases and creating ER models is a procedural task.
CO4:PO2- Moderately related as identifying data models involves both conceptual and procedural understanding.
CO5:PO2- Strongly related as procedural language concepts are directly linked to procedural knowledge.
CO6:PO2- Strongly related because ERD tools require procedural and practical skills.
CO7:PO2- Moderately related as problem definition at different levels involves both practical and theoretical knowledge.

3. Justification of PO3 to All COs:

CO1:PO3- Understanding DBMS concepts helps entrepreneurs manage data-driven business decisions.
CO2:PO3- Normalization enhances database efficiency, aiding in better business process management.
CO3:PO3- ER modelling helps entrepreneurs structure and conceptualize data for business applications.
CO4:PO3- Choosing the right data model is crucial for effective business solutions and decision-making.
CO5:PO3- Procedural language knowledge helps entrepreneurs automate business operations.
CO6:PO3- ERD tools support structured database design, crucial for business strategy and execution.
CO7:PO3- Understanding data views and physical structures aids in designing scalable business systems.

4. Justification of PO4 to All COs:

CO1:PO4- Strongly related, as understanding database concepts is fundamental to specialized skills.

CO2:PO4- Strongly related, since applying normalization is a key competency in database design.

CO3:PO4- Strongly related, as ER modeling is essential for conceptual database design.

CO4:PO4- Moderately related, since identifying data models supports problem-solving but is not a direct specialized skill.

CO5:PO4- Strongly related, as procedural language skills are crucial for database handling.

CO6:PO4- Strongly related, as using ERD tools is a key technical competency.

CO7:PO4-Strongly related, as understanding view-level and physical structures is essential for data handling.

5. Justification of PO5 to All COs:

CO1:PO5- Understanding database concepts is fundamental to problem-solving in database applications.

CO2:PO5- Applying normalization helps in optimizing database design, improving efficiency and reasoning.

CO3:PO5- Analyzing use cases and using the ER model enhances conceptual problem-solving.

CO4:PO5- Identifying appropriate data models is keys to solving database-related problems effectively.

CO5:PO5- Understanding procedural languages aids in logical problem-solving in databases.

CO6:PO5- Implementing ERD tools strengthens analytical reasoning in database design.

CO7:PO5- Defining problems at different levels enhance the ability to handle data effectively.

6. Justification of PO6 to All COs:

CO1:PO6- Understanding DBMS concepts aids in clear communication of database-related ideas in collaborative environments.

CO2:PO6- Applying normalization requires discussions and collaboration to ensure an efficient database design.

CO3:PO6- Analyzing use cases and designing ER models necessitates teamwork and communication with stakeholders.

CO4:PO6- Identifying data models involves collaborative decision-making for problem-solving.

CO5:PO6- Procedural language concepts help in writing clear database scripts but have limited direct impact on communication.

CO6:PO6- Using tools like ERD require effective collaboration among developers, analysts, and stakeholders.

CO7:PO6- Defining problems and understanding physical structures involve teamwork and effective communication to manage data efficiently.

7. Justification of PO7 to All COs:

CO1:PO7- Understanding DBMS concepts aid research in data management.

CO2:PO7- Normalization ensures structured and optimized data, aiding research quality.

CO3:PO7- ER modeling is crucial for conceptualizing database applications in research.

CO4:PO7- Selecting appropriate data models enhances research problem-solving.
CO5:PO7- Procedural languages help in automating and analyzing research data.
CO6:PO7- ERD tools are essential for designing databases in research projects.
CO7:PO7- Understanding database structure aids in data retrieval and research analysis.

8. Justification of PO8 to All COs:

CO1:PO8- Strongly related, as understanding database management is crucial for learning how to acquire new technical skills.
CO2:PO8- Strongly related, as applying normalization enhances problem-solving and learning efficiency in database design.
CO3:PO8- Strongly related, as analyzing use cases and conceptual modeling strengthens structured thinking and learning.
CO4:PO8- Moderately related, as identifying data models helps in learning domain-specific problem-solving.
CO5:PO8- Strongly related, as understanding procedural languages builds logical thinking and adaptability in learning new skills.
CO6:PO8- Strongly related, as implementing ERD tools fosters hands-on learning and visualization skills.
CO7:PO8- Moderately related, as understanding different database views and structures

9. Justification of PO9 to All COs:

CO1:PO9- Strongly related, as understanding database management systems is fundamental to digital and technological skills.
CO2:PO9- Strongly related, as normalization is a crucial technical skill for efficient database design.
CO3:PO9- Strongly related, as analyzing and designing databases using ER models is an essential digital skill.
CO4:PO9- Strongly related, since identifying data models enhances database structuring capabilities.
CO5:PO9- Moderately related, as procedural languages contribute to database handling but are not the sole focus.
CO6:PO9- Strongly related, as using tools like ERD improves technological proficiency.
CO7:PO9- Strongly related, as understanding database views and physical structures is crucial for data handling.

10. Justification of PO10 to All COs:

CO1:PO10- Understanding database management fosters inclusivity by managing diverse data sources effectively.
CO2:PO10- Ensures data integrity and supports diverse, inclusive datasets.
CO3:PO10- ER modeling helps design databases that accommodate multicultural and inclusive data structures.
CO4:PO10- Selecting appropriate data models enables handling data from diverse cultural perspectives.
CO5:PO10- Procedural languages aid in implementing logic for inclusive database operations.
CO6:PO10- ERD tools help visualize and design databases that support multicultural and

inclusive applications.
CO7:PO10- Understanding view levels and physical structures enable efficient, inclusive data handling.

11. Justification of PO11 to All COs:

CO1:PO11- Understanding DBMS concepts can aid in managing environmental data effectively.
CO2:PO11- Normalization helps structure environmental datasets efficiently.
CO3:PO11- Conceptual design through ER models can represent environmental systems.
CO4:PO11- Choosing the right data model supports environmental data analysis.
CO5:PO11- Procedural languages can be used for environmental data processing.
CO6:PO11- ERD tools help model and analyze environmental databases.
CO7:PO11- Understanding database structure enables efficient management of environmental data.

12. Justification of PO12 to All COs:

CO1:PO12- Understanding database concepts helps in making informed decisions about database management, ensuring responsibility in handling data.
CO2:PO12- Applying normalization requires accountability to maintain data integrity and consistency.
CO3:PO12- Analyzing and designing databases require responsibility in structuring data effectively.
CO4:PO12- Identifying appropriate data models require moderate autonomy and decision-making.
CO5:PO12- Applying procedural languages demands responsibility in implementing correct database operations.
CO6:PO12- Using ERD tools requires accountability in designing accurate representations of databases.
CO7:PO12- Understanding database structures ensures responsibility in managing and securing data efficiently.

13. Justification of PO13 to All COs:

CO1:PO13- Understanding DBMS helps in organizing community data effectively.
CO2:PO13- Normalization ensures efficient data handling in community services.
CO3:PO13- Conceptual design aids in structuring databases for community applications.
CO4:PO13- Selecting data models improves data-driven decision-making for community services.
CO5:PO13- Procedural languages help in automating tasks related to community service databases.
CO6:PO13- ERD tools assist in designing structured databases for community needs.
CO7:PO13- Understanding database views and physical structure enhances data management for community engagement.

CBCS Syllabus as per NEP 2020 for S.Y.B.C.A (2024 Pattern)

Name of the Programme : B.C.A.

Programme Code : BCA

Class : S.Y.B.C.A.

Semester : III

Course Type : Major Mandatory [Practical]
Course Code : BCA-203-MRM

Course Title : Practical Lab on Algorithms and Data Structures

No. of Credits : 02

No. of Teaching Hours : 4 Hrs./Batch

Prerequisites:

1. To understand the basic techniques of algorithm analysis.
2. To understand the different methods of organizing large amount of data
3. To efficiently implement the different data structures
4. To efficiently implement solutions for specific problems
5. To understand various algorithmic strategies to approach the problem solution.
6. To understand the memory requirement for various data structures.
7. To understand various data searching and sorting methods with pros and cons

Course Objectives:

1. To implement different data structures.
2. To learn static & dynamic memory allocation.

Course Outcomes:

By the end of the course, students will be able to:

CO1: Efficiently implement the different data structures.

CO2: Efficiently implement various sorting methods.

CO3: Efficiently implement various searching methods.

CO4: Understand & apply basics of memory allocation and how it used.

CO5: Implement dynamic memory using linked list.

CO6: Implement stacks allocation.

CO7: Implement polynomials.

Suggested Practical Assignments

Sr. No.	Assignment Name
Assignment 1	Calculating Time & Space Complexity
Assignment 2	Applications of Array - Bubble sort
Assignment 3	Applications of Array - Insertion sort
Assignment 4	Applications of Array - Merge sort
Assignment 5	Applications of Array - Quick Sort
Assignment 6	Applications of Array - Linear Search
Assignment 7	Applications of Array - Binary search
Assignment 8	Operations on Linked List
Assignment 9	Operations on Linked List
Assignment 10	Operations on Linked List
Assignment 11	Applications of Linked List – polynomial manipulation
Assignment 12	Static implementation of Stack
Assignment 13	Dynamic implementation of Stack
Assignment 14	Expression Conversion & Evaluation
Assignment 15	Simulating recursion using stack.

CO-PO Mapping Table

Course Outcomes	Programme Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	3	2	3	3	2	2	3	3	2	2	3	2
CO2	3	3	2	3	3	2	2	3	3	2	2	3	2
CO3	3	3	1	2	3	1	1	2	2	1	1	2	1
CO4	3	3	1	2	2	1	1	2	2	1	1	2	1
CO5	3	3	1	2	2	1	1	2	2	1	1	2	1
CO6	2	2	1	2	2	1	1	2	1	1	1	2	1
CO7	3	3	2	3	3	2	2	3	3	2	2	3	2

Mapping- 3= strongly relates 2= Moderately Related 1= Partially Related

Course Objectives (CO) and Program Outcomes (PO) Mapping:

1. Justification of PO1 to ALL COs:

CO1:PO1- As proficiency in using data structures demonstrates a profound understanding of foundational theories and principles within the field of study, essential for problem-solving in a multidisciplinary context.

CO2:PO1- As the ability to differentiate between different data structures and their appropriate usage showcases a deep understanding of methodologies and key concepts, contributing to a broader multidisciplinary perspective.

CO3:PO1- As understanding discrete structures is foundational to grasping the theoretical underpinnings of computer science, enhancing knowledge within a broader multidisciplinary context.

CO4:PO1- As studying propositional logic and Boolean algebra provides a theoretical framework that is crucial for understanding foundational theories and principles within the field of study, contributing to a broader multidisciplinary perspective.

CO5:PO1- As the ability to analyze proof techniques demonstrates proficiency in applying methodologies and key concepts within the field of study, essential for understanding foundational theories and principles in a broader multidisciplinary context.

CO6:PO1- As understanding memory allocation contributes to a practical understanding of computer science concepts, although it may be less directly related to multidisciplinary contexts covered in PO1.

CO7:PO1- As the ability to efficiently implement data structures demonstrates practical application of foundational theories and principles, essential for problem-solving within a broader multidisciplinary context.

2. Justification of PO2 to ALL COs:

CO1:PO2- As practical skills in utilizing data structures are essential for professional tasks in problem-solving within real-world scenarios, aligning with industry standards and best practices.

CO2:PO2- As the ability to differentiate between different data structures and select the appropriate one for problem-solving reflects expertise and practical skills needed in professional tasks, adhering to industry standards and best practices.

CO3:PO2 - As understanding discrete structures is fundamental for applying knowledge in real-world scenarios, ensuring adherence to industry standards and best practices in problem-solving tasks.

CO4:PO2- As studying propositional logic and Boolean algebra provides a theoretical foundation essential for understanding industry standards, regulations, and ethical considerations in real-world scenarios.

CO5:PO2- As the ability to analyze proof techniques enhances problem-solving skills in professional tasks, aligning with industry standards and best practices.

CO6:PO2- As understanding memory allocation is practical knowledge applicable to professional tasks, although it may be less directly related to industry standards and regulations.

CO7:PO2- As the ability to efficiently implement data structures demonstrates practical expertise essential for professional tasks, aligning with industry standards and best practices.

3. Justification of PO3 to ALL COs:

CO1:PO3- As the ability to use data structures can contribute to problem-solving skills, which are important in identifying opportunities and fostering innovation, although it may not directly address business principles, market dynamics, and risk management strategies.

CO2:PO3- As the ability to differentiate between different data structures can enhance problem-solving abilities, which can indirectly contribute to fostering innovation and understanding market dynamics.

CO3:PO3- As understanding discrete structures may have limited direct relevance to cultivating an entrepreneurial mindset and understanding business principles, market dynamics, and risk management strategies.

CO4:PO3- As studying propositional logic and Boolean algebra may have limited direct relevance to entrepreneurial mindset or business principles, although it may indirectly enhance analytical skills important for risk management.

CO5:PO3- As studying proof techniques may have limited direct relevance to entrepreneurship or business principles, although it may indirectly enhance critical thinking skills important for identifying opportunities and fostering innovation.

CO6:PO3- As understanding memory allocation may have limited direct relevance to entrepreneurial mind set or business principles, although it may indirectly contribute to problem-solving abilities.

CO7:PO3- As the ability to efficiently implement data structures can contribute to problem-solving skills, which are important in identifying opportunities and fostering innovation, although it may not directly address business principles, market dynamics, and risk management strategies.

4. Justification of PO4 to ALL COs:

CO1:PO4- As proficiency in utilizing data structures demonstrates technical skills, analytical abilities, and problem-solving capabilities, essential for adapting and innovating in response to changing circumstances.

CO2:PO4- As the ability to differentiate between different data structures showcases analytical abilities and problem-solving skills, crucial for adapting and innovating in response to changing circumstances.

CO3:PO4- As understanding discrete structures enhances analytical abilities and problem-solving skills, although its direct impact on technical proficiency and effective communication may be limited.

CO4:PO4- As studying propositional logic and Boolean algebra develops analytical abilities and problem-solving skills, although its direct impact on technical proficiency and effective communication may be limited.

CO5:PO4- As analyzing proof techniques enhances analytical abilities and problem- solving skills, although its direct impact on technical proficiency and effective communication may be limited.

CO6:PO4- As understanding memory allocation contributes to technical proficiency and problem-solving skills, although its direct impact on effective communication and leadership may be limited.

CO7:PO4- As efficiently implementing data structures demonstrates technical proficiency, problem-solving abilities, and leadership qualities, crucial for adapting and innovating in response to changing circumstances.

5. Justification of PO5 to ALL COs:

CO1:PO5- As the ability to use data structures effectively in problem-solving requires critical thinking, creativity, adaptability, and readiness to learn, essential for applying learned concepts in practical settings and solving complex problems.

CO2:PO5- As the ability to differentiate between different data structures demonstrates critical thinking and adaptability, crucial for analyzing data effectively and solving complex problems in practical settings.

CO3:PO5- As understanding discrete structures enhances critical thinking and problem-solving abilities, essential for analyzing data effectively and solving complex problems in practical settings.

CO4:PO5- As studying propositional logic and Boolean algebra develops analytical skills and critical thinking, although its direct impact on creativity, adaptability, and readiness to take calculated risks may be limited.

CO5:PO5- As analyzing proof techniques requires critical thinking and creativity, essential for solving complex problems and taking calculated risks in practical settings.

CO6:PO5- As understanding memory allocation contributes to problem-solving abilities, although its direct impact on critical thinking and adaptability may be limited.

CO7:PO5- As efficiently implementing data structures requires critical thinking, creativity, adaptability, and a readiness to learn, essential for applying learned concepts in practical settings and solving complex problems.

6. Justification of PO6 to ALL COs:

CO1:PO6- As effectively communicating complex information and collaborating in diverse teams may require the ability to articulate the usage of data structures in problem- solving, but it may not directly address communication skills or teamwork.

CO2:PO6- As the ability to differentiate between different data structures may indirectly contribute to effective communication and collaboration by facilitating clear explanations and discussions within teams.

CO3:PO6- As understanding discrete structures may not directly address communication skills or teamwork but may indirectly contribute to problem-solving abilities within teams.

CO4:PO6- As studying propositional logic and Boolean algebra may enhance analytical skills but may not directly contribute to effective communication or teamwork.

CO5:PO6- As studying proof techniques may improve critical thinking skills but may not directly address communication skills or teamwork.

CO6:PO6 - As understanding memory allocation may not directly contribute to communication skills or teamwork but may indirectly support problem-solving abilities within teams.

CO7:PO6 - As efficiently implementing data structures may indirectly support effective communication and collaboration by ensuring that team members understand and utilize appropriate structures in problem-solving tasks.

7. Justification of PO7 to ALL COs :

CO1:PO7- As the ability to use data structures effectively may indirectly support observational and inquiry skills by providing a structured approach to problem-solving, although it may not directly address research methodologies or ethics.

CO2:PO7- As the ability to differentiate between different data structures may indirectly contribute to observational and inquiry skills by fostering critical thinking and analytical abilities, although it may not directly address research methodologies or ethics.

CO3:PO7- As understanding discrete structures may enhance analytical skills but may not directly contribute to observational and inquiry skills, research methodologies, or ethics.

CO4:PO7- As studying propositional logic and Boolean algebra may improve analytical skills but may not directly address observational and inquiry skills, research methodologies, or ethics.

CO5:PO7- As studying proof techniques may enhance critical thinking skills but may not directly contribute to observational and inquiry skills, research methodologies, or ethics.

CO6:PO7- As understanding memory allocation may support problem-solving abilities but may not directly address observational and inquiry skills, research methodologies, or ethics.

CO7:PO7- As efficiently implementing data structures may indirectly support observational and inquiry skills by providing practical experience with structured problem- solving, although it may not directly address research methodologies or ethics.

8. Justification of PO8 to ALL COs :

CO1:PO8- As the ability to utilize data structures effectively demonstrates self-directed learning by acquiring new knowledge and skills, adapting to changing demands, and setting and achieving goals independently through problem-solving.

CO2:PO8- As the ability to differentiate between different data structures reflects self-directed learning by acquiring a deeper understanding of their functionalities, adapting to changing demands, and setting and achieving goals independently in problem-solving tasks.

CO3:PO8- As understanding discrete structures enhances problem-solving abilities and reflects self-directed learning, although its direct impact on adaptability to changing demands and goal achievement may be limited.

CO4:PO8- As studying propositional logic and Boolean algebra enhances analytical skills and reflects self-directed learning, although its direct impact on adaptability and goal achievement may be limited.

CO5:PO8- As analyzing proof techniques develops critical thinking skills and reflects self-directed learning, although its direct impact on adaptability and goal achievement may be limited.

CO6:PO8- As understanding memory allocation contributes to problem-solving abilities and reflects self-directed learning, although its direct impact on adaptability and goal achievement may be limited.

CO7:PO8- As efficiently implementing data structures demonstrates self-directed learning by acquiring practical skills, adapting to changing demands, and setting and achieving goals independently in problem-solving tasks.

9. Justification of PO9 to ALL COs :

CO1:PO9- As proficiency in using data structures is essential for effectively organizing and analyzing data using appropriate software, aligning with the demonstration of proficiency in ICT and data analysis.

CO2:PO9- As the ability to differentiate between different data structures reflects proficiency in understanding and utilizing appropriate software for data analysis, accessing information sources, and utilizing ICT effectively.

CO3:PO9- As understanding discrete structures contributes to analytical skills, although its direct impact on using ICT and accessing information sources may be limited.

CO4:PO9- As studying logic and algebra enhances analytical abilities, although its direct impact on using ICT and accessing information sources may be limited.

CO5:PO9- As analyzing proof techniques enhances critical thinking skills, although its direct impact on using ICT and accessing information sources may be limited.

CO6:PO9- As understanding memory allocation contributes to technical skills but may have limited direct relevance to using ICT and accessing information sources.

CO7:PO9- As efficiently implementing data structures demonstrates proficiency in utilizing appropriate software for data analysis, accessing information sources, and using ICT effectively.

10. Justification of PO10 to ALL COs :

CO1:PO10- As the ability to utilize data structures effectively may indirectly contribute to engaging effectively in multicultural settings by fostering problem-solving skills and analytical thinking, although its direct impact on leading diverse teams and demonstrating empathy may be limited.

CO2:PO10- As the ability to differentiate between different data structures may indirectly support engaging effectively in multicultural settings by promoting critical thinking and adaptability, although its direct impact on leading diverse teams and demonstrating empathy may be limited.

CO3:PO10- As understanding discrete structures may enhance analytical skills but may not directly address engagement in multicultural settings or leading diverse teams.

CO4:PO10- As studying logic and algebra may improve analytical skills but may not directly contribute to engaging in multicultural settings or leading diverse teams.

CO5:PO10- As analyzing proof techniques may enhance critical thinking skills but may not directly address engagement in multicultural settings or leading diverse teams.

CO6:PO10- As understanding memory allocation contributes to technical skills but may not directly impact engagement in multicultural settings or leading diverse teams.

CO7:PO10- As efficiently implementing data structures may indirectly support engagement in multicultural settings by fostering problem-solving skills and adaptability, although its direct impact on leading diverse teams and demonstrating empathy may be limited.

11. Justification of PO11 to ALL COs :

CO1:PO11- As the ability to use data structures effectively may indirectly contribute to addressing ethical issues by promoting structured problem-solving and decision-making, although its direct impact on embracing ethical values and promoting sustainability may be limited.

CO2:PO11- As the ability to differentiate between different data structures may indirectly support recognizing and addressing ethical issues by enhancing analytical skills and critical thinking, although its direct impact on ethical values and environmental conservation may be limited.

CO3:PO11- As understanding discrete structures may enhance problem-solving abilities but may not directly address ethical values or environmental conservation.

CO4:PO11- As studying logic and algebra may improve analytical skills but may not directly contribute to embracing ethical values or promoting sustainability.

CO5:PO11- As analyzing proof techniques may enhance critical thinking skills but may not directly address ethical values or environmental conservation.

CO6:PO11- As understanding memory allocation contributes to technical skills but may not directly impact ethical values or environmental conservation.

CO7:PO11- As efficiently implementing data structures may indirectly support responsible citizenship by promoting effective use of resources and decision-making, although its direct impact on ethical values and environmental conservation may be limited.

12. Justification of PO12 to ALL COs :

CO1:PO12- As the ability to use data structures effectively is essential for independent application of knowledge and skills, effective project management, and demonstrating responsibility and accountability in work and learning contexts.

CO2:PO12- As the ability to differentiate between different data structures reflects analytical skills and contributes to effective project management and responsibility in work contexts.

CO3:PO12- As understanding discrete structures enhances problem-solving abilities, which are crucial for managing projects effectively and demonstrating accountability in work contexts.

CO4:PO12- As studying logic and algebra enhances analytical skills, which are important for independent application of knowledge, and skills and effective project management.

CO5:PO12- As analyzing proof techniques fosters critical thinking and problem- solving abilities, which are relevant for managing projects effectively and demonstrating responsibility in work contexts.

CO6:PO12- As understanding memory allocation contributes to technical skills necessary for independent application of knowledge and skills and effective project management.

CO7:PO12: As efficiently implementing data structures demonstrates proficiency in applying knowledge and skills independently, managing projects effectively, and showing responsibility and accountability in work and learning contexts.

13. Justification of PO13 to ALL COs :

CO1:PO13- As the ability to use data structures effectively can indirectly support community-engaged services by facilitating problem-solving skills, although its direct impact on promoting societal well-being may be limited.

CO2:PO13- As the ability to differentiate between different data structures reflects analytical skills, which can indirectly contribute to community-engaged services by fostering critical thinking, although its direct impact on promoting societal well-being may be limited.

CO3:PO13- As understanding discrete structures may enhance problem-solving abilities but may not directly contribute to community-engaged services or promoting societal well-being.

CO4:PO13- As studying logic and algebra enhances analytical skills but may not directly impact community-engaged services or societal well-being.

CO5:PO13- As analyzing proof techniques fosters critical thinking skills but may not directly contribute to community-engaged services or promoting societal well-being.

CO6:PO13- As understanding memory allocation contributes to technical skills but may not directly impact community-engaged services or societal well-being.

CO7:PO13- As efficiently implementing data structures demonstrates proficiency in problem-solving, which can indirectly support community-engaged services by facilitating effective solutions, although its direct impact on promoting societal well-being may be limited.

CBCS Syllabus as per NEP 2020 for S.Y.B.C.A (2024 Pattern)

Name of the Programme : B.C.A.

Programme Code : BCA

Class : S.Y.B.C.A.

Semester : III

Course Type : Vocational Skill Course (VSC) [Practical]
Course Code : BCA-204-VSC

Course Title : Practical Lab on Database Management System

No. of Credits : 02

No. of Teaching Hours : 4 Hrs./ Batch

Course Objectives:

1. To know the basic concepts of Databases.
2. To understand how to use Databases real life Applications.
3. Apply SQL to find solutions to a broad range of queries.
4. To familiarize the students with a good formal foundation on the relational model.
5. Improve the database design by normalization.
6. Teach design concepts and creation of relational databases.
7. Provide overview of database programming and procedural languages.

Course Outcomes:

By the end of the course, students will be able to:

CO1: Understand the basic concepts of database management systems.

CO2: Apply normalization constraints to design the database.

CO3: Analyze database application use case model to use ER model for conceptual design of the database.

CO4: Identify the data models for relevant problems.

CO5: Understand and apply the concepts of procedural languages.

CO6: To implement the logic by using tools like ERD.

CO7: Ability to define a problem at the view level & ability to understand the physical structure of the database to handle data.

Suggested Practical Assignments

Sr. No.	Assignment Name
1.	Assignment on SQL – DDL Commands.
2.	Assignments on SQL – DML Commands.
3.	Assignments on SQL – DTL Commands.
4.	Assignments on Aggregate Functions.
5.	Assignments on Relational Algebra Operations.
6.	Assignments on Nested Queries.
7.	Assignments on Create Database, select database, Drop database.
8.	Assignments on Create Table, Drop table, Insert Query, Select Query.
9.	Assignments on Constraints.
10.	Assignments on displaying data from multiple tables.
11.	Assignments on Operators, Expressions, where clause, AND & OR clauses.
12.	Assignments on Update Query/Delete Query, like clause, Limit Clause.
13.	Assignments on Order By Clause with Ascending and Descending order.
14.	Assignments on Order By, Group By, With Clause, Having Clause, Distinct keyword

CO-OP Mapping Table

Course Outcomes	Programme Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	3	2	3	3	2	2	3	3	2	1	2	2
CO2	3	3	2	3	3	2	2	3	3	1	1	3	2
CO3	3	3	3	3	3	3	3	3	3	2	2	3	3
CO4	3	2	3	2	3	2	3	2	3	2	2	2	2
CO5	2	3	2	3	2	1	2	3	2	1	1	2	1
CO6	3	3	3	3	3	3	3	2	3	3	2	3	3
CO7	2	2	3	3	2	3	3	3	2	3	3	3	3

Mapping- 3= strongly relates 2= Moderately Related 1= Partially Related

Course Objectives (CO) and Program Outcomes (PO) Mapping:

1. Justification of PO1 to All COs:

CO1:PO1- Fundamental understanding of DBMS is crucial for comprehensive knowledge.
CO2:PO1- Normalization is a core concept for database design, requiring deep understanding.
CO3:PO1- ER modelling requires strong analytical skills and conceptual knowledge.
CO4:PO1- Identifying data models is essential for problem-solving in databases.
CO5:PO1- Procedural languages contribute to database operations but are not the primary focus.
CO6:PO1- ERD tools are crucial for conceptualizing and designing databases.
CO7:PO1- Understanding view-level problems and physical structures strengthen knowledge but are more application-oriented.

2. Justification of PO2 to All COs:

CO1:PO2- Strongly related as understanding DBMS concepts is fundamental to procedural knowledge.
CO2:PO2- Strongly related since normalization requires applying procedural and professional knowledge.
CO3:PO2- Strongly related because analyzing use cases and creating ER models is a procedural task.
CO4:PO2- Moderately related as identifying data models involves both conceptual and procedural understanding.
CO5:PO2- Strongly related as procedural language concepts are directly linked to procedural knowledge.
CO6:PO2- Strongly related because ERD tools require procedural and practical skills.
CO7:PO2- Moderately related as problem definition at different levels involves both practical and theoretical knowledge.

3. Justification of PO3 to All COs:

CO1:PO3- Understanding DBMS concepts helps entrepreneurs manage data-driven business decisions.
CO2:PO3- Normalization enhances database efficiency, aiding in better business process management.
CO3:PO3- ER modelling helps entrepreneurs structure and conceptualize data for business applications.
CO4:PO3- Choosing the right data model is crucial for effective business solutions and decision-making.
CO5:PO3- Procedural language knowledge helps entrepreneurs automate business operations.
CO6:PO3- ERD tools support structured database design, crucial for business strategy and execution.
CO7:PO3- Understanding data views and physical structures aids in designing scalable business systems.

4. Justification of PO4 to All COs:

CO1:PO4- Strongly related, as understanding database concepts is fundamental to specialized skills.

CO2:PO4- Strongly related, since applying normalization is a key competency in database design.

CO3:PO4- Strongly related, as ER modeling is essential for conceptual database design.

CO4:PO4- Moderately related, since identifying data models supports problem-solving but is not a direct specialized skill.

CO5:PO4- Strongly related, as procedural language skills are crucial for database handling.

CO6:PO4- Strongly related, as using ERD tools is a key technical competency.

CO7:PO4-Strongly related, as understanding view-level and physical structures is essential for data handling.

5. Justification of PO5 to All COs:

CO1:PO5- Understanding database concepts is fundamental to problem-solving in database applications.

CO2:PO5- Applying normalization helps in optimizing database design, improving efficiency and reasoning.

CO3:PO5- Analyzing use cases and using the ER model enhances conceptual problem-solving.

CO4:PO5- Identifying appropriate data models is keys to solving database-related problems effectively.

CO5:PO5- Understanding procedural languages aids in logical problem-solving in databases.

CO6:PO5- Implementing ERD tools strengthens analytical reasoning in database design.

CO7:PO5- Defining problems at different levels enhance the ability to handle data effectively.

6. Justification of PO6 to All COs:

CO1:PO6- Understanding DBMS concepts aids in clear communication of database-related ideas in collaborative environments.

CO2:PO6- Applying normalization requires discussions and collaboration to ensure an efficient database design.

CO3:PO6- Analyzing use cases and designing ER models necessitates teamwork and communication with stakeholders.

CO4:PO6- Identifying data models involves collaborative decision-making for problem-solving.

CO5:PO6- Procedural language concepts help in writing clear database scripts but have limited direct impact on communication.

CO6:PO6- Using tools like ERD require effective collaboration among developers, analysts, and stakeholders.

CO7:PO6- Defining problems and understanding physical structures involve teamwork and effective communication to manage data efficiently.

7. Justification of PO7 to All COs:

CO1:PO7- Understanding DBMS concepts aid research in data management.

CO2:PO7- Normalization ensures structured and optimized data, aiding research quality.

CO3:PO7- ER modeling is crucial for conceptualizing database applications in research.

CO4:PO7- Selecting appropriate data models enhances research problem-solving.
CO5:PO7- Procedural languages help in automating and analyzing research data.
CO6:PO7- ERD tools are essential for designing databases in research projects.
CO7:PO7- Understanding database structure aids in data retrieval and research analysis.

8. Justification of PO8 to All COs:

CO1:PO8- Strongly related, as understanding database management is crucial for learning how to acquire new technical skills.
CO2:PO8- Strongly related, as applying normalization enhances problem-solving and learning efficiency in database design.
CO3:PO8- Strongly related, as analyzing use cases and conceptual modeling strengthens structured thinking and learning.
CO4:PO8- Moderately related, as identifying data models helps in learning domain-specific problem-solving.
CO5:PO8- Strongly related, as understanding procedural languages builds logical thinking and adaptability in learning new skills.
CO6:PO8- Strongly related, as implementing ERD tools fosters hands-on learning and visualization skills.
CO7:PO8- Moderately related, as understanding different database views and structures

9. Justification of PO9 to All COs:

CO1:PO9- Strongly related, as understanding database management systems is fundamental to digital and technological skills.
CO2:PO9- Strongly related, as normalization is a crucial technical skill for efficient database design.
CO3:PO9- Strongly related, as analyzing and designing databases using ER models is an essential digital skill.
CO4:PO9- Strongly related, since identifying data models enhances database structuring capabilities.
CO5:PO9- Moderately related, as procedural languages contribute to database handling but are not the sole focus.
CO6:PO9- Strongly related, as using tools like ERD improves technological proficiency.
CO7:PO9- Strongly related, as understanding database views and physical structures is crucial for data handling.

10. Justification of PO10 to All COs:

CO1:PO10- Understanding database management fosters inclusivity by managing diverse data sources effectively.
CO2:PO10 - Ensures data integrity and supports diverse, inclusive datasets.
CO3:PO10- ER modeling helps design databases that accommodate multicultural and inclusive data structures.
CO4:PO10- Selecting appropriate data models enables handling data from diverse cultural perspectives.
CO5:PO10-Procedural languages aid in implementing logic for inclusive database operations.
CO6:PO10- ERD tools help visualize and design databases that support multicultural and inclusive applications.

CO7:PO10- Understanding view levels and physical structures enable efficient, inclusive data handling.

11. Justification of PO11 to All COs:

CO1:PO11-Understanding DBMS concepts can aid in managing environmental data effectively.
CO2:PO11- Normalization helps structure environmental datasets efficiently.
CO3:PO11- Conceptual design through ER models can represent environmental systems.
CO4:PO11- Choosing the right data model supports environmental data analysis.
CO5:PO11- Procedural languages can be used for environmental data processing.
CO6:PO11- ERD tools help model and analyze environmental databases.
CO7:PO11- Understanding database structure enables efficient management of environmental data.

12. Justification of PO12 to All COs:

CO1:PO12- Understanding database concepts helps in making informed decisions about database management, ensuring responsibility in handling data.
CO2:PO12- Applying normalization requires accountability to maintain data integrity and consistency.
CO3:PO12- Analyzing and designing databases require responsibility in structuring data effectively.
CO4:PO12- Identifying appropriate data models require moderate autonomy and decision-making.
CO5:PO12- Applying procedural languages demands responsibility in implementing correct database operations.
CO6:PO12- Using ERD tools requires accountability in designing accurate representations of databases.
CO7:PO12- Understanding database structures ensures responsibility in managing and securing data efficiently.

13. Justification of PO13 to All COs:

CO1:PO13- Understanding DBMS helps in organizing community data effectively.
CO2:PO13- Normalization ensures efficient data handling in community services.
CO3:PO13- Conceptual design aids in structuring databases for community applications.
CO4:PO13- Selecting data models improves data-driven decision-making for community services.
CO5:PO13- Procedural languages help in automating tasks related to community service databases.
CO6:PO13- ERD tools assist in designing structured databases for community needs.
CO7:PO13- Understanding database views and physical structure enhances data management for community engagement.

CBCS Syllabus as per NEP 2020 for S.Y.B.C.A (2024 Pattern)

Name of the Programme : B.C.A.

Programme Code : BCA

Class : S.Y.B.C.A.

Semester : III

Course Type : Field Project (FP) [Practical]

Course Code : BCA-205-FP

Course Title : Field Project

No. of Credits : 02

No. of Teaching Hours : 60

Course Objectives:

1. To introduce students to field-based experiential learning.
2. To develop research, data collection, and analysis skills.
3. To enhance problem-solving and critical thinking abilities.
4. To improve communication and teamwork skills.
5. To encourage the application of theoretical knowledge in practical scenarios.
6. To exposure to industry practices, standards, and work environments, allowing them.
7. To manage projects, including planning, execution, time management, and resource allocation.

Course Outcomes:

By the end of the course, students will be able to:

CO1: Identify and define a research problem relevant to real-world applications.

CO2: Design and develop an appropriate research methodology, including questionnaire.

CO3: Conduct fieldwork and collect primary data systematically.

CO4: Analyze and interpret collected data using qualitative and quantitative methods.

CO5: Prepare a structured project report following academic guidelines.

CO6: Develop teamwork, ethical considerations, and professional communication skills.

CO7: Deliver an effective oral presentation, demonstrating clarity and confidence.

Topics and Learning Points

Time Allocation & Marks Distribution

Component	Hours Allocated	Marks
Topic Selection & Study Design	02.5 Hours	05 Marks
Survey Preparation & Fieldwork	12.5 Hours	20 Marks
Data Analysis	05.0 Hours	05 Marks
Report Writing	07.5 Hours	10 Marks
Oral Presentation	02.5 Hours	10 Marks
Total	**30 Hours**	**50 Marks**

Project Work Guidelines

1. Topic Selection:

Each student/group (2-3 students per group) must select a real-world topic relevant to their field of study. A faculty guide will supervise the project.

2. Survey Preparation & Fieldwork:

Prepare a structured questionnaire (20-30 questions) in Marathi or English. If the project does not require a survey, replace this step with relevant data collection methods. Conduct field visits to collect at least 25 responses or relevant data.

3. Data Analysis:

Compile and analyze the collected data using statistical tools, charts, and graphs**.** Identify patterns and key insights.

4. Report Writing:

The report should include Index, Chapters, Conclusion, and References**. Format:** 25 pages, Font Size 12, Line Spacing 1.5**.**

5. Oral Presentation:

Each student/group must present their findings in front of two faculty examiners. Evaluation is based on clarity, confidence, and presentation quality.

6. Evaluation Scheme

Evaluation will be done internally and externally by two faculty members. The Field Project is compulsory, and students must pass to complete their degree.

COPO Mapping Table

Course Outcomes	Programme Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PO13
CO1	3	2	3	-	2	2	-	2	2	2	2	3	-
CO2	2	3	2	-	2	2	-	-	-	3	2	3	2
CO3	-	2	3	-	2	2	2	2	-	2	3	2	2
CO4	2	2	3	-	3	2	2	-	-	3	2	3	2
CO5	2	2	2	2	2	-	-	-	-	2	2	3	2
CO6	-	2	2	3	2	3	-	2	-	-	2	3	2
CO7	-	2	2	3		2	-	2	-	2	2	-	2

Mapping- 3= strongly relates 2= Moderately Related 1= Partially Related

Course Objectives (CO) and Program Outcomes (PO) Mapping:

PO1: A Fundamental Knowledge and Coherent Understanding
CO1 is strongly mapped; it involves identifying and defining a research problem using foundational knowledge. CO2, CO4, and CO5 are moderately mapped with required application of basic concepts to design methodology and analyze data. CO3, CO6, and CO7 are weakly mapped. Focus more on application and communication than core knowledge.

PO2: Procedural Knowledge for Skill Enhancement
CO2 is strongly mapped as Designing a methodology directly reflects procedural skill. CO1, CO3, CO4, CO5, CO6, and CO7 are moderately mapped: Apply structured approaches throughout the research process.

PO3: Critical Thinking and Problem-Solving Skills:
CO1, CO3, and CO4 are strongly mapped with each stage of research involving problem identification, data analysis, and evaluation. CO2, CO5, CO6, and CO7 are moderately mapped. Indirectly involve logical and strategic thinking in execution and reporting

PO4: Communication Skills:
CO6 and CO7 are strongly mapped to an emphasis on verbal and written communication, especially for reporting and presentation. CO5 is moderately mapped, with academic writing requiring formal communication.

PO5: Analytical Reasoning Skills:
CO4 is strongly mapped. It directly involves interpreting data with analytical tools. CO1, CO2, CO3, CO5, and CO6 are moderately mapped. It engages with reasoning during problem identification, data collection, and ethics.

PO6: Innovation, Employability, and Entrepreneurial Skills
CO6 is strongly mapped. Enhances employability through professionalism and ethics. CO1, CO2, CO3, CO4, and CO7 are moderately mapped: Research and presentation skills foster innovation and applied learning.

PO7: Multidisciplinary Competence:
CO3 and CO4 are moderately mapped with Fieldwork and data analysis may involve multiple disciplines.

PO8: Value Inculcation through Community Engagement
CO1, CO3, and CO6 are moderately mapped, with Real-world research often involving community focused problems and ethical practices.

PO9: Traditional Knowledge into Modern Application
CO1 and CO2 are moderately mapped with Research may integrate traditional issues or practices depending on the topic.

PO10: Design and Development of System
CO2 and CO4 are strongly mapped with Research design and data analysis mirrors system development principles. CO1, CO3, CO5, and CO7 are moderately mapped, which includes elements of structured design and planning.

PO11: Ethical and Social Responsibility
CO6 is strongly mapped with ethics and professionalism and is explicitly taught. CO1, CO2, CO3, CO4, CO5, and CO7 are moderately mapped: Indirectly involve ethics in research handling.

PO12: Research-Related skills:
CO1, CO2, CO3, CO4, and CO5 are strongly mapped for Central focus on research planning, execution, and reporting. CO6 is moderately mapped to apply to professional research practices.

PO13: Teamwork
CO6 is strongly mapped for promoting collaboration and team ethics. CO2, CO3, CO4, CO5, and CO7 are moderately mapped. Often carried out in group projects or peer-reviewed settings.

CBCS Syllabus as per NEP 2020 for S.Y.B.C.A (2024 Pattern)

Name of the Programme : B.C.A.

Programme Code : BCA

Class : S.Y.B.C.A.

Semester : III

Course Type : Minor [Theory]

Course Code : BCA-206-MN

Course Title : Fundamentals of ICT

No. of Credits : 02

No. of Teaching Hours : 30

Prerequisites:

1. Basic knowledge of Computers and its concepts.
2. Familiarity with Operating Systems
3. Knowledge of using a web browser, search engines, and basic websites

Course Objectives:

1. Understand the foundational concepts of Information and Communication Technology (ICT).
2. Identify various hardware and software components essential to ICT systems.
3. Apply word processing, spreadsheet, and presentation tools in day-to-day academic and business activities.
4. Explore the role of ICT in education, governance, healthcare, and business sectors.
5. Use internet-based tools for communication, collaboration, and information retrieval.
6. Gain awareness of current ICT trends such as cloud computing, IoT, and AI.
7. Develop an understanding of digital literacy, cyber ethics, data privacy, and responsible digital behavior.

Course Outcomes:

By the end of the course, students will be able to:

CO1: Explain the basic concepts, components, and evolution of ICT.

CO2: Demonstrate effective use of productivity tools like Word, Excel, and

PowerPoint.

CO3: Utilize internet tools such as browsers, email, and cloud services for academic and professional use.

CO4: Recognize the application of ICT in various fields like e-governance, education, and health.

CO5: Identify emerging trends in ICT such as cloud computing, AI, and IoT.

CO6: Apply digital safety and cyber ethics in online communication and data handling.

CO7: Collaborate using online tools and practice netiquette and digital citizenship.

Topics and Learning Points

Unit	Title and Contents	No. of Lectures
1.	**Introduction to ICT** ▪ Definition, scope, and significance of ICT ▪ Components: Hardware, Software, Network, and Users ▪ History and evolution of ICT ▪ Impact of ICT on society and education	06
2.	**ICT Tools and Applications** ▪ Word processing and document formatting ▪ Spreadsheet basics: functions, formulas, and charts ▪ Presentation tools: design, layout, and delivery ▪ ICT in education, e-governance, health, and business	06
3.	**Peripherals of Computer** ▪ Primary storage devices – RAM, ROM, PROM, EPROM ▪ Secondary Storage Devices – HDD, CD, DVD, Pen drive ▪ I/O Devices- Keyboards, Scanners, Digitizers, Plotters, LCD, Plasma Display, ▪ Pointing Devices –Mouse, Joystick, Touch Screens ▪ Introduction to Network devices – Hubs, Switches, Routers, NAS, MODEM, Access	06
4.	**Internet and Communication** ▪ Internet basics: protocols, IP address, domain names ▪ Email, web browsing, search engines ▪ Introduction to cloud storage and collaboration tools (Google Drive, MS Teams)	06

5.	**Emerging ICT Trends** ▪ Cloud computing and virtualization ▪ Internet of Things (IoT) ▪ Artificial Intelligence in ICT ▪ Mobile computing and smart devices	06

References:

1. **"Fundamentals of Information Technology"** – Alexis Leon & Mathews Leon, Vikas Publishing
2. **"Information and Communication Technology"** – Pradeep K. Sinha & Priti Sinha, BPB Publications
3. **"Computer Fundamentals"** – P.K. Sinha, BPB Publications
4. **"Introduction to Information Technology"** – ITL Education Solutions, Pearson Education
5. **"Computer Concepts and Programming in C"** – Vikas Gupta, Wiley India (for application context)
6. **Web Resources** –
    - Digital India Portal – GoI ICT Initiatives
    - NPTEL ICT Lectures (IITs)
    - SWAYAM ICT Courses
    - Microsoft Learn – Office Tools
    - Google for Education
    - Khan Academy – Computing and Internet
    - Coursera – ICT Courses

CO-OP Mapping Table

Course Outcomes	Programmes Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	2		2	2			2	3		1	1	
CO2	2	3		3	3	2		1	3			2	
CO3	2	3		2	3	2		1	3		1	2	
CO4	3	3	2	2	2			2	2	1	2	1	2
CO5	2	2	2	2	3			3	3	1	2	2	
CO6	2	3		2	3	2	1	2	3	1	3	3	1
CO7	1	2		2	2	3		2	3	3	2	2	3

Mapping- 3= strongly relates 2= Moderately Related 1= Partially Related

Course Objectives (CO) and Program Outcomes (PO) Mapping:

1. Justify PO1 to All COs:

CO1:PO1- Strongly supports foundational understanding of ICT and its evolution.
CO2:PO1- Moderately contributes by teaching tool functionalities and their purpose.
CO3:PO1- Moderately enhances knowledge of internet-based technologies.
CO4:PO1- Strongly builds multidisciplinary understanding (e.g., e-governance, health).
CO5:PO1- Moderately contributes by introducing advanced ICT trends.
CO6:PO1- Moderately contributes by highlighting ethical issues in tech use.
CO7:PO1- Partially contributes to understanding netiquette and digital citizenship.

2. Justify PO2 to All COs:

CO1:PO2- Moderately supports professional knowledge through ICT fundamentals.
CO2:PO2- Strongly contributes via hands-on experience with industry-standard tools.
CO3:PO2- Strong relation to everyday professional tools like email and cloud.
CO4:PO2- Strong support through domain-specific applications (education, health, etc.).
CO5:PO2- Moderately supports understanding of upcoming tech relevant to industries.
CO6:PO2- Strong focus on cyber ethics and safe digital practices.
CO7:PO2- Moderately supports collaborative professional skills online.

3. Justify PO3 to All COs:

CO1:PO3- Not directly focused on entrepreneurship.
CO2:PO3- Not directly related.
CO3:PO3- Not directly supporting entrepreneurial development.
CO4:PO3- Moderately supports by revealing how ICT drives innovation in sectors.
CO5:PO3- Moderately supports entrepreneurial thinking through exposure to trends.
CO6:PO3- Not explicitly aligned.
CO7:PO3- Not directly contributing.

4. Justify PO4 to All COs:

CO1:P04- Moderately supports technical understanding.
CO2:P04- Strongly builds tool-based skills used in industry.
CO3:P04- Moderately improves skills through internet-based tools.
CO4:P04- Moderately supports domain-specific competency development.
CO5:P04- Moderately builds awareness of advanced competencies.
CO6:P04- Moderately supports digital conduct and safety.
CO7:P04- Moderately builds collaborative and online communication competencies.

5. Justify PO5 to All COs:

CO1:PO5- Moderately supports problem-solving using ICT principles.
CO2:PO5- Strongly supports through practical application of productivity tools.
CO3:PO5- Strongly contributes by applying internet and cloud tools effectively.

CO4:PO5- Moderately supports real-world problem analysis using ICT.
CO5:PO5- Strongly supports by introducing disruptive technologies that require critical thinking.
CO6:PO5- Strongly supports ethical problem-solving in digital contexts.
CO7:PO5- Moderately contributes through online collaboration and digital responsibility.

6. Justify PO6 to All COs:

CO1:PO6- Not directly focused on communication.
CO2:PO6- Moderately supports communication via presentations.
CO3:PO6- Moderately supports through email, sharing tools.
CO4:PO6- Not primarily communication-focused.
CO5:PO6- Not focused here.
CO6:PO6- Moderately supports responsible communication in digital spaces.
CO7:PO6- Strongly supports collaboration and netiquette in team environments.

7. Justify PO7 to All COs:

CO1:PO7- Not research-oriented.
CO2:PO7- Not applicable.
CO3:PO7- Not directly focused on research.
CO4:PO7- Not relevant.
CO5:PO7- Not primarily research-based.
CO6:PO7- Partially supports research ethics in digital data use.
CO7:PO7- Not directly related.

8. Justify PO8 to All COs:

CO1:PO8- Moderately supports by laying the foundation for future ICT learning.
CO2:PO8- Partially supports self-directed learning of tools.
CO3:PO8- Partially supports independent use of online resources.
CO4:PO8- Moderately promotes ICT as a learning enabler in various domains.
CO5:PO8- Strongly supports adaptive learning by introducing tech evolution.
CO6:PO8- Moderately supports learning ethical behavior online.
CO7:PO8- Moderately supports digital self-regulation and community learning.

9. Justify PO9 to All COs:

CO1:PO9- Strongly contributes to digital literacy through ICT understanding.
CO2:PO9- Strongly supports tech skill development via hands-on software use.
CO3:PO9- Strongly supports internet and cloud technology use.
CO4:PO9- Moderately contributes through digital application awareness.
CO5:PO9- Strongly contributes by addressing emerging digital trends.
CO6:PO9- Strongly contributes by teaching cyber safety and ethics.
CO7:PO9- Strongly contributes via online collaboration platforms and behavior.

10. Justify PO10 to All COs:

CO1:PO10- Not directly relevant.
CO2:PO10- Not applicable.
CO3:PO10- Not strongly related.
CO4:PO10- Partially supports by addressing societal applications of ICT.
CO5:PO10- Partially promotes inclusivity through accessibility technologies.
CO6:PO10- Partially supports ethical and inclusive behavior online.
CO7:PO10- Strongly supports digital citizenship and respectful online communication.

11. Justify PO11 to All COs:

CO1:PO11- Partially supports ethical awareness in ICT.
CO2:PO11- Not strongly connected.
CO3:PO11- Partially supports ethical use of cloud and online tools.
CO4:PO11- Moderately supports values via ICT for public good.
CO5:PO11- Moderately promotes responsible use of emerging technologies.
CO6:PO11- Strongly contributes through cyber ethics and data privacy.
CO7:PO11- Moderately promotes respectful digital behavior.

12. Justify PO12 to All COs:

CO1:PO12- Partially supports responsible understanding of ICT.
CO2:PO12- Moderately promotes self-reliant use of digital tools.
CO3:PO12- Moderately promotes accountable use of email, cloud, etc.
CO4:PO12- Partially supports responsibility in using ICT for social good.
CO5:PO12- Moderately promotes independent thinking about tech evolution.
CO6:PO12- Strongly supports responsible digital behavior.
CO7:PO12- Moderately promotes accountable online conduct.

13. Justify PO13 to All COs:

CO1:PO13- Not directly contributing.
CO2:PO13- Not relevant.
CO3:PO13- Not focused on community impact.
CO4:PO13- Moderately supports service applications like e-governance.
CO5:PO13- Not directly connected.
CO6:PO13- Partially promotes ethical community behavior online.
CO7:PO13- Strongly supports digital community engagement and collaboration.

CBCS Syllabus as per NEP 2020 for S.Y.B.C.A (2024 Pattern)

Name of the Programme : B.C.A.

Programme Code : BCA

Class : S.Y.B.C.A.

Semester : III

Course Type : Minor [Practical]

Course Code : BCA-207-MN

Course Title : Practical Lab on Advanced Excel

No. of Credits : 02

No. of Teaching Hours : 60

Prerequisites:

1. Basic Computer Skills – Navigating files, using a mouse/keyboard, basic typing.
2. Understanding of MS Excel Interface – Ribbon, cells, rows, columns, worksheets.
3. Basic Excel Operations – Data entry, formatting, copy-paste, simple calculations.
4. Basic Formulas and Functions – SUM, AVERAGE, MIN, MAX, basic arithmetic.

Course Objectives:

1. Edit worksheets using advanced enhancements and worksheet features.
2. Import and export data from the Internet and merge the data in to Excel.
3. Worksheets and publish Excel worksheets on the web.
4. Work with named ranges and create lists.
5. Import and Export data to and from Excel and other Office applications
6. Enhance lists using pivot tables and pivot table charts
7. Summarize data in worksheets and workbooks
8. Customize Excel worksheets and workbooks
9. Use case studies to create worksheets and workbooks.

Course Outcomes:

By the end of the course, students will be able to:

CO1: Able to handle MS-Excel data feeding and formatting

CO2: Able to manipulate data lists using Outline, Auto filter and PivotTables.

CO3: To Use Consolidation to summarize and report results from multiple worksheets.

CO4: Use advanced functions and productivity tools to assist in developing worksheets.

CO5: Able to create various data representation charts.

CO6: Understand to use various data validations

CO7: Applying advanced Excel skills to real-world projects and business scenarios, demonstrating the ability to solve complex problems using Excel.

Suggested Practical Assignments:

Sr. No.	Title and Contents	No. of Practical
1.	**Review of Basic Excel Skills** ▪ Recap of fundamental Excel functions and features	01
2.	**Advanced Formulas and Functions:** ▪ Nested functions ▪ Array formulas ▪ Logical functions (IF, AND, OR, etc.) ▪ Lookup and reference functions (VLOOKUP, HLOOKUP, INDEX, MATCH, etc.) ▪ Text functions ▪ Date and time functions	05
3.	**Data Analysis Techniques:** ▪ Data validation ▪ What-if analysis with scenarios ▪ Goal seek and solver ▪ Data tables ▪ Pivot tables and Pivot Charts	05
4.	**Advanced Formatting and Conditional Formatting:** ▪ Advanced formatting options ▪ Creating custom cell styles ▪ Advanced conditional formatting rules	03
5.	Collaboration and Security: ▪ Workbook protection and security ▪ Sharing workbooks and managing changes	2

References:

1. Excel 2019 Bible, 1st Edition by Michel Alexander, Richard Kulseika, John Walkenbatch.
2. Web links: www.tutorialspoint.com

COPO Mapping Table

Course Outcomes	Programmes Outcomes (POs)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PO13
CO1	2	3	1	2	2	1	1	2	3	1	1	2	1
CO2	2	3	1	3	3	2	1	2	3	1	1	2	1
CO3	2	3	1	3	3	2	1	2	3	1	1	2	1
CO4	2	3	1	3	3	2	1	2	3	1	1	2	1
CO5	2	3	1	2	3	2	1	2	3	1	1	2	1
CO6	2	3	1	2	2	2	1	2	3	1	1	2	1
CO7	3	3	2	3	3	2	2	3	3	2	2	3	2

Mapping- 3= strongly relates 2= Moderately Related 1= Partially Related

Course Objectives (CO) and Program Outcomes (PO) Mapping:

1. Justify PO1 to All COs:

CO1:PO1- Handling Excel formatting develops foundational understanding of data structure and presentation.
CO2:PO1- Working with filters and pivot tables builds conceptual clarity on data organization.
CO3:PO1- Consolidating worksheets reinforces understanding of multi-source data handling.
CO4:PO1- Using functions deepens understanding of logic and structure in data analysis.
CO5:PO1- Creating charts promotes visual literacy and communication of data concepts.
CO6:PO1- Data validation teaches rule-based logic and data control.
CO7:PO1- Real-world application requires conceptual clarity to build accurate business solutions.

2. Justify PO2 to All COs:

CO1:PO2- Demonstrates practical proficiency in spreadsheet creation and formatting.
CO2:PO2- Enables real-world data manipulation using standard Excel tools.
CO3:PO2- Consolidation reflects professional reporting and data summarization practices.
CO4: PO2- Advanced functions mirror industry expectations for productivity.
CO5: PO2- Charts are essential professional tools for presentations and analysis.
CO6: PO2- Data validation reflects procedural standards in data integrity.
CO7: PO2- Full project integration shows readiness for real-world data work.

3. Justify PO3 to All COs:

CO1:PO3- Basic Excel knowledge is a starting point for financial and business planning.
CO2: PO3- Filters and tables help small businesses analyze product or customer data.
CO3: PO3- Consolidation supports entrepreneurial reporting (e.g., multi-department summaries).

CO4: PO3- Functions automate calculations in budgeting or sales tracking.
CO5: PO3- Charts help visualize trends or projections in business contexts.
CO6: PO3- Validations prevent data-entry errors in business systems.
CO7: PO3- Projects simulate entrepreneurial scenarios requiring decision-making and innovation.

4. Justify PO4 to All COs:

CO1:PO4- Develops accuracy in basic data handling tasks.
CO2:PO4- Strengthens analytical thinking through sorting and summarizing large data sets.
CO3:PO4- Requires precise structuring and linking of multiple data points.
CO4:PO4- Technical mastery of formulas and functions enhances problem-solving.
CO5:PO4- Chart creation requires understanding of data relationships and visual logic.
CO6:PO4- Validations enhance technical rigor and user-oriented design.
CO7:PO4- Integrates all technical skills in a real-world scenario requiring strategic thinking.

5. Justify PO5 to All COs:

CO1:PO5- Formatting is used to organize and troubleshoot data presentation issues.
CO2:PO5- Filtering and outlining data enhances decision-making from raw datasets.
CO3:PO5- Applying consolidation solves multi-source reporting challenges.
CO4:PO5- Functions help automate tasks and optimize worksheet performance.
CO5:PO5- Visual data interpretation aids in deriving insights.
CO6:PO5- Validation anticipates and prevents user errors a problem-solving mechanism.
CO7:PO5- Business-based tasks demand end-to-end reasoning and solution building.

6. Justify PO6 to All COs:

CO1:PO6- Clean formatting contributes to readability and clarity.
CO2:PO6- Summarized tables and filters support team discussions.
CO3:PO6- Consolidated reports serve as communicative summaries across teams.
CO4:PO6- Structured formulas enhance collaborative worksheet development.
CO5:PO6- Charts are a primary visual communication tool.
CO6:PO6- Validation ensures consistent, understandable input rules across users.
CO7:PO6- Requires communication of ideas in collaborative or client-facing projects.

7. Justify PO7 to All COs:

CO1:PO7- Provides foundational exposure to data handling.
CO2:PO7- Helps in cleaning and categorizing data for analysis.
CO3:PO7- Prepares multi-sheet datasets for research summarization.
CO4:PO7- Automates analysis for repeated calculations in research.
CO5:PO7- Charts visualize data trends, supporting hypothesis validation.
CO6:PO7- Validations protect research data from contamination.
CO7:PO7- Projects mimic research cycles—data gathering, processing, analysis, and reporting.

8. Justify PO8 to All COs:

CO1:PO8- Encourages exploring Excel features beyond taught examples.
CO2:PO8- Requires learning to customize filters and pivot tables.
CO3:PO8- Teaches how to link sheets and navigate new features.
CO4:PO8- Mastering new functions requires self-initiative and experimentation.
CO5:PO8- Chart types and settings are often learned through trial.
CO6:PO8- Learning validation rules and applying them demands exploration.
CO7:PO8- Open-ended project work fosters independent problem-solving.

9. Justify PO9 to All COs:

CO1:PO9- Basic digital literacy in Excel.
CO2:PO9- Demonstrates effective use of complex Excel features.
CO3:PO9- Manages data from multiple worksheets with digital consolidation tools.
CO4:PO9- Uses advanced logic-based functions.
CO5:PO9- Creates high-impact charts using digital tools.
CO6:PO9- Applies software-based controls like validation lists.
CO7:PO9- Full integration of digital tools in simulated business or data projects.

10. Justify PO10 to All COs:

CO1–CO6:PO10- Minor but supports communication and clarity in shared work environments.
CO7:PO10- Real-world project scenarios may involve diverse data and team collaboration, promoting inclusive thinking and empathy.

11. Justify PO11 to All COs:

CO1–CO6:PO11- Can include responsible data representation (e.g., financial ethics, environmental data).
CO7:PO11- Projects may include themes (e.g., sustainability data) requiring ethical data use and analysis.

12. Justify PO12 to All COs:

CO1–CO6:PO12- Each task demands attention to detail and individual responsibility.
CO7:PO12- Project-based work fosters accountability and independence in planning and execution.

13. Justify PO13 to All COs:

CO1–CO6:PO13- Marginal links; skills may support civic data or service analysis (e.g., NGO reports).
CO7:PO13- Project topics may involve social data or serve a community-based objective, enhancing engagement.

CBCS Syllabus as per NEP 2020 for S.Y.B.C.A (2024 Pattern)

Name of the Programme : B.C.A.

Programme Code : BCA

Class : S.Y.B.C.A.

Semester : III

Course Type : Open Elective (OE) [Theory]
Course Code : BCA-208- OE

Course Title : Informatics and Cyber laws

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

1. Understand Cyber Laws.
2. Identify Cybercrimes & Legal Frameworks.
3. Explore Cyber security & Data Privacy.
4. Examine E-Commerce & Intellectual Property Laws.
5. Analyze Privacy & Data Protection Laws.
6. Study Cybercrime Investigation & Digital Forensics.
7. Apply Cyber Law in Real-World Scenarios.

Course Outcomes:

By the end of the course, students will be able to:

CO1: Understand Cyber Laws.

CO2: Identify Cybercrimes & Legal Implications.

CO3: Apply Cyber security & Data Protection Measures.

CO4: Analyze E-Commerce & Intellectual Property Laws.

CO5: Evaluate Privacy & Data Protection Regulations.

CO6: Conduct Cybercrime Investigations & Digital Forensics.

CO7: Integrate Cyber Law Knowledge in Professional Practice.

Topics and Learning Points

Teaching Hours

UNIT 1: Introduction to Informatics Cyber laws **[06]**

- Overview of Cyber laws and their significance
- Types of Cybercrimes and legal implications
- Jurisdiction and challenges in Cyber law enforcement.

UNIT 2: Cyber Security and Data Privacy **[06]**

- Cyber security threats and countermeasures
- Data protection laws and regulations
- Cyber security policies and practices

UNIT 3: Legal Framework for E-commerce and Intellectual Property **[06]**

- Laws related to e-commerce and electronic transactions
- Intellectual Property laws and their application in the digital environment.

UNIT 4: Privacy and Data Protection Laws **[06]**

- Privacy laws and regulations
- Data breach notification and handling
- GDPR and other global data protection laws

UNIT 5: Cyber Crime Investigation and Digital Forensics **[06]**

- Digital evidence and forensic techniques
- Cybercrime investigation process
- Role of digital forensics in legal proceedings

Reference Books:

1. "Cyber Law: Legal and Practical Considerations for Computer, E-commerce, and Intellectual Property" by Brett J. Trout.
2. "Cyber law: Management and Entrepreneurship" by Patricia L. Bellia, Paul Schiff Berman, and David G. Post.

COPO Mapping Table

Course Outcomes	Programmes Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	2	1	1	2	1	2	2	1	1	3	2	1
CO2	3	3	2	2	3	2	2	2	2	1	3	2	2
CO3	2	3	2	3	3	2	2	2	3	1	3	2	1
CO4	3	2	2	2	3	2	2	2	2	2	2	2	2
CO5	3	3	2	2	3	2	2	2	2	2	3	3	2
CO6	2	3	2	3	3	2	3	2	3	1	2	3	2
CO7	3	3	3	3	3	3	2	3	3	2	3	3	3

Mapping- 3= strongly relates 2= Moderately Related 1= Partially Related

Course Objectives (CO) and Program Outcomes (PO) Mapping:

1. Justify PO1 to All COs:

CO1:PO1- Understanding cyber laws involves foundational legal principles in cyberspace.
CO2:PO1- Identifying cybercrimes and legal consequences require deep knowledge of criminal and IT law.
CO3:PO1- Cyber security and data protection measures are based on well-established theories and standards.
CO4:PO1- E-commerce and IP laws are rooted in comprehensive legal and business principles.
CO5:PO1- Evaluating privacy regulations demands mastery of multidisciplinary concepts.
CO6:PO1- Forensics requires understanding of legal, technical, and procedural principles.
CO7:PO1- Applying cyber law in practice relies on integrated domain knowledge.

2. Justify PO2 to All COs:

CO1:PO2- Knowledge of cyber laws is essential for professional IT/legal compliance.
CO2:PO2- Recognizing cybercrime types helps professionals prevent and respond to threats.
CO3:PO2- Practical security implementation is key in the workplace.
CO4:PO2- Understanding IP and e-commerce laws ensure lawful operations.
CO5:PO2- Professionals must comply with global and regional data privacy laws.
CO6:PO2- Forensics demands stepwise application of procedures and tools.
CO7:PO2- Legal knowledge directly informs ethical and professional practices.

3. Justify PO3 to All COs:

CO1:PO3- Entrepreneurs must understand cyber regulations to protect digital assets.
CO2:PO3- Recognizing cybercrime threats helps mitigate risks in digital ventures.
CO3:PO3- Entrepreneurs must apply data security best practices in startups.
CO4:PO3- Understanding IP law protects innovation and brand identity.

CO5:PO3- Privacy compliance builds trust with users and customers.
CO6:PO3- Forensics knowledge supports investigation in internal breaches.
CO7:PO3- Law integration helps entrepreneurs run legally sound businesses.

4. Justify PO4 to All COs:

CO1:PO4- Builds legal reasoning and analytical capability.
CO2:PO4- Enhances ability to identify legal violations and respond appropriately.
CO3:PO4- Requires understanding of security architecture and risk handling.
CO4:PO4- Combines legal analysis with practical application in digital commerce.
CO5:PO4- Deepens capacity to interpret and apply complex privacy laws.
CO6:PO4- Requires technical, legal, and procedural investigation skills.
CO7:PO4- Applies all specialized knowledge into informed legal decisions.

5. Justify PO5 to All COs:

CO1:PO5- Legal interpretation improves analytical thinking.
CO2:PO5- Requires evaluating cybercrimes and appropriate responses.
CO3:PO5- Implementing security protocols solves real-world IT threats.
CO4:PO5- Requires analysis of IP disputes or e-commerce violations.
CO5:PO5- Analyzing and comparing data protection regulations across borders.
CO6:PO5- Involves forensic analysis to trace crimes and collect admissible evidence.
CO7:PO5- Integrates laws into workplace scenarios requiring problem-solving.

6. Justify PO6 to All COs:

CO1:PO6- Explaining cyber laws builds legal communication ability.
CO2:PO6- Collaboration needed in cybercrime response teams.
CO3:PO6- Clear communication of security protocols is essential in teams.
CO4:PO6- Requires cross-functional communication between legal and IT teams.
CO5:PO6- Articulating privacy policies and legal frameworks is key.
CO6:PO6- Requires communication with law enforcement and legal counsel.
CO7:PO6- Application in practice involves both legal advising and teamwork.

7. Justify PO7 to All COs:

CO1:PO7- Legal research skills are developed when studying cyber laws.
CO2:PO7- Analyzing new crime types and legal precedents requires inquiry skills.
CO3:PO7- Researching evolving security tools and legal mandates.
CO4:PO7- Requires study of international legal frameworks for IP and e-commerce.
CO5:PO7- Involves researching national and global privacy standards.
CO6:PO7- Forensics often involves systematic investigation and documentation.
CO7:PO7- Real-world application includes policy or legal document research.

8. Justify PO8 to All COs:

CO1:PO8- Cyber laws evolve; learners must continuously update their knowledge.
CO2:PO8- New threats require adaptive learning of emerging crime trends.
CO3:PO8- Learning new security tools and practices is continuous.
CO4:PO8- E-commerce and IP laws change with technology—demanding ongoing learning.
CO5:PO8- Privacy laws vary by region and must be independently learned.
CO6:PO8- Forensics technology and methods evolve rapidly.
CO7:PO8- Application in professional roles involves self-learning new legal updates.

9. Justify PO9 to All COs:

CO1:PO9- Cyber law understanding supports responsible tech use.
CO2:PO9- Recognizing crimes involves use of digital tools and evidence.
CO3:PO9- Security measures include use of software tools and ICT skills.
CO4:PO9- IP law often intersects with digital product protection.
CO5:PO9- Understanding tech platforms' privacy configurations is essential.
CO6:PO9- Forensic investigations require advanced digital analysis tools.
CO7:PO9- Integrating law into tech environments requires strong digital acumen.

10. Justify PO10 to All COs:

CO1:PO10- Cyber laws differ globally—learners develop respect for legal diversity.
CO2:PO10- Recognizing cyber threats across communities build inclusive awareness.
CO3:PO10- Security practices must be inclusive, protecting all user demographics.
CO4:PO10- IP laws must respect diverse traditions and ownership rights.
CO5:PO10- Empathy is needed to balance user rights with legal obligations.
CO6:PO10- Cyber investigations often involve understanding victim perspectives.
CO7:PO10- Professionals must practice ethical and inclusive legal interpretation.

11. Justify PO11 to All COs:

CO1:PO11- Understanding laws fosters ethical conduct online.
CO2:PO11- Identifying crimes promote justice and responsible digital behavior.
CO3:PO11- Data protection aligns with values of privacy and dignity.
CO4:PO11- IP respect is rooted in ethics and fairness.
CO5:PO11- Privacy law compliance reflects moral accountability.
CO6:PO11- Cybercrime investigations seek truth and protect the innocent.
CO7:PO11- Law integration requires consistent ethical and civic responsibility.

12. Justify PO12 to All COs:

CO1:PO12- Knowing the law empowers independent ethical decision-making.
CO2:PO12- Enables proactive response to violations without external prompting.
CO3:PO12- Applying cyber security solutions shows personal accountability.
CO4:PO12- Understanding IP allows professionals to self-regulate their actions.

CO5:PO12- Adhering to privacy regulations reflects individual responsibility.
CO6:PO12- Forensics requires rigorous attention to lawful and responsible practice.
CO7:PO12- Professionals must be legally informed and act responsibly without supervision.

13. Justify PO13 to All COs:

CO1:PO13- Cyber law awareness enables professionals to educate others.
CO2:PO13- Identifying and reporting crimes benefits the broader community.
CO3:PO13- Security practices protect not just individuals but community networks.
CO4:PO13- IP law knowledge can support artists, creators, and businesses.
CO5:PO13- Privacy law compliance shows respect for community rights.
CO6:PO13- Investigations serve justice and community well-being.
CO7:PO13- Law knowledge enables contributions to legal literacy and digital citizenship.

CBCS Syllabus as per NEP 2020 for S.Y.B.C.A (2024 Pattern)

Name of the Programme : B.C.A.

Programme Code : BCA

Class : S.Y.B.C.A.

Semester : III

Course Type : Subject Specific Indian Knowledge System (IKS) [Theory]

Course Code : BCA-209-IKS

Course Title : Ancient Indian Foundations of Computing

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

1. To understand the fundamentals of the Indian Knowledge System (IKS) and its relevance to computing.
2. To explore ancient Indian contributions in science, mathematics, and technology.
3. To study the decimal system, concept of zero, and Vedic mathematics in computing.
4. To analyse contributions of Aryabhata, Brahmagupta, and Bhaskara to computation.
5. To examine Pingala's binary system and its link to modern computing.
6. To learn the role of Sulba Sutras in geometry and measurements.
7. To identify the influence of Indian logic and mathematical principles on algorithms.

Course Outcomes:

By the end of the course, students will be able to:

CO1: Explain the Indian Knowledge System (IKS) and its role in computing.

CO2: Identify ancient Indian contributions in various scientific fields.

CO3: Analyse Indian mathematicians' impact on modern computation.

CO4: Demonstrate Vedic math techniques for fast calculations.

CO5: Explain the decimal system and zero in digital computing.

CO6: Describe Pingala's binary system and its computing relevance.

CO7: Apply Indian logic and math concepts in algorithm design.

Topics and Learning Points

Unit	Topic	No. of Lectures
1	**Indian Knowledge System and Its Influence on Computing** **1. Introduction to Indian Knowledge System (IKS)** **1.1 Overview of Indian Knowledge System (IKS)** 1.1.1 Key elements of IKS 1.1.2 Relevance of IKS in modern science and technology **1.2 Ancient Indian Contributions to Science and Technology** 1.2.1 Indian knowledge in Astronomy, Medicine, Engineering and Computing 1.2.2 Role of Sulba Sutras in geometry and measurements 1.2.3 Early concepts of robotics and automation in Indian texts **2. Mathematical Foundations of Computing in Ancient India** **2.1 Contributions of Indian Mathematicians to Computation** 2.1.1 Aryabhata: Contributions to trigonometry, algebra, and numerical methods 2.1.2 Brahmagupta: Introduction of zero, algebraic equations 2.1.3 Bhaskara: Calculus concepts, continued fractions **2.2 Decimal Number System and Concept of Zero (Shunya)** 2.2.1 Origin and significance of the decimal system in Indian mathematics 2.2.2 Application of positional number systems in digital computing **2.3 Vedic Mathematics and Fast Computation Techniques** 2.3.1 Sutras and their practical applications in calculations 2.3.2 Speedy multiplication, division, and algebraic operations **2.4 Pingala's Binary Number System** 2.4.1 Pingala's Chandaśhāstra 2.4.2 Meru Prastara (Pascal's Triangle)	**10**

2	**Indian Logic, Computational Thinking, and Ethics in Computing** **2.1 Introduction to Indian Logic Systems** 2.1.1 Nyaya Sutras 2.1.2 Tarka Shastra 2.1.3 Mimamsa philosophy **2.2 Panini's Ashtadhyayi and Formal Language Theory** 2.2.1 Structure and rules of Panini's grammar as an early computing model 2.2.2 Use of Paninian rules in Natural Language Processing (NLP) 2.2.3 Computational linguistics inspired by Sanskrit grammar **2.3 Indian Philosophical Approach to Algorithms and Data Processing** 2.3.1 Indian methods of data classification and pattern recognition 2.3.2 Influence of Indian logic on decision trees, sorting, and searching algorithms **2.4 Indian Ethical Framework in Knowledge and Technology** 2.4.1 Dharma and Ethics in technological advancements 2.4.2 Moral considerations in AI, cyber security, and data privacy 2.4.3 Ethical software development based on Indian values **2.5 Sustainability and Indian Knowledge-Based Computing Practices** 2.5.1 Sustainable computing inspired by ancient Indian ecological knowledge 2.5.2 Low-energy computing models and environment-friendly technology	12
3	**Evolution in Computer and Indian Contribution in Computer and Technology** 3.1.Early Computing Devices 3.2.Generations of computer 3.3.Evolutions of programming Languages 3.4. Indian contribution in computer and technology: 3.4.1 Pentium chip by Vinod Dham, 3.4.2 Hotmail by Sabeer Bhatia, 3.4.3 Universal Serial Bus (USB) by Ajay Bhatt 3.4.4 Fibre Optics by Dr. Narinder Singh Kapany, 3.4.5 First Supercomputer by Vijay Bhatkar, 3.5.Major information technology hubs in india, 3.6.Major data centre hubs in india,	08

References:

Books:

1. **"Indian Knowledge System"** – *Kapil Kapoor*
2. **"Vedic Mathematics"** – *Bharati Krishna Tirtha*
3. **"History of Hindu Mathematics"** – *Bibhutibhushan Datta & Avadesh Narayan Singh*
4. **"Panini: A Survey of Research"** – *George Cardona*
5. **"Nyaya and Logic"** – *Bimal Krishna Matilal*
6. **"The Crest of the Peacock: Non-European Roots of Mathematics"** – *George Gheverghese Joseph*"
7. **Artificial Intelligence and Indian Knowledge System"** – *P.V. Sivaraman*
8. **"History of Science and Technology in India"** – *S. K. Jain*

Links:

1. https://www.amazon.com/Introduction-Indian-Knowledge-System-Applications/dp/939181820X
2. https://iks.iitgn.ac.in/wp-content/uploads/2020/06/Indian_Knowledge_Systems-Kapil-Kapoor.pdf
3. https://www.amazon.com/Universal-History-Computing-Georges-Ifrah/dp/0471441473
4. https://archive.org/details/HistoryOfHinduMathematics

COPO Mapping Table

Course Outcomes	Programmes Outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	2	2	2	2	2	2	3	2	3	3	2	2
CO2	3	2	2	2	2	2	2	3	2	3	3	2	2
CO3	3	2	2	3	3	2	2	2	2	2	2	2	1
CO4	2	3	2	3	3	2	1	2	2	2	2	2	1
CO5	3	3	2	3	3	2	2	2	3	2	2	2	1
CO6	3	2	2	3	3	2	2	2	3	2	2	2	1
CO7	3	3	2	3	3	2	2	2	3	2	2	3	2

Mapping- 3= strongly relates 2= Moderately Related 1= Partially Related

Course Objectives (CO) and Program Outcomes (PO) Mapping:

1. **Justify PO1 to All COs:**

CO1:PO1- Understanding IKS enriches foundational knowledge of computing from a historical perspective.
CO2:PO1- Identifying ancient scientific contributions expand multidisciplinary awareness.
CO3:PO1- Analyzing Indian mathematicians builds conceptual clarity on computation's evolution.
CO4:PO1- Vedic math enhances numerical literacy through traditional logic.
CO5:PO1- Linking the decimal system to digital computing strengthens core conceptual understanding.
CO6:PO1- Understanding Pingala's binary system connects ancient theory to modern computing logic.
CO7:PO1- Applying Indian logic in algorithms demonstrates integration of classical knowledge into technical fields.

2. **Justify PO2 to All COs:**

CO1:PO2- Demonstrates application of classical knowledge in computing domains.
CO2:PO2- Shows how ancient procedures inform modern methodologies.
CO3:PO2- Helps derive practical computing logic from historical insights.
CO4:PO2- Vedic techniques provide faster calculation methods useful in real tasks.
CO5:PO2- Decimal system knowledge aids understanding of computation foundations.
CO6:PO2- Binary relevance shows direct link to computer architecture.
CO7:PO2- Enhances algorithmic problem-solving using traditional reasoning frameworks.

3. **Justify PO3 to All COs:**

CO1:PO3- Recognizing IKS opens new avenues for cultural tech products.
CO2:PO3- Historical knowledge can drive heritage-based innovation.
CO3:PO3- Ancient mathematics may inspire new algorithmic applications.
CO4:PO3- Vedic math may lead to educational tool development.
CO5:PO3- Cultural systems like the decimal system can be marketed through edtech.
CO6:PO3- Binary insights from Pingala may support low-level computing innovations.
CO7:PO3- Traditional logic enhances innovation in algorithm and system design.

4. **Justify PO4 to All COs:**

CO1:PO4- Builds communication and interpretive skills across domains.
CO2:PO4- Enables articulation of complex knowledge in various contexts.
CO3:PO4- Improves analytical skills by comparing ancient and modern computation.
CO4:PO4- Vedic math boosts mental agility and numerical efficiency.
CO5:PO4- Understanding positional value in computing improves abstraction skills.
CO6:PO4- Enhances logical and sequential thinking relevant to binary coding.
CO7:PO4- Strengthens technical algorithmic skills using traditional logic.

5. Justify PO5 to All COs:

CO1:PO5- IKS principles can be applied in unique tech problem-solving.
CO2:PO5- Recognizing ancient problem-solving techniques fosters creative application.
CO3:PO5- Encourages logical reasoning by tracing computational roots.
CO4:PO5- Vedic math teaches simplification and faster approaches to problems.
CO5:PO5- Enables better understanding of base systems and numeric reasoning.
CO6:PO5- Binary system comprehension enhances application of logic circuits.
CO7:PO5- Strengthens real-world problem solving via integration of traditional logic in algorithms.

6. Justify PO6 to All COs:

CO1:PO6- Explaining IKS concepts promotes interdisciplinary communication.
CO2:PO6- Sharing discoveries about ancient contributions fosters collaborative learning.
CO3:PO6- Comparative presentations build strong articulation of technical evolution.
CO4:PO6- Group discussions on Vedic math develop collaborative skills.
CO5:PO6- Interpreting numerical systems requires clear explanation.
CO6:PO6- Binary logic representation develops technical language skills.
CO7:PO6- Communicating logic flows strengthens group collaboration on coding logic.

7. Justify PO7 to All COs:

CO1:PO7- IKS offers a rich base for literature and historical inquiry.
CO2:PO7- Researching ancient scientific contributions encourages academic inquiry.
CO3:PO7- Tracing mathematical evolution hones analytical research skills.
CO4:PO7- Research into Vedic sources improves sourcing and validation abilities.
CO5:PO7- Historical study of number systems promotes investigative approaches.
CO6:PO7- Research into Pingala's texts develops qualitative and quantitative inquiry.
CO7:PO7- Algorithmic design using classical models involves hypothesis formulation and testing.

8. Justify PO8 to All COs:

CO1:PO8- Encourages learning from traditional knowledge sources.
CO2:PO8- Promotes self-directed exploration of historical systems.
CO3:PO8- Stimulates curiosity about evolution of mathematics.
CO4:PO8- Learning Vedic math independently promotes metacognitive learning.
CO5:PO8- Discovery of decimal origins builds initiative in learning.
CO6:PO8- Binary exploration fosters independent learning and connection-building.
CO7:PO8- Application of Indian logic promotes deeper exploration into algorithmic thinking.

9. Justify PO9 to All COs:

CO1:PO9- IKS concepts can be digitized and presented via technology tools.
CO2:PO9- Digital libraries and simulations can be used to study ancient contributions.
CO3:PO9- Learning tech-based platforms to simulate historic algorithms.

CO4:PO9- Using Excel/Python to simulate Vedic calculations.
CO5:PO9- Understanding place value and binary links to digital computing.
CO6:PO9- Pingala's binary theory directly relates to digital computation.
CO7:PO9- Algorithms built using ancient logic foster tech-skills.

10. Justify PO10 to All COs:

CO1:PO10- Understanding IKS fosters appreciation for non-Western knowledge systems.
CO2:PO10- Ancient science builds pride and respect for global heritage.
CO3:PO10- Encourages inclusive discussions around contributions from different cultures.
CO4:PO10- Vedic methods promote acceptance of diverse learning styles.
CO5:PO10- Sharing positional systems promotes appreciation of diverse origins.
CO6:PO10- Binary links show how non-Western systems influenced global computing.
CO7:PO10- Inclusion of Indian logic in modern computing shows cultural respect.

11. Justify PO11 to All COs:

CO1:PO11- IKS integrates holistic thinking with ethical knowledge-sharing.
CO2:PO11- Respect for ancient scientific efforts fosters value-based learning.
CO3:PO11- Ethical use of knowledge from historic sources is emphasized.
CO4:PO11- Vedic systems teach clarity, simplicity, and humility.
CO5:PO11- History of zero encourages academic honesty and intellectual humility.
CO6:PO11- Study of binary ethics instills intellectual credit and integrity.
CO7:PO11- Application of Indian logic involves value-based computation.

12. Justify PO12 to All COs:

CO1:PO12- Encourages learners to research and present independently.
CO2:PO12- Learners take initiative in studying diverse scientific topics.
CO3:PO12- Promotes ownership in analyzing historical influences.
CO4:PO12- Vedic math requires discipline in practice and application.
CO5:PO12- Study of zero system demands clarity and accountability.
CO6:PO12- Binary understanding demands accuracy and responsibility.
CO7:PO12- Designing logic algorithms from Indian roots involves responsibility in correctness.

13. Justify PO13 to All COs:

CO1:PO13- Learners can educate communities on cultural knowledge.
CO2:PO13- Promotes heritage awareness in outreach and school programs.
CO3:PO13- Engages communities through exhibitions of India's computational legacy.
CO4:PO13- Vedic math can be taught to rural/underserved students.
CO5:PO13- Positional systems can be shared in educational drives.
CO6:PO13- Binary legacy can be part of cultural coding bootcamps.
CO7:PO13- Logical systems can be used in social educational initiatives.