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 (Science)

(Faculty of Science and Technology)

CBCS Syllabus

FYBCA (Sci.)

For Department of BCA (Sci.)

NEP-2.0

Choice Based Credit System Syllabus

(2024 Pattern)

(As Per NEP-2020)

(Eligibility: Any 12 with MH-CET of BBA/BCA)

To be implemented from Academic Year 2024-2025

Title of the Programme: FYBCA (Science)

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(Science) of Tuljaram Chaturchand College, Baramati - Pune has prepared the syllabus of FYBCA Semester - I 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 (Science) 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 (Science) 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 2024-25)
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

(Autonomous)

Board of Studies (BOS) in BCA

From 2024-25 to 2026-27

Sr. No.	Name	Designation
1.	Mr. Vishal Shaha	Chairman
2.	Mr. Rahul Shah	Member
3.	Ms. Prajakta Kulkarni	Member
4.	Mrs. Asmita Bhagat	Member
5.	Ms. Kalyani Londhe	Member
6.	Mrs. Poornima Swami	Member
7.	Dr. Ms. Kavita Khobragade	Expert from SPPU Pune
8.	Dr. Sudhakar Bhoite	Expert from other University
9.	Dr. Suhas Satonkar	Expert from other University
10.	Mr. Rohit Shah	Industry Expert
11.	Dr. Nita Dhane	Member
12.	Dr. Priti Malusare	Member
13.	Dr. Aniket Kothawale	Member
14.	Dr. Shital Gawade	Member
15.	Dr. Prakash Fulari	Member
16.	Dr. Shaila Jadhav	Member
17.	Dr. Sushil Deshmukh	Member
18.	Dr. Pradeep Saravde	Member
19.	Mr. Pranit Wabale	Member
20.	Miss. Surashi Sonawane	Member

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

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 from (Electronics, Mathematics).													
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**

SEMESTER –I

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

Name of the Programme : B.C.A. (Science)

Programme Code : BCA

Class : F.Y.B.C.A.

Semester : I

Course Type : Major Mandatory [Theory]

Course Code : BCA-101 GEN

Course Title : Problem Solving Techniques and Basic C Programming

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

1. Understand basic terminology of computers, problem solving, programming Languages and their evolution
2. Understanding C language and its important features.
3. Design the solution from specification of a problem and write pseudo code of the algorithm using basic building blocks or structured programming constructs (Sequence, Selection and Repetition statement).
4. Apply C programming concepts to real-world problems.
5. Improve code efficiency and optimization.
6. Write programs using function call techniques
7. To understand the importance of Array

Course Outcomes:

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

CO1: Understand the fundamentals of C programming language.

CO2: Develop problem-solving skills.

CO3: Gain proficiency in C programming syntax and semantics.

CO4: Gain a foundation for advanced programming concepts.

CO5: Apply C programming concepts to real-world problems.

CO6: Improve code efficiency and optimization.

CO7: Develop debugging and error handling skills.

Topics and Learning Points

Teaching Hours

UNIT I: Introduction to Problem solving Techniques **[05]**

1.0 Introduction
1.1 Procedure (steps involved in problem solving)
1.2 Algorithm
1.3 Flow Chart
1.4 Symbols used in Flow Charts
1.5 Pseudo Code
1.6 Programming languages

UNIT II: Features of C **[10]**

2.0 Introduction
2.1 Character Set
2.2 Structure of a 'C' Program
2.3 Data Types in 'C'
2.4 Operations
2.5 Expressions
2.6 Assignment Statement
2.7 Conditional Statements
2.8 Structure for Looping Statements
2.9 Nested Looping Statements
2.10 Multi Branching Statement (Switch), Break and Continue
2.11 Differences between Break and Continue
2.12 Unconditional Branching (Go to Statement)

UNIT III: Functions in C **[08]**

3.0 Introduction
3.1 Functions
3.2 Differences between Function and Procedures
3.3 Advantages of Functions
3.4 Advanced features of Functions
3.5 Recursion

UNIT IV: Arrays in C **[07]**

4.0 Introduction
4.1 Definition of Array
4.2 Types of Arrays

4.3 Two - Dimensional Array
4.4 Declare, initialize array of char type

Text Books:

1. Venkatesh, Nagaraju Y, Practical C Programming for Problem Solving, Khanna Book Publishing Company, 2024.
2. AICTE's Programming for Problem Solving (with Lab Manual), Khanna Book Publishing Company, 2024.
3. Harvey Deitel and Paul Deitel, C How to Program, 9th edition, Pearson India, 2015.
4. R G Dromey, How to Solve It by Computer.

Reference Books:

1. Brian W. Kernighan and Dennis Ritchie, The C Programming Language, 2nd edition,Pearson, 2015.
2. Jeri Hanly and Elliot Koffman, Problem Solving and Program Design in C, 8th edition,Pearson, 2015.
3. Yashavant Kanetkar :Let Us C 7th Edition, PBP Publications
4. E Balaguruswamy : Programming in ANSI C 7th Edition, Tata Mc-Graw Hill Publishing Co. Ltd.- New Delhi

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

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-Understanding the digital paradigm provides foundational context for designing computational solutions that leverage digital technologies effectively.

CO2:PO1-Recognizing the importance of digital tools influences the design of computational solutions to address relevant technological and financial challenges.

Communication and network knowledge is essential for designing robust computational solutions that CO3:PO1-involve data transmission, networking protocols, and system connectivity.

CO4:PO1-While awareness of e-governance and Digital India initiatives is beneficial, its direct impact on designing and implementing computational solutions is limited compared to other COs.

CO5:PO1- Understanding practical applications of digital technology informs the design and implementation of computational solutions tailored to specific technological contexts

CO6:PO1- Basic knowledge of machine learning and big data is relevant for designing computational solutions that involve data analytics, pattern recognition, and decision-making processes.

CO7:PO1- Knowledge of social networking, while interesting, has limited direct relevance to designing and implementing computational solutions to significant problems compared to other COs.

2. Justification of PO2 to ALL COs :

CO1:PO2- A solid understanding of C fundamentals is crucial for acquiring practical skills and expertise in professional tasks, as it forms the base for all programming activities.

CO2:PO2- Problem-solving skills are essential for effectively applying industry standards and best practices in real-world scenarios, directly contributing to professional competence.

CO3:PO2- Proficiency in C syntax and semantics is vital for carrying out professional tasks with precision and adhering to industry standards.

CO4:PO2- While foundational knowledge in advanced programming is important, its direct application to practical professional tasks may vary, making it moderately related.

CO5:PO2- Applying programming concepts to real-world problems is directly aligned with the ability to perform professional tasks and apply knowledge effectively in real-world scenarios.

CO6:PO2- Code efficiency and optimization are key aspects of professional expertise, adhering to best practices and industry standards.

CO7:PO2- Debugging and error handling are essential skills for professional competence, enabling effective troubleshooting and adherence to quality standards in real-world scenarios.

3. Justification of PO3 to ALL COs:

CO1:PO3- Understanding C programming fundamentals provides basic skills useful in entrepreneurship, though not directly related.

CO2:PO3- Problem-solving skills are crucial for identifying opportunities and fostering innovation, key in entrepreneurship.

CO3:PO3- Proficiency in programming supports innovation, aiding entrepreneurial activities.

CO4:PO3-Advanced programming concepts enhance innovation, contributing to entrepreneurial ventures.

CO5:PO3-Applying programming to real-world problems is tied to innovation and business opportunities, essential for entrepreneurship.

CO6:PO3- Efficient and optimized code can lead to competitive products, aiding entrepreneurial success.

CO7:PO3- Debugging and error handling ensure robust solutions, valuable in entrepreneurial ventures.

4. Justification of PO4 to ALL COs:

CO1:PO4-Fundamentals of C programming build the foundational technical skills necessary for specialized competencies.

CO2:PO4-Problem-solving is critical for analytical abilities and adaptability, essential for specialized skills.

CO3:PO4-Proficiency in programming syntax and semantics is a fundamental technical skill required for specialized competencies.

CO4:PO4-Advanced programming concepts enhance technical skills and analytical abilities, key for specialized competencies.

CO5:PO4-Applying programming to real-world problems involves technical skills and problem-solving, aligning with specialized competencies.

CO6:PO4-Code efficiency and optimization demonstrate analytical abilities and innovation, crucial for specialized skills.

CO7:PO4-Debugging and error handling require problem-solving and analytical abilities, contributing to specialized competencies.

5. Justification of PO5 to ALL COs:

CO1:PO5- Fundamentals of C programming are crucial for basic application and problem-solving, but they form the starting point.

CO2:PO5- Problem-solving skills are essential for tackling complex problems and applying analytical reasoning effectively.

CO3:PO5- Proficiency in C programming syntax and semantics is crucial for accurate application and effective problem-solving.

CO4:PO5- Advanced programming concepts enhance analytical reasoning and the ability to solve complex problems creatively.

CO5:PO5- Applying programming to real-world problems is key for practical application, critical thinking, and adaptability.

CO6:PO5- Code efficiency and optimization are vital for solving complex problems effectively and enhancing analytical reasoning.

CO7:PO5- Debugging and error handling are critical for solving problems and require strong analytical reasoning and adaptability.

6. Justification of PO6 to ALL COs:

CO1:PO6- Fundamentals of C programming are important for technical knowledge but not directly related to communication skills or collaboration.

CO2:PO6- Problem-solving often requires teamwork and effective communication to address challenges.

CO3:PO6- Proficiency in programming syntax and semantics is essential for technical tasks, with limited impact on communication and collaboration.

CO4:PO6-Advanced programming concepts are important for technical competence but not directly related to communication or collaboration.

CO5:PO6-Applying programming concepts to real-world problems involves teamwork and effective communication of solutions.

CO6:PO6- Improving code efficiency is a technical skill that may involve some communication but is not primarily focused on collaboration.

CO7:PO6- Debugging and error handling involve communicating with team members to resolve issues, enhancing communication and collaboration.

7. Justification of PO7 to ALL COs:

CO1:PO7- Fundamentals of C programming provide a base but only indirectly support research-related skills.

CO2:PO7- Problem-solving is critical for formulating research questions, designing methodologies, and analyzing data.

CO3:PO7- Proficiency in syntax and semantics supports writing code for research activities, indirectly aiding research skills.

CO4:PO7- Advanced programming concepts aid in developing methodologies for research but vary in direct impact on research skills.

CO5:PO7- Applying programming concepts to real-world problems is essential for conducting practical research.

CO6:PO7- Code efficiency and optimization are important for handling large datasets and analyses in research.

CO7:PO7- Debugging and error handling ensure the accuracy and reliability of research findings, supporting research skills.

8. Justification of PO8 to ALL COs:

CO1:PO8- Fundamentals of C programming provide base knowledge necessary for self-directed learning and adapting to new concepts.

CO2:PO8- Problem-solving skills are essential for self-directed learning, adapting to challenges, and independently achieving goals.

CO3:PO8-Proficiency in syntax and semantics provides a foundation for independent learning of advanced topics.

CO4:PO8-Advanced programming concepts encourage continuous learning and adaptation to new technologies.

CO5:PO8-Applying programming concepts to real-world problems promote practical, self-directed learning and goal achievement.

CO6:PO8- Improving code efficiency and optimization involves ongoing learning and adaptation to best practices.

CO7:PO8- Debugging and error handling are crucial for independent problem-solving and learning from mistakes.

9. Justification of PO9 to ALL COs:

CO1:PO9- Fundamentals of C programming provide a base for developing digital and technological skills needed for ICT proficiency.

CO2:PO9-Problem-solving skills are crucial for effectively using ICT tools and software, enabling efficient data analysis.

CO3:PO9-Proficiency in programming syntax and semantics is directly related to using and understanding software development tools.

CO4:PO9- Advanced programming concepts are essential for mastering digital and technological skills, enabling software development.

CO5:PO9- Applying programming concepts to real-world problems shows practical use of ICT tools in solving issues and data analysis.

CO6:PO9- Code efficiency and optimization are vital for developing robust software, enhancing technological proficiency.

CO7:PO9- Debugging and error handling are essential for effective software use and development, contributing to technological proficiency.

10. Justification of PO10 to ALL COs:

CO1:PO10- Understanding the fundamental of C programming are primarily a technical skill and has limited direct impact on multicultural competence and empathy.

CO2:PO10- Problem-solving skills can be enhanced through collaboration in diverse teams, fostering an inclusive spirit and understanding different perspectives.

CO3:PO10-Proficiency in programming syntax and semantics is technical and has limited direct relevance to multicultural competence.

CO4:PO10- Advanced programming concepts are important for technical expertise but do not directly contribute to multicultural competence.

CO5:PO10- Applying programming concepts to real-world problems often involves working in diverse teams, enhancing multicultural competence.

CO6:PO10- Improving code efficiency and optimization is technical with limited direct impact on multicultural competence.

CO7:PO10- Debugging and error handling require collaboration and communication with diverse team members, fostering inclusivity.

11. Justification of PO11 to ALL COs:

CO1:PO11- Fundamentals of C programming are technical skills with limited direct impact on value inculcation or environmental awareness.

CO2:PO11- Problem-solving skills can be applied to ethical and environmental issues, promoting responsible citizenship and sustainability.

CO3:PO11- Proficiency in programming syntax and semantics is technical and does not directly relate to values or environmental awareness.

CO4:PO11- Advanced programming concepts are important for technical expertise but do not inherently promote values or environmental awareness.

CO5:PO11- Applying programming concepts to real-world problems can involve creating solutions that address ethical issues and promote sustainability.

CO6:PO11- Improving code efficiency and optimization can lead to sustainable computing practices, reducing resource consumption and environmental impact.

CO7:PO11- Debugging and error handling are technical skills with limited direct impact on promoting values or environmental awareness.

12. Justification of PO12 to ALL COs:

CO1:PO12- Understanding C programming fundamentals is essential for independently applying programming knowledge and skills.

CO2:PO12- Problem-solving skills are crucial for independently managing projects and demonstrating responsibility and accountability.

CO3:PO12-Proficiency in syntax and semantics is necessary for writing and maintaining code independently, showing moderate autonomy.

CO4:PO12- Advanced programming concepts equip graduates to handle complex tasks and manage projects independently, demonstrating high responsibility.

CO5:PO12- Applying programming concepts to real-world problems requires autonomy, responsibility, and accountability in practical implementation.

CO6:PO12- Improving code efficiency shows a commitment to high standards and responsibility in work, reflecting moderate autonomy.

CO7:PO12- Debugging and error handling are critical for maintaining code independently, ensuring accountability in outcomes.

13. Justification of PO13 to ALL COs:

CO1:PO13- Understanding C programming fundamentals is a technical skill with limited direct impact on community engagement and service.

CO2:PO13-Problem-solving skills can be applied in community service projects, addressing societal issues and promoting well-being.

CO3:PO13- Proficiency in programming syntax and semantics is primarily technical and does not directly relate to community engagement.

CO4:PO13- Advanced programming concepts are important for technical expertise but do not inherently promote community engagement.

CO5:PO13-Applying programming concepts to real-world problems can involve community-oriented projects, promoting societal well-being.

CO6:PO13- Improving code efficiency and optimization is technical with limited direct impact on community engagement and service.

CO7:PO13- Debugging and error handling are technical skills with limited direct impact on community engagement and service.

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

Name of the Programme : B.C.A. (Science)

Programme Code : BCA

Class : F.Y.B.C.A.

Semester : I

Course Type : Major Mandatory [Practical]

Course Code : BCA-102 GEN

Course Title : Lab Course on BCA-101 GEN

No. of Credits : 02

No. of Teaching Hours : 04/Batch

Course Objectives:

1. Understand basic terminology of computers, problem solving, programming Languages and their evolution
2. Understanding C language and its important features.
3. Design the solution from specification of a problem and write pseudo code of the algorithm using basic building blocks or structured programming constructs (Sequence, Selection and Repetition statement).
4. Apply C programming concepts to real-world problems.
5. Improve code efficiency and optimization.
6. Write programs using function call techniques
7. To understand the importance of Array

Course Outcomes:

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

CO1: Problem solving and programming capability.

CO2: Apply C programming concepts to real-world problems.

CO3: Gain a foundation for advanced programming concepts.

CO4: Develop debugging and error handling skills.

CO5: Understand the fundamentals of C programming language.

CO6: Develop problem-solving skills.

CO7: Gain proficiency in C programming syntax and semantics.

Suggested Laboratory Practical

Sr. no.	Title of Experiment/ Practical
1	Assignment to demonstrate use of data types, simple operators & expressions.
2	Assignment to demonstrate decision making statements (if and if-else, nested structures)
3	Assignment to demonstrate decision making statements (switch - case)
4	Assignment to demonstrate use of simple and nested loops
5	Assignment to demonstrate menu driven programs.
6	Assignment to demonstrate writing C programs in modular way (use of user defined functions)
7	Assignment to demonstrate recursive functions.
8	Assignment to demonstrate use of arrays (1-D arrays)
9	Assignment to demonstrate use of arrays (2-D arrays)
10	Case Study

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	2	2	2	3	2
CO2	3	3	3	3	3	2	2	3	2	2	2	3	3
CO3	3	3	2	3	3	2	2	3	2	2	2	2	2
CO4	3	3	1	3	3	1	1	3	1	1	1	2	1
CO5	3	3	2	3	3	2	2	3	2	2	2	2	2
CO6	3	3	3	3	3	2	2	3	2	2	2	3	2
CO7	3	3	2	3	3	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:

1. Justification of PO1 to ALL COs:

CO1:PO1- Problem-solving and programming capability are foundational skills that contribute directly to a profound understanding of the field of study

CO2:PO1- Applying C programming concepts to real-world problems demonstrates practical application and understanding of foundational theories and methodologies.

CO3:PO1- Foundation in advanced programming concepts deepens understanding of key methodologies within the field.

CO4:PO1- Debugging and error handling skills enhance mastery of programming principles, contributing to overall understanding.

CO5:PO1- Understanding C programming fundamentals is crucial for grasping foundational theories and principles in the field.

CO6:PO1- Developing problem-solving skills is essential for effective application of theories and concepts within the field.

CO7:PO1- Proficiency in C programming syntax and semantics supports understanding of foundational theories and key concepts.

2. Justification of PO2 to ALL COs:

CO1:PO2-Problem-solving and programming capability are fundamental practical skills necessary for professional tasks.

CO2:PO2-Applying C programming concepts to real-world problems demonstrates practical skills essential for professional tasks.

CO3:PO2-Foundation in advanced programming concepts supports effective application of industry standards and best practices.

CO4:PO2-Debugging and error handling skills are crucial for maintaining quality and adhering to regulations in professional tasks.

CO5:PO2-Understanding C programming fundamentals is essential for acquiring practical skills and expertise in professional tasks.

CO6:PO2-Developing problem-solving skills enables effective application of knowledge in real-world scenarios within the field.

CO7:PO2-Proficiency in C programming syntax and semantics enhances capability for professional tasks in the programming field.

3. Justification of PO3 to ALL COs:

CO1:PO3-Problem-solving and programming capability support entrepreneurial activities by enabling technical solutions and innovations.

CO2:PO3-Applying C programming concepts to real-world problems directly fosters an entrepreneurial mindset through practical applications.

CO3:PO3-Foundation in advanced programming concepts enhances technical knowledge, indirectly supporting entrepreneurial endeavors.

CO4:PO3-Debugging and error handling skills, while important, have less direct impact on entrepreneurial mindset and knowledge.

CO5:PO3-Understanding programming fundamentals indirectly supports entrepreneurial activities by enabling effective technical communication.

CO6:PO3-Developing problem-solving skills is crucial for fostering an entrepreneurial mindset and creatively addressing challenges.

CO7:PO3-Proficiency in C programming syntax and semantics facilitates technical implementations that can support entrepreneurial innovations.

4. Justification of PO4 to ALL COs:

CO1:PO4- Problem-solving and programming capability are core skills demonstrating proficiency in technical and analytical abilities.

CO2:PO4- Applying C programming concepts to real-world problems showcases practical problem-solving and technical proficiency.

CO3:PO4-Foundation in advanced programming concepts enhances analytical abilities and technical competence in specialized skills.

CO4:PO4- Developing debugging and error handling skills demonstrates technical proficiency and problem-solving capabilities.

CO5:PO4- Understanding programming fundamentals supports effective communication and technical skills relevant to the field.

CO6:PO4- Developing problem-solving skills directly contributes to adapting and innovating in response to changing circumstances.

CO7:PO4- Proficiency in C programming syntax and semantics is crucial for effective technical communication and leadership in the field.

5. Justification of PO5 to ALL COs:

CO1:PO5-Problem-solving and programming capability directly contribute to the capacity for application and analytical reasoning.

CO2:PO5-Applying C programming concepts to real-world problems demonstrates critical thinking and effective problem-solving skills.

CO3:PO5-Foundation in advanced programming enhances the ability to solve complex problems and analyze data effectively.

CO4:PO5-Debugging and error handling skills ensure data accuracy and support effective problem-solving in practical settings.

CO5:PO5-Understanding C programming fundamentals supports practical application and effective data analysis in real-world scenarios.

CO6:PO5-Developing problem-solving skills demonstrates critical thinking and readiness to take calculated risks in problem-solving.

CO7:PO5-Proficiency in C programming syntax and semantics supports critical analysis and adaptability in applying learned concepts.

6. Justification of PO6 to ALL COs:

CO1:PO6-Problem-solving capability indirectly supports effective task management and team coordination in collaborative efforts.

CO2:PO6-Applying C programming concepts aids in articulating technical solutions, supporting effective communication within teams.

CO3:PO6-Understanding advanced programming concepts enhances the ability to communicate technical ideas effectively to diverse audiences.

CO4:PO6-Debugging and error handling skills have limited direct impact on communication and collaboration skills.

CO5:PO6-Understanding programming fundamentals supports clear communication of technical concepts to diverse stakeholders.

CO6:PO6- Developing problem-solving skills fosters effective teamwork and collective problem-solving approaches in collaborations.

CO7:PO6- Proficiency in C programming syntax ensures clarity and precision in technical discussions within collaborative settings.

7. Justification of PO7 to ALL COs:

CO1:PO7- Problem-solving capability indirectly supports research question formulation and methodology application in data analysis.

CO2:PO7- Applying C programming concepts aids in practical problem-solving relevant to research tasks like data analysis methodologies.

CO3:PO7- Understanding advanced programming concepts supports innovative research methodologies and advanced data analysis techniques.

CO4:PO7- Debugging skills have limited direct impact on research-related skills such as formulating research questions and methodologies.

CO5:PO7- Understanding programming fundamentals facilitates algorithm implementation and analysis relevant to research tasks.

CO6:PO7- Developing problem-solving skills supports addressing research challenges, formulating hypotheses, and data analysis in research.

CO7:PO7- Proficiency in C programming enhances technical capability to develop and apply methodologies for research data collection and analysis.

8. Justification of PO8 to ALL COs:

CO1:PO8- Problem-solving capability is foundational for self-directed learning and adapting to new knowledge and skills independently.

CO2:PO8- Applying C programming concepts requires continuous learning and adaptation to solve real-world problems effectively.

CO3:PO8- Foundation in advanced programming concepts prepares graduates to independently pursue and master new knowledge and skills.

CO4:PO8- Debugging and error handling skills are essential for adapting to new challenges and demands in self-directed learning.

CO5:PO8-Understanding programming fundamentals supports independent learning of new programming languages and concepts.

CO6:PO8- Developing problem-solving skills enables graduates to set and achieve goals independently by overcoming challenges effectively.

CO7:PO8- Proficiency in C programming enhances the ability to independently learn and apply new programming skills effectively.

9. Justification of PO9 to ALL COs:

CO1:PO9- Problem-solving capability indirectly supports proficiency in using ICT and analyzing data by enabling efficient solution development.

CO2:PO9- Applying C programming concepts involves using technology effectively to address real-world problems, contributing to digital skills development.

CO3:PO9- Foundation in advanced programming concepts enhances proficiency in utilizing ICT tools and software effectively.

CO4:PO9- Debugging skills have limited direct impact on digital and technological skills like using ICT and analyzing data.

CO5:PO9-Understanding programming fundamentals supports proficiency in using ICT tools and software for data analysis tasks.

CO6:PO9-Developing problem-solving skills aids in effectively utilizing ICT tools and software to analyze data and solve technical challenges.

CO7:PO9- Proficiency in C programming enhances the ability to utilize ICT tools and software efficiently for data analysis and programming tasks.

10. Justification of PO10 to ALL COs:

CO1:PO10- Problem-solving skills indirectly foster adaptability and understanding diverse perspectives in problem-solving contexts.

CO2:PO10-Applying programming concepts involves understanding diverse real-world scenarios and contexts.

CO3:PO10-Advanced programming concepts enhance problem-solving approaches that consider multicultural perspectives.

CO4:PO10- Debugging skills have limited direct impact on multicultural competence and inclusive spirit.

CO5:PO10- Fundamental programming understanding supports problem-solving in diverse contexts, including multicultural considerations.

CO6:PO10- Effective problem-solving includes considering diverse perspectives and inputs, contributing to multicultural competence.

CO7:PO10- Proficiency in programming syntax and semantics aids in clear communication and collaboration in multicultural teams.

11. Justification of PO11 to ALL COs:

CO1:PO11-Problem-solving skills indirectly support ethical decision-making and addressing ethical issues by promoting analytical thinking and consideration of consequences.

CO2:PO11-Applying programming concepts can address ethical and environmental issues through technological solutions.

CO3:PO11-Advanced programming knowledge supports designing solutions that consider ethical and environmental implications.

CO4:PO11-Debugging skills have limited direct impact on ethical values and environmental awareness.

CO5:PO11-Fundamental programming understanding supports ethical and sustainable programming practices.

CO6:PO11-Problem-solving skills include considering ethical implications and environmental factors in solutions.

CO7:PO11-Proficiency in programming syntax and semantics aids in developing responsible and efficient code.

12. Justification of PO12 to ALL COs:

CO1:PO12- Problem-solving capability directly supports independent application of knowledge, effective project management, and accountability.

CO2:PO12- Applying programming concepts requires autonomy, responsibility, and accountability in project management and execution.

CO3:PO12- Advanced programming knowledge contributes to managing complex projects independently and with accountability.

CO4:PO12- Debugging skills enhance autonomy and responsibility in ensuring code quality and project management effectiveness.

CO5:PO12- Fundamental programming understanding supports autonomous application of skills and responsibility in project tasks.

CO6:PO12- Effective problem-solving skills are essential for independent project management and demonstrating accountability.

CO7:PO12- Proficiency in programming syntax and semantics aids in autonomous application of skills and responsible task execution.

13. Justification of PO13 to ALL COs:

CO1:PO13- Problem-solving skills enable graduates to address societal challenges through technology in community-engaged services.

CO2:PO13- Applying programming concepts directly supports solving real-world community problems and engaging in meaningful service activities.

CO3:PO13- Advanced programming concepts enhance the ability to innovate and develop solutions for community engagement and service.

CO4:PO13- Debugging skills have limited direct impact on community engagement and service activities.

CO5:PO13- Fundamental programming knowledge supports effective participation in community projects using technology solutions.

CO6:PO13-Effective problem-solving skills are essential for addressing community needs and contributing to societal well-being.

CO7:PO13- Proficiency in programming aids in developing efficient solutions for community engagement and service projects.

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

Name of the Programme : B.C.A. (Science)

Programme Code : BCA

Class : F.Y.B.C.A.

Semester : I

Course Type : Major Mandatory [Theory]

Course Code : BCA-103 GEN

Course Title : Computer Architecture

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

1. To Understand the basics of Digital Electronics and Binary Number System
2. To Learn the implementation of Combinational Circuit.
3. To Learn the implementation of Sequential Circuit.
4. To Understand the Organization of basic computers.
5. To Provide a broad overview of architecture and functioning of computer system.
6. To understand the concept of memory organization.
7. To train them to design and analyse circuits for specific purpose.

Course Outcomes:

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

CO1: Understand fundamental digital concepts, including digital signals, logic, and computer architecture, and apply Boolean laws and K-maps for logic simplification.

CO2: Convert between number systems (decimal, binary, octal, hexadecimal), perform binary arithmetic, and analyze various binary codes for data representation, including ASCII, EBCDIC, and Gray Code.

CO3: Design and analyze basic combinational circuits (adders, subtractors, encoders, decoders, multiplexers, demultiplexers) and sequential circuits (flip-flops, registers, and counters) for digital logic applications.

CO4: Explain the organization of a basic computer system, instruction cycle, memory-reference instructions, and differences between RISC and CISC architectures.

CO5: Describe block diagram of CPU, memory and types of I/O transfers.

CO6: Comprehend memory organization, cache, and virtual memory, and understand memory management hardware in computer systems.

CO7: To know operation of different instruments used in the laboratory.

Topics and Learning Points

Teaching Hours :30

UNIT-I

Number Systems: Binary, Octal, Decimal, Hexadecimal Number System & their Conversions, Binary Arithmetic, 1's and 2's compliment, BCD Code, Gray Code, ASCII, EBCDIC.

UNIT-II

Boolean Algebra & Logic Gates: Introduction to Logic gate, Implementations of other gates using universal gates, Boolean Laws, De Morgan's Theorems.

UNIT-III

Combinational Circuits: Definition of Combinational Circuits**,** Half Adder and Full Adder, Universal Adder & Subtractor, Multiplexer (4:1), Demultiplexer (1:4), Decoders, Encoder.

UNIT-IV

Sequential Circuits: Definition of sequential Circuits**,** Flip-Flops- RS Flip- Flop, J-K Flip-Flop, D-Flip-Flop, T Flip-Flop.

Shift Registers and their types, Binary Counters-4 bit synchronous and Asynchronous binary counter.

UNIT-V

CPU, Memory and I/O Organization: Block diagram of CPU, function of CPU, Register Organization, flags, Concept RISC & CISC.

Memory Hierarchy, Main Memory, Internal memory, External Memory, Cache Memory, Virtual Memory.

Reference Books:

1. William Stallings- "Computer Organization and Architecture", Pearson/PHI, Sixth Edition,
2. M. Morris Mano- "Computer System Architecture", Pearson/Phi, Third Edition.
3. Flod and Jain ,Digital Fundamental ,Pearson Publication.
4. Andrew S. Tanenbaum- "Structured Computer Organization", PHI /Pearson 4th Edition,
5. Ikvinderpal Singh, Computer Organization Architecture, Khanna Book Publishing.
6. Donald P Leach, Albert Paul Malvino, Goutam Saha- "Digital Principles & Applications" , Tata McGraw Hill Education Private Limited,2011Edition.

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	-
CO2	3	3	2	3	3	2	3	3	3	-	-	-	-
CO3	3	3	3	3	3	3	3	3	3	2	2	3	2
CO4	3	2	2	2	2	2	2	2	2	-	-	-	-
CO5	2	2	-	2	2	2	2	2	2	-	-	-	1
CO6	3	2	2	3	3	3	3	3	3	-	-	-	-
CO7	2	3	3	3	3	3	3	3	3	2	2	-	2

Justification of Mapping

PO1: Comprehensive Knowledge and Understanding:

CO1: Understanding fundamental digital concepts, logic simplification, and computer architecture demonstrates a profound comprehension of foundational theories and principles.

CO2: Converting between number systems, performing binary arithmetic, and analysing binary codes showcases a deep understanding of key concepts and methodologies in digital systems.

CO3: Designing and analyzing combinational and sequential circuits requires comprehensive knowledge of methodologies and principles.

CO4: Explaining the organization of a basic computer system and instruction cycles demonstrates an understanding of foundational theories and concepts within the broader context of computer architecture

CO5: Describing the block diagram of the CPU, memory, and I/O transfers demonstrates a good understanding of system-level concepts.

CO6: Understanding memory organization, cache, virtual memory, and memory management hardware reflects an in-depth understanding of foundational theories and methodologies.

CO7: Knowing the operation of different laboratory instruments demonstrates a practical understanding of methodologies.

PO2: Practical, Professional, and Procedural Knowledge:

CO1: Understanding digital concepts and applying Boolean laws demonstrate practical and procedural knowledge essential for professional digital logic design.

CO2: Converting number systems, performing binary arithmetic, and analyzing data representation codes require procedural knowledge and professional problem-solving skills

CO3: Designing and analyzing combinational and sequential circuits demonstrates practical and procedural expertise in circuit design.

CO4: Explaining computer system organization and instruction cycles involves professional-level understanding but is more theoretical.

CO5: Describing the block diagram of CPU, memory, and I/O transfers shows a moderate connection to procedural and professional knowledge, as it focuses on understanding system organization.

CO6: Comprehending memory organization and management hardware involves both theoretical and procedural knowledge.

CO7: Knowing the operation of laboratory instruments reflects a high level of practical and procedural knowledge.

PO3: Entrepreneurial Mind set and Knowledge:

CO1: Understanding digital concepts and applying Boolean laws fosters analytical and problem-solving skills, which moderately contribute to entrepreneurial thinking and decision-making in technology-driven businesses.

CO2: Converting number systems and analyzing data representation codes provide foundational skills applicable in technical problem-solving, which can support entrepreneurial applications in digital solutions.

CO3: Designing and analyzing combinational and sequential circuits fosters innovation and problem-solving skills that are essential for entrepreneurial ventures in electronics and digital systems.

CO4: Explaining computer system organization and instruction cycles provides knowledge useful for entrepreneurial ventures involving computer system design, but its application is more indirect compared to direct innovation.

CO6: Understanding memory organization and management hardware equips learners with knowledge relevant to high-performance computing, which could support entrepreneurial activities in this domain.

CO7: Knowing the operation of laboratory instruments equips learners with hands-on skills essential for prototyping and testing, which directly supports entrepreneurial activities in electronics and related fields.

PO4: Specialized Skills and Competencies:

CO1: Understanding digital concepts and applying Boolean laws reflect specialized skills in digital logic design and optimization, directly contributing to the development of specialized competencies.

CO2: Converting number systems, performing binary arithmetic, and analyzing binary codes require precise and advanced computational skills, essential for specialized competencies in digital electronics.

CO3: Designing and analyzing combinational and sequential circuits develops technical expertise and problem-solving capabilities, directly aligning with specialized skills in electronics and digital systems.

CO4: Explaining the organization of a basic computer system builds foundational knowledge, but its contribution to hands-on specialized skills is moderate compared to direct design and implementation tasks.

CO5: Describing the block diagram of CPU, memory, and I/O transfers demonstrates understanding of system-level design

CO6: Comprehending memory organization, cache, and virtual memory demonstrates advanced knowledge in computer architecture, which is a specialized competency for modern computing systems.

CO7: Operating laboratory instruments requires practical, hands-on expertise, which is a critical specialized skill for working in electronics and related fields.

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

CO1: Understanding digital concepts and applying Boolean laws demonstrate analytical reasoning and problem-solving in logic simplification, a core component of problem-solving in digital design.

CO2: Converting number systems, performing binary arithmetic, and analyzing binary codes require analytical reasoning and practical application skills for problem-solving in data representation.

CO3: Designing and analyzing combinational and sequential circuits involves application-oriented problem-solving and analytical reasoning for digital logic implementation.

CO4: Explaining computer system organization develops analytical reasoning to understand system-level architecture, but its application-oriented problem-solving impact is moderate compared to circuit design.

CO5: Describing CPU, memory, and I/O transfers provides a conceptual framework for problem-solving, but its direct contribution to analytical reasoning and application is limited.

CO6: Comprehending memory organization and management hardware requires problem-solving and analytical reasoning for efficient system design and optimization.

CO7: Operating laboratory instruments fosters hands-on application skills and problem-solving through practical experimentation and analysis.

PO6: Communication Skills and Collaboration:

CO1: Understanding digital concepts and applying Boolean laws require clear articulation and logical reasoning, which indirectly contributes to effective communication of technical concepts.

CO2: Converting between number systems and analyzing binary codes involves explaining processes and results, fostering analytical communication skills within collaborative settings.

CO3: Designing and analyzing circuits requires teamwork for collaborative problem-solving and clear communication of design rationale and results.

CO4: Explaining the organization of computer systems enhances the ability to present and discuss theoretical concepts, contributing moderately to communication and collaboration.

CO5: Describing the block diagram of CPU and I/O transfers involves conceptual explanation, supporting moderate development of communication skills.

CO6: Comprehending memory organization and management hardware requires clear documentation and discussion, moderately contributing to communication and teamwork.

CO7: Operating laboratory instruments fosters teamwork in shared experimental setups, requiring effective communication for collaboration and result sharing.

PO7: Research-related Skills:

CO1: Understanding digital concepts and applying Boolean laws lay a foundation for analyzing and researching logic simplifications for further advancements.

CO2: Converting number systems, performing binary arithmetic, and analyzing binary codes involve systematic problem-solving and exploration

CO3: Designing and analyzing circuits involves researching optimal design approaches and applying theoretical knowledge, strongly contributing to research skills.

CO4: Explaining computer system organization fosters research into system optimization and deeper understanding of architecture types

CO5: Describing CPU block diagrams and I/O transfers requires the ability to investigate and understand system-level interactions, supporting moderate research skill development.

CO6: Comprehending memory organization, cache, and virtual memory fosters research into efficient memory management techniques

CO7: Operating instruments in the laboratory requires experimental investigation, data collection, and analysis, directly contributing to hands-on research skills.

PO8: Learning How to Learn Skills:

CO1: Understanding digital concepts and applying Boolean laws foster independent learning by encouraging the application of theoretical principles to practical problems.

CO2: Converting between number systems and analyzing binary codes develops critical reasoning and adaptability, essential for learning and applying new concepts.

CO3: Designing and analyzing circuits promotes self-directed learning by requiring exploration of new tools, techniques, and problem-solving methods.

CO4: Explaining system organization and architectures enhances the ability to comprehend new technologies, moderately contributing to learning skills.

CO5: Describing CPU block diagrams and I/O types aids in understanding complex systems, requiring independent study to grasp underlying concepts.

CO6: Comprehending memory organization and management involves continuous learning and adaptation to understand evolving system designs.

CO7: Operating instruments in the laboratory develops hands-on learning skills, requiring independent exploration of tools and methodologies.

PO9: Digital and Technological Skills:

CO1: Understanding digital concepts and Boolean logic equips students with essential technological skills applicable to modern digital systems.

CO2: Converting between number systems and analyzing binary codes is fundamental for developing skills in digital data processing and representation.

CO3: Designing and analyzing combinational and sequential circuits enhances the ability to work with digital technologies and hardware design tools.

CO4: Explaining the organization of a computer system and instruction cycles provides foundational technological knowledge but is less hands-on.

CO5: Describing CPU and memory block diagrams contributes to understanding digital systems but is less focused on direct technological applications.

CO6: Comprehending memory organization and management fosters an understanding of advanced technological concepts, critical for digital system design.

CO7: Learning the operation of laboratory instruments develops hands-on skills in digital and electronic technologies, essential for practical applications.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy:

CO3: Designing and analyzing circuits often involves teamwork and collaboration, which can foster empathy and respect for diverse perspectives in group problem-solving.

CO7: Operating instruments in a lab encourages teamwork, fostering respect and empathy in a multicultural setting.

PO11: Value Inculcation and Environmental Awareness:

CO3: Designing combinational and sequential circuits may lead to developing energy-efficient designs, promoting environmental awareness in technological applications.

PO12: Autonomy, Responsibility, and Accountability:

CO1: Understanding digital concepts and applying Boolean laws demonstrates an ability to take responsibility for problem-solving and logical design, fostering autonomy in technical thinking.

CO3: Designing and analyzing combinational and sequential circuits requires autonomy in the design process and responsibility for ensuring the functionality and correctness of circuits.

PO13: Community Engagement and Service:

CO3: Designing and analyzing combinational and sequential circuits has some potential for community engagement, particularly if applied in service-oriented technology projects or for educational purposes.

CO5: Describing block diagrams of CPUs and memory is important for technical knowledge but does not directly link to community engagement unless connected to projects or initiatives benefiting a broader population.

CO7: Knowing the operation of different instruments used in the laboratory could contribute to community service through education or practical application in projects aimed at improving local infrastructure or technology.

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

Name of the Programme : B.C.A. (Science)

Programme Code : BCA

Class : F.Y.B.C.A.

Semester : I

Course Type : Major Mandatory [Practical]

Course Code : BCA-104 GEN

Course Title : Lab Course on BCA-103 GEN

No. of Credits : 02

No. of Teaching Hours : 04/Batch

Course Objectives:

1. To Understand the basics of Digital Electronics and Binary Number System
2. To understand logic gates and truth tables.
3. To Learn the implementation of Combinational Circuit.
4. To Learn the implementation of Sequential Circuit.
5. To Understand the Organization of basic computers.
6. To Provide a broad overview of architecture and functioning of computer system.
7. To understand the concept of memory organization.

Course Outcomes:

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

CO1: To solve problems based on inter-conversion of number systems

CO2: Capacity to identify and implementation of the formulate to solve the arithmetic circuits and analyze the problems in digital electronics

CO3: To learn logic gates and truth tables. Capability to understand the working principles of the logical devices and their applications

CO4: Design combinational circuits using logic gates.

CO5: Design sequential circuits using logic gates.

CO6: Understand the fundamental concepts and techniques used in digital electronics.

CO7: To understand the concept of memory organization.

Suggestive Laboratory Experiments

1. Verify logic behavior of AND, OR, NAND, NOR, EX-OR, EX-NOR, Invert and Buffer gates.
2. To study and verify NAND as a Universal Gate
3. To verify De- Morgan's theorem for 2 variables
4. Design and test of an S-R flip-flop using NAND/NOR gate.
5. Convert BCD to Excess-3 code using NAND gate
6. To Convert Binary to Grey Code
7. Verification of Truth Tables of J-K Flip-Flop using NAND/NOR gate
8. Realize Decoder and Encoder circuit using Basic Gates.
9. Design and implement the 4:1 MUX using gates.
10. Implementation of 4-Bit Parallel Adder Using 7483 IC.
11. Design and verify operation of half adder and full adder.
12. Design and verify operation of half subtractor.
13. Design and Implement a 4 bit shift register using Flip flops.
14. Implement Boolean function using logic gates in both SOP and POS
15. Design and Implement a 4 bit synchronous counter.
16. Design and verify 4 bit asynchronous counter.
17. Familiarize the computer system layout: marking positions of SMPS, motherboard, FDD, HDD, CD, DVD and add on cards.
18. Identify the Computer Name and Hardware Specification (RAM capacity, Processor type, HDD, 32 bit/ 64 bit)
19. Identify and troubleshoot the problems of RAM, SMPS and motherboard
20. Demonstration of various ports: CPU, VGA port, PS/2 (keyboard, mouse) ,USB, LAN, Speaker, Audio.

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

Justification of Mapping

PO1: Comprehensive Knowledge and Understanding:

CO1: Solving problems based on inter-conversion of number systems requires a deep understanding of digital systems, which is a fundamental concept in digital electronics and forms the base of the discipline.

CO2: Identifying and implementing formulas to solve arithmetic circuits involves applying fundamental principles of digital electronics and logic design, demonstrating a strong grasp of core concepts.

CO3: Learning logic gates and truth tables is foundational to understanding digital electronics and logic design, forming an essential part of the theoretical knowledge in this field.

CO4: Designing combinational circuits using logic gates directly applies foundational knowledge of logic design principles and methodologies, strongly relating to comprehensive understanding.

CO5: Designing sequential circuits using logic gates extends the application of fundamental concepts, integrating a deeper understanding of how digital systems are structured and function.

CO6: Understanding fundamental concepts and techniques in digital electronics is at the core of the discipline, directly contributing to comprehensive knowledge and a broader multidisciplinary context.

CO7: Understanding memory organization is critical to the field of digital electronics and computer systems, making it an essential component of the comprehensive knowledge required for the discipline.

PO2: Practical, Professional, and Procedural Knowledge:

CO1: Solving problems based on the inter-conversion of number systems is crucial in understanding the application of digital systems but is less directly related to industry practices.

CO2: The ability to identify and implement formulas to solve arithmetic circuits is key in real-world applications of digital electronics, especially in the design and analysis of circuits.

CO3: Learning logic gates and truth tables is fundamental, but while it's a core skill, its direct link to professional applications is moderate, as practical use occurs in circuit design and analysis.

CO4: Designing combinational circuits using logic gates is directly aligned with professional tasks in circuit design and implementation, following best practices and industry standards.

CO5: Designing sequential circuits using logic gates is a critical practical skill in digital systems design, making this directly relevant to professional tasks and industry applications.

CO6: Understanding fundamental concepts and techniques in digital electronics is important but more foundational compared to specific industry practices and regulations.

CO7: Understanding memory organization is essential for digital systems design and is directly applied in real-world scenarios involving hardware development and optimization, following industry**.**

PO3: Entrepreneurial Mindset and Knowledge:

CO2: The ability to identify and implement formulas for solving arithmetic circuits can be linked to innovation and problem-solving in entrepreneurial ventures, though the connection to broader business principles is moderate.

CO3: Learning logic gates and truth tables is critical for technical understanding, but their direct relation to entrepreneurial principles such as market dynamics or business strategies is moderately related.

CO4: Designing combinational circuits using logic gates can be an entrepreneurial opportunity, especially for those interested in creating innovative digital products, though it's more of a technical task than a direct business-oriented one.

CO5: Designing sequential circuits using logic gates is a valuable skill for engineers looking to innovate in the tech space, but it has a moderate relationship to entrepreneurial knowledge and market dynamics.

CO7: Understanding memory organization is crucial for developing new products in electronics, and this knowledge can fuel innovation in digital systems.

PO4: Specialized Skills and Competencies:

CO2: Identifying and implementing formulas to solve arithmetic circuits involves technical problem-solving skills and analytical abilities, which are important for adapting and innovating in response to challenges.

CO3: Learning logic gates and truth tables provides a foundational understanding necessary for effective problem-solving in digital electronics.

CO4: Designing combinational circuits using logic gates involves high-level technical expertise, problem-solving, and the ability to adapt and innovate when creating effective digital solutions..

CO5: Designing sequential circuits using logic gates requires a deep understanding of digital electronics and the application of advanced problem-solving techniques. This is crucial for developing specialized skills and adapting to new technological challenges.

CO7: Understanding memory organization is a specialized skill in digital electronics. It plays a role in enhancing problem-solving and adapting to new technological trends.

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

CO1: Solving problems based on inter-conversion of number systems requires problem-solving and analytical reasoning.

CO2: Identifying and implementing formulas for arithmetic circuits involves applying learned concepts and problem-solving abilities.

CO3: Understanding logic gates and truth tables requires analytical reasoning to apply them effectively.

CO4: Designing combinational circuits demands problem-solving skills and the ability to apply logical reasoning in practice.

CO5: Designing sequential circuits demands creativity, problem-solving, and adaptability, with application of learned concepts.

CO6: Understanding the fundamentals of digital electronics involves analytical reasoning and the application of basic principles.

PO6: Communication Skills and Collaboration:

CO1: While solving problems related to number system inter-conversion may involve communication for explaining concepts, it's not directly related to oral or written communication.

CO4: Designing combinational circuits can require some communication skills, especially when collaborating with team members to discuss design choices.

CO5: Designing sequential circuits also involves some level of communication and collaboration, particularly in team settings for project work.

PO7: Research-related Skills:

CO3: Learning logic gates and truth tables focuses on foundational knowledge, not on formulating research questions or conducting research.

CO4: Designing combinational circuits may involve some research-related skills when investigating methods, but it's more focused on practical application.

CO5: Designing sequential circuits involves analysis and could incorporate some research-related inquiry, particularly in testing and exploring different designs.

CO6: Understanding digital electronics includes foundational techniques that can be explored through research, but it does not directly focus on research skills.

PO8: Learning How to Learn Skills:

CO1: Solving problems based on number system inter-conversion encourages self-directed learning as students need to understand and apply abstract concepts independently.

CO2: Identifying and implementing formulas for arithmetic circuits requires independent learning to adapt to new problem-solving strategies.

CO3: Learning logic gates and truth tables encourages self-paced learning and adaptation as students explore and apply different logical concepts.

CO4: Designing combinational circuits fosters self-directed learning as students are required to independently research, design, and apply logical solutions.

CO5: Designing sequential circuits requires self-learning to understand and apply more advanced principles, adapting to new challenges.

CO6: Understanding digital electronics requires independent learning to grasp fundamental concepts and adapt to the evolving field of electronics.

CO7: Understanding memory organization involves learning concepts independently, adapting knowledge to different systems and contexts.

PO9: Digital and Technological Skills:

CO1: Solving problems related to number system inter-conversion often requires using digital tools and ICT to analyze and verify results.

CO2: Identifying and implementing formulas for arithmetic circuits involves using digital tools (e.g., circuit simulation software) to design and analyze circuits.

CO3: Learning logic gates and truth tables involves understanding and using digital tools and software to visualize and simulate logical operations.

CO4: Designing combinational circuits involves using appropriate software tools for design, simulation, and analysis, requiring proficiency in digital technology.

CO5: Designing sequential circuits also requires the use of digital tools for simulation and analysis, highlighting proficiency in technological skills.

CO6: Understanding fundamental concepts and techniques in digital electronics includes using ICT for analysis and access to information sources.

CO7: Understanding memory organization may involve using digital tools to access and analyze data, but it's less directly focused on technological proficiency.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy:

CO3: Learning logic gates and truth tables is a technical focus, which is not directly related to interacting in multicultural or diverse environments**.**

PO11: Value Inculcation and Environmental Awareness:

CO2: Identifying and implementing formulas for arithmetic circuits is a technical process, not directly related to environmental or ethical issues.

PO12: Autonomy, Responsibility, and Accountability:

CO1: Solving problems related to number system inter-conversion requires independent thinking and applying knowledge, which promotes responsibility in learning.

CO2: Identifying and implementing formulas for arithmetic circuits requires autonomy in applying concepts and responsibility for the correctness of designs.

CO3: Learning logic gates and truth tables promotes independent learning and the ability to manage tasks related to logical analysis with responsibility.

CO4: Designing combinational circuits requires students to apply knowledge independently, manage their designs, and take responsibility for their outcomes.

CO5: Designing sequential circuits involves independent problem-solving and project management, with students accountable for their designs and analysis.

CO6: Understanding the fundamentals of digital electronics fosters autonomy in learning and developing foundational knowledge for further independent study.

CO7: Understanding the fundamentals of digital electronics fosters autonomy in learning and developing foundational knowledge for further independent study.

PO13: Community Engagement and Service:

CO4: Designing combinational circuits primarily focuses on technical design skills, with limited relevance to community engagement or societal well-being.

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

Name of the Programme : B.C.A. (Science)

Programme Code : BCA

Class : F.Y.B.C.A.

Semester : I

Course Type : Major Mandatory [Theory]

Course Code : BCA-105 GEN

Course Title : Foundation of Mathematics for Computer Science

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

1. To introduce students to the foundational concepts of sets, relations, and functions, and their applications in computer science.
2. To develop students' skills in performing operations on sets, understanding binary relations, and classifying functions.
3. To enable students to understand and apply principles of counting, permutations, and combinations in various contexts.
4. To familiarize students with recurrence relations and their role in mathematical modelling, including solving common examples like the Fibonacci sequence.
5. To provide students with a strong foundation in graph theory, including graph terminologies, types of graphs, and their applications.
6. To teach students the fundamentals of matrix algebra, including operations, types of matrices, and determinants.
7. To equip students with the ability to solve systems of linear equations using matrix methods, enhancing their analytical and problem-solving skills.

Course Outcomes:

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

CO1: Students will be able to define and manipulate sets, relations, and functions, and represent them using Venn diagrams and Cartesian products.

CO2: Students will demonstrate understanding of equivalence relations, equivalence classes, and their applications in partitioning sets.

CO3: Students will apply counting techniques, permutations, combinations, and the pigeonhole principle to solve combinatorial problems.

CO4: Students will be able to analyse and solve recurrence relations, including practical examples such as Fibonacci numbers and the tower of Hanoi problem.

CO5: Students will describe and classify graphs, including connected, disconnected, and complete graphs, and understand basic tree structures.

CO6: Students will perform operations on matrices, determine matrix rank, and identify properties of special matrices like symmetric and orthogonal matrices.

CO7: Students will solve systems of linear equations using matrix operations and row echelon form, applying these skills to real-world computational problems.

Topics and Learning Points

	Teaching Hours
Unit 1: Set, Relation and Function	**06**

1.1 Set, Operations on sets, Subset and Venn diagram
1.2 Cartesian product, Relations, Binary relation and Types of binary relation
1.3 Equivalence relation, Equivalence class and Partition of set
1.4 Functions, Injective functions, surjective functions and bijective functions
1.5 Composition of functions.

Unit 2: Counting and Recurrence Relation **10**

2.1 Basics of counting and Pigeonhole principle
2.2 Permutation and Combinations
2.3 Binomial coefficients and Binomial theorem
2.4 Recurrence relations: Modelling with examples like Fibonacci numbers, the tower of Hanoi.

Unit 3: Elementary Graph Theory **06**

3.1 Basic terminologies of graphs
3.2 Connected and disconnected graphs
3.3 Complete graphs and Trees
3.4 Subgraphs, Paths and Cycles

Unit 4: Matrix Algebra **08**

4.1 Matrix and Types of matrices
4.2 Algebra of matrices: Addition and Multiplication
4.3 Determinant of matrix
4.4 Symmetric, Skew-symmetric and Orthogonal matrix.

Reference Books:

1. Clyton K., (1986), Earth Crust, Adus Book, London.
2. Davis W. M., (1909), Geographical Essay, Ginnia Co.
3. Dayal P., (1996), Text Book of Geomorphology, Shukla Book Depot, Patna.
4. Kale V.S. and Gupta A., (2015), Introduction of Geomorphology, University Press, PVT Kolkata.
5. Lal, D. S. (1998): 'Climatology', Chaitanya Publishing House, Allahabad
6. Kale V.S. and Gupta A., (2001), Elements of Geomorphology, Oxford Univ. Press.
7. Monkhouse, (1951), Principle of Physical Geography, McGraw Hill Pub – New York.
8. Pitty A. F., (1974), Introduction to Geomorphology, Methuen London.
9. Singh Savindra, (2000), Physical Geography, Prayag Pustak Bhavan, 20-A, University Road, Allahabad – 211002.
10. Steers J. A., (1964), The Unstable Earth Some Recent Views in Geography, Kalyani Publishers, New Delhi.
11. Swaroop Shanti, (2006), Physical Geography, King Books, Nai Sarak, Delhi –110006.
12. Wooldridge S. W. and Morgan R. S., (1959), The Physical Basis of Geography and Outline of Geomorphology, Longman Green and Co. London.
13. Chaudhari J. L (2013) Physical Geography

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Programme Outcomes	Course Programme Outcomes (COs)						
	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6	CO 7
PO 1	3	3	2	3	3	3	3
PO 2	2	2	3	3	3	3	3
PO 3	1	1	2	2	2	2	3
PO 4	2	2	3	3	3	3	3
PO 5	2	2	3	3	3	2	3
PO 6	1	1	1	1	1	1	1
PO 7	1	2	2	3	2	2	2

PO8	2	2	3	3	3	3	3
PO9	1	1	2	2	2	3	3
PO10	1	1	1	1	1	1	-
PO11	1	1	1	1	1	1	1
PO12	2	2	2	2	2	2	3
PO13	1	1	1	1	1	1	1

Justification for the mapping

PO1 (Comprehensive Knowledge and Understanding):

Strong links to CO1, CO2, CO4, and CO5 due to the foundational nature of sets, relations, recurrence, and graph theory. Moderate relevance to CO3 (combinatorics).

PO2 (Practical, Professional, and Procedural Knowledge):

Strong for CO3 to CO7 as they involve procedural skills like problem-solving, graph classification, and matrix operations. Moderate for CO1 and CO2 as they provide foundational knowledge.

PO3 (Entrepreneurial Mindset):

Moderate for CO3–CO7 as they contribute to analytical thinking and problem-solving, essential for entrepreneurial innovation.

PO4 (Specialized Skills and Competencies):

Strong for CO3–CO7, which involve advanced topics and applications in combinatorics, recurrence relations, and linear algebra.

PO5 (Application, Problem-Solving, and Analytical Reasoning):

Strong for CO3–CO7 as they involve solving real-world problems using mathematical techniques.

PO6 (Communication Skills and Collaboration):

Weak link across all COs; although collaboration might indirectly arise during group projects, the course primarily focuses on technical content.

PO7 (Research-related Skills):

Moderate for CO2 (equivalence classes) and CO3–CO7 due to their importance in advanced studies and practical applications.

PO8 (Learning How to Learn):

Strong for CO3–CO7 as these outcomes requires mastering abstract concepts and solving challenging problems.

PO9 (Digital and Technological Skills):

Strong for CO6 and CO7, which focus on computational techniques. Moderate for CO3 and CO4 as they can be applied to computational tasks.

PO10 (Multicultural Competence and Empathy):

Weak relation across all COs, as this course focuses on technical content.

PO11 (Value Inculcation and Environmental Awareness):

Weak relation across all COs due to limited relevance to the subject.

PO12 (Autonomy, Responsibility, and Accountability):

Moderate for CO1–CO6 as they require independent learning. Strong for CO7 due to real-world application.

PO13 (Community Engagement and Service):

Weak relation, as the course is highly technical with minimal direct social or community impact.

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

Name of the Programme : B.C.A. (Science)

Programme Code : BCA

Class : F.Y.B.C.A.

Semester : I

Course Type : Major Mandatory [Practical]

Course Code : BCA-106 GEN

Course Title : Lab Course on BCA-105 GEN

No. of Credits : 02

No. of Teaching Hours : 4/Batch

Course Objectives:

1. To introduce students to the foundational concepts of sets, relations, and functions, and their applications in computer science.
2. To develop students' skills in performing operations on sets, understanding binary relations, and classifying functions.
3. To enable students to understand and apply principles of counting, permutations, and combinations in various contexts.
4. To familiarize students with recurrence relations and their role in mathematical modelling, including solving common examples like the Fibonacci sequence.
5. To provide students with a strong foundation in graph theory, including graph terminologies, types of graphs, and their applications.
6. To teach students the fundamentals of matrix algebra, including operations, types of matrices, and determinants.
7. To equip students with the ability to solve systems of linear equations using matrix methods, enhancing their analytical and problem-solving skills.

Course Outcomes:

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

CO1: Students will be able to define and manipulate sets, relations, and functions, and represent them using Venn diagrams and Cartesian products.

CO2: Students will demonstrate understanding of equivalence relations, equivalence classes, and their applications in partitioning sets.

CO3: Students will apply counting techniques, permutations, combinations, and the pigeonhole principle to solve combinatorial problems.

CO4: Students will be able to analyse and solve recurrence relations, including practical examples such as Fibonacci numbers and the tower of Hanoi problem.

CO5: Students will describe and classify graphs, including connected, disconnected, and complete graphs, and understand basic tree structures.

CO6: Students will perform operations on matrices, determine matrix rank, and identify properties of special matrices like symmetric and orthogonal matrices.

CO7: Students will solve systems of linear equations using matrix operations and row echelon form, applying these skills to real-world computational problems.

Suggested List of Laboratory Assignments

Applied Mathematics: Assignment based on following topics

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

Statistics (To be performed using R software)

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

References

- Richard Cotton, “Learning R”, SPD O’Reilly Publications

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Programme Outcomes	**Course Programme Outcomes (COs)**						
	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6	CO 7
PO 1	3	3	2	3	3	3	2
PO 2	2	2	3	3	2	3	3
PO 3	1	1	2	2	1	2	3
PO 4	2	2	3	3	3	3	3
PO 5	2	2	3	3	2	3	3
PO 6	1	1	1	1	1	1	2
PO 7	1	1	2	3	2	2	2
PO8	2	2	2	3	2	2	3
PO9	2	1	2	2	1	3	3
PO10	1	1	1	1	1	1	1
PO11	1	1	1	1	1	1	1
PO12	2	2	2	2	2	2	3
PO13	1	1	1	1	1	1	1

Justification for the mapping

PO 1 (Comprehensive Knowledge and Understanding):

Strongly related to most COs as they contribute to foundational and advanced understanding of sets, graphs, matrices, and combinatorics.

PO 2 (Practical, Professional, and Procedural Knowledge):Moderate to strong relations, especially for COs involving problem-solving techniques like recurrence relations and graph analysis.

PO 3 (Entrepreneurial Mindset and Knowledge):

Weak to moderate relation as COs like CO3, CO4, and CO7 can foster an entrepreneurial approach in applying these techniques to real-world problems.

PO 4 (Specialized Skills and Competencies):

Strong relations with COs emphasizing specific mathematical and computational techniques.

PO 5 (Application, Problem-Solving, and Analytical Reasoning):

Directly aligned with problem-solving-focused COs, particularly CO3, CO4, and CO7.

PO 6 (Communication Skills and Collaboration):

Weak relation as this course focuses more on individual analytical skills than collaborative or communicative competencies.

PO 7 (Research-related Skills):

Moderate relation for COs that involve analysis (CO4) or solving complex problems (CO7).

PO 8 (Learning How to Learn Skills):

COs involving problem-solving and analytical reasoning contribute significantly to lifelong learning abilities.

PO 9 (Digital and Technological Skills):

Strong relation for CO6 and CO7, where computational techniques are applied.

PO 10 (Multicultural Competence, Inclusive Spirit, and Empathy):

Minimal relation since this is a technical course.

PO 11 (Value Inculcation and Environmental Awareness):

Minimal relation, as the course does not directly address these aspects.

PO 12 (Autonomy, Responsibility, and Accountability): Moderate to strong relation for CO7, emphasizing independent problem-solving and responsibility in computations.

PO 13 (Community Engagement and Service): Weak relation, as the content primarily focuses on technical knowledge.

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

Name of the Programme : B.C.A. (Science)

Programme Code : BCA

Class : F.Y.B.C.A.

Semester : I

Course Type : Open Elective [Theory]

Course Code : BBA-104 OE

Course Title : Introduction to Data Science

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

1. Understand Data Science Fundamentals
2. Gain Statistical Insights for Data Science
3. Familiarize with Data Science Models and Tasks
4. Enhance Data Quality and Preprocessing Skills
5. Develop Data Visualization Proficiency

Course Outcomes:

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

CO1: Explain the fundamentals of Data Science, including data types, its lifecycle, applications, and the role of data scientists.

CO2: Apply statistical concepts such as frequency, central tendency, dispersion, and attributes to analyze datasets effectively.

CO3: Identify and implement data science models and tasks like classification, prediction, and clustering using appropriate tools.

CO4: Demonstrate data preprocessing techniques such as cleaning, normalization, and data transformation to enhance data quality.

CO5: Use data visualization tools like histograms, box plots, and scatter plots to perform exploratory data analysis and present findings.

CO6: Students will execute statistical analyses with professional statistical software.

CO7: Students will develop the ability to build and assess data-based models.

Topics and Learning Points

Teaching Hours

UNIT- I Introduction [06]

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

UNIT-II Statistics for Data Science [06]

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

UNIT-III Data science Models and Tasks [06]

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

UNIT-IV Data Quality and Pre-processing [06]

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

UNIT-V Data Visualization [06]

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

Reference /Text Books:

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

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

Mapping of this course with Programme Outcomes

Course Outcomes	Programmed 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	2	2	2	2
CO2	3	3	2	3	3	1	3	3	2	1	2	3	2
CO3	3	3	3	3	3	2	3	3	3	2	3	3	3
CO4	2	3	3	3	3	1	3	3	3	2	3	3	2
CO5	2	3	3	3	3	3	2	3	3	2	3	3	3
CO6	3	3	2	3	2	2	3	2	3	1	2	3	2
CO7	3	3	3	3	3	2	3	3	3	2	3	3	3

Weight: 1-Partially related 2 – Moderately Related 3–Strongly Related

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

1. Justification of PO1 to ALL COs:

CO1 - Understanding the fundamentals of Data Science builds comprehensive knowledge, aligning closely with PO1.

CO2 - Applying statistical concepts requires comprehensive understanding, crucial for analyzing datasets effectively.

CO3 - Identifying and implementing data science models demands deep knowledge of algorithms and tools.

CO4 - Data preprocessing enhances understanding of data quality but may not demand comprehensive knowledge in all cases.

CO5 - Visualizations assist in exploratory analysis, contributing to understanding but not as core as other outcomes.

CO6 - Executing statistical analyses with software builds applied knowledge, directly supporting PO1.

CO7 - Building and assessing models develops comprehensive understanding of data-driven approaches.

2. Justification of PO2 to ALL COs:

CO1 - Understanding fundamentals provides basic knowledge but less focus on practical or procedural aspects.

CO2 -Applying statistical concepts requires practical skills and procedural understanding for dataset analysis.

CO3 - Implementing models involves hands-on tools and procedural knowledge.

CO4 -Data preprocessing techniques demand practical application and procedural accuracy.

CO5 -Visualization tools requires practical and procedural expertise to effectively present findings.

CO6 -Executing statistical analyses involves professional software and procedural knowledge.

CO7 -Building and assessing data-based models requires practical and professional knowledge of processes.

3. Justification of PO3 to ALL COs:

CO1 - Understanding the fundamentals can help entrepreneurs identify opportunities in data-driven domains but does not directly develop an entrepreneurial mind-set.

CO2 -Applying statistical concepts can support data-driven decision-making, a critical entrepreneurial skill.

CO3 - Identifying and implementing data models fosters problem-solving and innovative thinking, key to entrepreneurship.

CO4 - Mastering data preprocessing ensures high-quality data, which is crucial for developing innovative, data-centric solutions.

CO5 - Effective visualization enhances data communication and presentation skills, important for entrepreneurial pitches and decision-making.CO6 - Executing statistical analyses with software builds applied knowledge, directly supporting PO1.

CO6 - Executing statistical analyses supports evidence-based decision-making but may not directly foster entrepreneurial thinking.

CO7- Building and assessing models aligns with creating innovative solutions and fostering an entrepreneurial mindset.

4. Justification of PO4 to ALL COs:

CO1 - Understanding fundamentals contributes to foundational knowledge but is less focused on specialized skills.

CO2 - Applying statistical concepts is a key specialized competency in analyzing datasets.

CO3 - Implementing models like classification and clustering is a core specialized skill in data science.

CO4 - Data preprocessing involves advanced techniques that are critical to ensuring data quality, a specialized competency.

CO5 - Creating visualizations requires expertise in data representation, which is an essential specialized skill.

CO6 - Executing statistical analyses with professional software requires proficiency in specialized tools.

CO7 - Building and assessing models demonstrates advanced technical competency and expertise in data science.

5. Justification of PO5 to ALL COs:

CO1 - Understanding the fundamentals of data science builds a foundation for analytical reasoning.

CO2 - Applying statistical concepts enhances problem-solving and analytical skills for data analysis.

CO3 - Implementing data science models directly involves problem-solving and reasoning to choose appropriate methods.

CO4 - Data preprocessing improves the quality of data for better application and problem-solving.

CO5 - Using visualization tools supports analytical reasoning to explore and communicate data insights.

CO6 - Executing statistical analyses with professional tools moderately develops analytical application skills.

CO7 - Building and assessing data-based models integrates problem-solving and analytical reasoning.

6. Justification of PO6 to ALL COs:

CO1 **-** Explaining the fundamentals of data science enhances communication skills through clear articulation of concepts.

CO2 - Statistical analysis focuses more on technical application, with limited emphasis on communication and collaboration.

CO3 - Implementing data science models requires effective collaboration to understand and apply suitable techniques.

CO4 - Data preprocessing emphasizes technical tasks with minimal direct impact on communication and teamwork.

CO5 - Data visualization strongly supports effective communication by presenting insights in an interpretable way.

CO6 - Executing statistical analyses involves collaboration when working with tools in team environments.

CO7 - Building and assessing models fosters collaboration in team projects and communication of model performance.

7. Justification of PO7 to ALL COs:

CO1 **-** Understanding the fundamentals of data science provides the foundation for conducting research in the field.

CO2 - Applying statistical concepts is essential for analyzing data, a core component of research skills.

CO3 - Identifying and implementing data science models directly supports research by enabling experimentation and discovery.

CO4 - Data preprocessing is critical for preparing datasets for research and ensuring reliable analysis.

CO5 - Using visualization tools aids in exploring research datasets and communicating findings effectively.

CO6 - Executing statistical analyses with professional tools is a vital research skill for processing data rigorously.

CO7 - Developing and assessing data-based models is a key aspect of research for generating and validating insights.

8. Justification of PO8 to ALL COs:

CO1 **-** Understanding the fundamentals of data science equips students with the foundational knowledge to independently explore advanced topics.

CO2 - Applying statistical concepts fosters analytical thinking, a crucial aspect of self-directed learning.

CO3 - Implementing data science models encourages learning new tools and techniques as the field evolves.

CO4 - Data preprocessing requires adapting to diverse datasets and exploring evolving methods, promoting self-learning skills.

CO5 - Using data visualization tools enables students to iteratively learn by interpreting and presenting data effectively.

CO6 - Executing statistical analyses involves learning professional software, though it may rely more on application than self-exploration.

CO7 - Building and assessing models nurtures iterative problem-solving and the ability to learn from errors and feedback.

9. Justification of PO9 to ALL COs:

CO1 **-** Understanding the fundamentals of data science introduces basic concepts in digital tools and technology.

CO2 - Applying statistical concepts requires digital tools, enhancing technological competency.

CO3 - Identifying and implementing data science models involves using advanced technological tools for classification, prediction, and clustering.

CO4 - Data preprocessing relies heavily on digital tools and techniques to clean and transform data effectively.

CO5 - Using data visualization tools fosters digital skills by leveraging software for graphical representation.

CO6 - Executing statistical analyses with professional software directly develops technological expertise.

CO7 - Building and assessing models requires hands-on use of digital platforms and technologies for data analysis.

10. Justification of PO10 to ALL COs:

CO1 **-** Understanding data science applications fosters awareness of diverse fields and the societal impact of data-driven solutions.

CO2 - Statistical analysis is primarily technical but can indirectly support inclusive decision-making when applied to diverse datasets.

CO3 - Implementing data science models can promote inclusion when addressing problems affecting multicultural communities.

CO4 - Data preprocessing ensures equitable representation of diverse datasets, supporting inclusivity in analysis.

CO5 - Using data visualization tools can communicate insights effectively across diverse audiences and promote empathy.

CO6 - Executing statistical analyses is technical but may contribute to multicultural competence when analyzing global datasets.

CO7 - Building and assessing models can foster empathy when applied to problems faced by diverse communities.

11. Justification of PO11 to ALL COs:

CO1 **-** Understanding data science fundamentals enables students to address ethical concerns and environmental challenges through data-driven insights.

CO2 - Applying statistical concepts can support value-driven decisions and environmental awareness by analyzing relevant datasets.

CO3 - Implementing data science models can solve environmental problems and promote sustainable practices.

CO4 - Data preprocessing ensures accurate and unbiased analysis of environmental and ethical datasets.

CO5 - Using data visualization tools helps in presenting environmental issues and value-driven insights effectively to diverse audiences.

CO6 - Executing statistical analyses can uncover trends and patterns related to environmental and societal values.

CO7- Building and assessing data-based models supports solutions for environmental and ethical challenges, promoting sustainable practices.

12. Justification of PO12 to ALL COs:

CO1 **-** Understanding data science fundamentals fosters autonomy in learning and decision-making within the field.

CO2 - Applying statistical concepts requires independent analysis and accountability for accurate outcomes.

CO3 - Implementing data science models demands responsible tool selection and accountability for the results.

CO4 - Data preprocessing involves taking responsibility for data quality and ensuring its reliability for analysis.

CO5 - Using data visualization tools independently fosters accountability for effectively communicating results.

CO6 - Executing statistical analyses with professional tools requires autonomy in problem-solving and responsibility for accuracy.

CO7- Building and assessing data-based models demonstrates responsibility for ensuring model Integrity & decision-making based on results.

13. Justification of PO13 to ALL COs:

CO1 - Understanding data science fundamentals equips students to identify community challenges and apply data-driven solutions.

CO2 - Applying statistical concepts can help analyze community data and address local issues effectively.

CO3 - Implementing data science models supports community-focused tasks like predicting trends or identifying solutions for public welfare.

CO4 - Data preprocessing ensures accurate representation of community data, contributing to better engagement and service.

CO5 - Using visualization tools helps present data insights to the community in an understandable and impactful manner.

CO6 - Executing statistical analyses enables actionable insights that can guide community service initiatives.

CO7- Building and assessing models can directly impact community engagement by providing evidence-based recommendations for service improvement.

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

Name of the Programme : B.C.A. (Science)

Programme Code : BCA

Class : F.Y.B.C.A.

Semester : I

Course Type : Skill Enhancement Course [Practical]

Course Code : BCA-101 SEC

Course Title : HTML & Web Page Designing

No. of Credits : 02

No. of Teaching Hours : 04/Batch

Course Objectives:

1. To understand web based application development process.
2. To study basics of HTML elements and tag.
3. To know usage of CSS in HTML.
4. To design and create simple websites.
5. To apply JavaScript to websites.

Course Outcomes:

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

CO1: Enlist various HTML elements and tags

CO2: Use HTML elements and tags

CO3: Apply CSS and Java script features.

CO4: Design a website using HTML, CSS and JavaScript.

CO5: Styling and Layout with CSS

CO6: Utilize Web Development Frameworks

CO7: Create Forms and Collect User Input

List of Assignments

1. Using basic HTML elements (headings, paragraphs, line break, colour, fonts, links, Images, etc)
2. Creating Lists using HTML Tags
3. Creating Tables using HTML Tags
4. Creating Frames in HTML
5. Creating Forms using HTML
6. Designing of HTML screens using CSS
7. Using Functions in JavaScript
8. Carryout Validation using JavaScript
9. Using Event Handling.
10. Designing website using basic elements of HTML, CSS and JavaScript.
11. Designing website using HTML, CSS and advanced JavaScript elements and event handling

Reference Books:

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

E-Resources:

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

Mapping of this course with Programme Outcomes

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	2	1	2	3	2	1	2	3	1	1	2	1
CO2	3	3	1	2	3	2	1	2	3	1	1	3	1
CO3	3	3	2	3	3	2	1	3	3	1	1	3	1
CO4	3	3	2	3	3	3	1	3	3	1	2	3	1
CO5	3	3	2	3	3	2	2	2	3	2	1	2	1
CO6	3	3	2	3	3	2	2	2	3	3	2	3	2
CO7	3	3	1	3	2	2	1	2	3	1	1	2	1

Justifications for Each Mapping

CO1: Enlist various HTML elements and tags

PO1 (3): Strongly related as it builds foundational knowledge of HTML elements and tags.
PO2 (2): Moderately related to acquiring professional procedural knowledge for web development.
PO3 (1): Partially related by fostering a minimal entrepreneurial mindset through awareness of basic elements.
PO4 (2): Moderately related as it contributes to technical competency.
PO5 (3): Strongly related by enabling application and problem-solving in a technical domain.
PO6 (2): Moderately related to communicating technical details effectively.
PO7 (1): Partially related by forming a base for research-related skills.
PO8 (2): Moderately related by fostering independent learning of HTML tags.
PO9 (3): Strongly related as digital tools and tags are central to technology usage.
PO10 (1): Partially related by involving some cultural relevance in web development.
PO11 (1): Partially related to inculcating values through ethical HTML practices.
PO12 (2): Moderately related to independent learning and accountability.
PO13 (1): Partially related by encouraging community sharing of basic knowledge.

CO2: Use HTML elements and tags

PO1 (3): Strongly related to practical implementation of foundational concepts.
PO2 (3): Strongly related to professional application and standards.
PO3 (1): Partially related by lightly fostering innovative use of HTML elements.
PO4 (2): Moderately related by contributing to technical skill development.
PO5 (3): Strongly related to solving problems using HTML.
PO6 (2): Moderately related to effective collaboration and technical communication.
PO7 (1): Partially related through minimal contribution to research practices.
PO8 (2): Moderately related by encouraging self-learning and adaptive use of elements.

PO9 (3): Strongly related due to its alignment with digital tools and web technologies.
PO10 (1): Partially related through inclusivity and cultural adaptation in web designs.
PO11 (1): Partially related by reinforcing value-oriented design.
PO12 (3): Strongly related by requiring independent application of knowledge.
PO13 (1): Partially related to engaging community through shared applications.

CO3: Apply CSS and JavaScript features

PO1 (3): Strongly related to combining foundational and advanced knowledge of web technologies.
PO2 (3): Strongly related by contributing to professional procedural skills.
PO3 (2): Moderately related by fostering creative innovation and dynamic user interfaces.
PO4 (3): Strongly related through advanced technical skills and adaptability.
PO5 (3): Strongly related to problem-solving with styles and interactivity.
PO6 (2): Moderately related by enabling clear communication through web design.
PO7 (1): Partially related by supporting minimal research-based customization.
PO8 (3): Strongly related to self-directed learning in a dynamic web environment.
PO9 (3): Strongly related by leveraging technology for interactivity and styling.
PO10 (1): Partially related to integrating inclusive designs and understanding diverse user needs.
PO11 (1): Partially related by fostering responsible and ethical web design practices.
PO12 (3): Strongly related by requiring independent implementation of CSS/JS features.
PO13 (1): Partially related to community support through reusable components.

CO4: Design a website using HTML, CSS, and JavaScript

PO1 (3): Strongly related by integrating foundational and multidisciplinary knowledge.
PO2 (3): Strongly related to professional-level website design.
PO3 (2): Moderately related through fostering innovation and entrepreneurial solutions.
PO4 (3): Strongly related through specialized skills and adaptability in web design.
PO5 (3): Strongly related by solving complex design problems with creativity.
PO6 (3): Strongly related by enabling collaboration and effective communication in teams.
PO7 (1): Partially related by fostering a basic research mindset in design.
PO8 (3): Strongly related by encouraging adaptive and self-directed learning.
PO9 (3): Strongly related due to advanced use of digital tools and technologies.
PO10 (1): Partially related through inclusivity in web design.
PO11 (2): Moderately related by reinforcing ethical and sustainable web design practices.
PO12 (3): Strongly related by requiring responsibility and accountability in project execution.
PO13 (1): Partially related by involving community engagement through website utility.

CO5: Styling and Layout with CSS:

PO1(3): Strongly related because the course content deepens knowledge in CSS and its applications in layouts.
PO2(3): Strongly related as applying CSS in layouts is a core professional skill in web development.
PO3 (1): Partially related as CSS layout skills can support entrepreneurial ventures by providing technical solutions for web products.
PO4 (3): Strongly related due to the specialized nature of CSS and layout design.
PO5 (2): Moderately related because CSS layout involves practical problem-solving but may not always require deep analytical reasoning.
PO6 (2): Moderately related because CSS design work often requires communication with stakeholders or team members.
PO7 (2): Moderately related since CSS practices evolve, and staying updated requires ongoing research.
PO8 (2): Moderately related, CSS encourages continuous learning as web development trends change.
PO9 (3): Strongly related as mastering CSS is a critical component of digital skills for web development.
PO10 (1): Partially related, though CSS allows adaptation for global accessibility, it is less about direct cultural competence.
PO11 (1): Partially related, with environmental awareness potentially influencing minimalistic design approaches.
PO12 (2): Moderately related as mastery of CSS encourages responsibility in web development tasks.
PO13 (2): Moderately related as web development can be linked to broader community impact, such as through open-source projects.

CO6: Utilize Web Development Frameworks:

PO1 (3): Strongly related because understanding the architecture and design of web frameworks requires solid knowledge of programming concepts and technologies.
PO2 (3): Strongly related as utilizing web development frameworks is a crucial professional skill, necessary for efficient and effective development.
PO3 (2): Moderately related because frameworks can empower entrepreneurs to rapidly develop scalable products, but the connection to entrepreneurship is indirect.
PO4 (3): Strongly related as the use of frameworks is a specialized skill in web development, enhancing technical competency.
PO5 (3): Strongly related since frameworks are designed to solve common development problems and allow for more efficient problem-solving through reusable components.

PO6 (2): Moderately related because frameworks often follow standardized conventions that support team collaboration but may not always directly involve communication beyond technical teams.
PO7 (2): Moderately related because staying current with framework updates and best practices requires active research.
PO8 (2): Moderately related since learning to use a new framework is a skill that encourages self-learning and adaptation.
PO9 (3): Strongly related as mastering web frameworks is fundamental to modern web development, enhancing technological proficiency.
PO10 (2): Moderately related because frameworks are designed to be scalable and adaptable to different environments, which can support inclusivity in development.
PO11 (1): Partially related since some frameworks promote reusable code, contributing to cleaner, more sustainable web development, but the focus is more on technical efficiency than environmental awareness.
PO12 (2): Moderately related as frameworks enable developers to work more independently on complex tasks, but also introduce shared responsibility for code quality within teams.
PO13 (2): Moderately related because many web development frameworks have active open-source communities, which contribute to collaborative projects and service-oriented development.

CO7: Create Forms and Collect User Input

PO1 (3): Strongly related because creating forms and handling user input requires a comprehensive understanding of HTML and web development principles, which is fundamental to programming concepts and technologies.
PO2 (3): Strongly related because form creation is a practical, hands-on skill in web development that involves procedural knowledge and professional expertise in building user-interactive forms.
PO3 (1): Partially related because entrepreneurial mindset could come into play when designing forms for business use (e.g., collecting user feedback), but form creation itself is not directly linked to entrepreneurship.
PO4 (3): Strongly related because creating forms is a specialized technical skill required to develop functional and interactive web applications, demonstrating core competencies in web development.
PO5 (2): Moderately related because creating forms involves application of problem-solving skills (such as validation and submission handling), but it does not involve deep analytical reasoning for more complex problems.
PO6 (2): Moderately related because form creation requires communication and collaboration with stakeholders and team members to ensure the form functions correctly and meets user needs.

PO7 (1): Partially related because research may be needed to explore best practices for form design or validation techniques, but the primary focus of form creation is not research-driven.
PO8 (2): Moderately related because creating forms requires iterative learning and adaptation, which supports the process of learning how to improve development skills continuously.
PO9 (3): Strongly related because form creation is a core digital skill essential to building websites, involving technical proficiency to design and manage forms that collect and process user data effectively.
PO10 (1): Partially related because while forms can be made accessible (e.g., for users with disabilities), the focus of creating forms is less directly related to multicultural competence or inclusivity in a broader sense.
PO11 (1): Partially related because ethical considerations such as data privacy are essential in form creation, but environmental awareness and broader value inculcation are not central to form creation.
PO12 (2): Moderately related because building forms requires responsibility for secure data collection and handling, promoting autonomy in web development and accountability for form submissions.
PO13 (1): Partially related because forms can be used for community engagement, such as surveys or feedback, but the core task of form creation is not focused on direct community service.

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

Name of the Programme : B.C.A. (Science)

Programme Code : BCA

Class : F.Y.B.C.A.

Semester : I

Course Type : Ability Enhancement Course [Theory]

Course Code : ENG-101 AEC

Course Title : General English –I

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

1. To introduce students to the functionality of the English language through strong prose articles.
2. To introduce students to the functionality of the English language through good poetry.
3. To help students to the functionality of English grammar through extensive grammar.
4. To help students understand the functionality of English composition through practice exercises in paragraph writing.
5. To help students understand the functionality of English comprehension through practice exercises in a Newspaper Advertisement.
6. To help students enrich their vocabulary through world-class English literature.
7. To make students think creatively and critically.

Course Outcomes:

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

CO1: The students understand the functionality of the English language through strong prose articles.

CO2: The students understand the functionality of the English language through good poetry.

CO3: The students comprehend the functionality of English grammar through extensive grammar.

CO4: The learners understand the functionality of English composition through practice exercises in paragraph writing.

CO5: The learners understand the functionality of English comprehension through practice exercises in Newspaper Advertisement.

CO6: The students are enriched in their vocabulary through world-class English literature.

CO7: The students think creatively and critically.

Topics and Learning Points

UNIT 1: Prose **(10 lectures)**

1. Sweets for Angels (R K Narayan)
2. Karma (Khushwant Singh)

UNIT 2: Poetry **(06 lectures)**

1. Sonnet 29 (Shakespeare)
2. The Education of Nature (William Blake)

UNIT 3: Grammar **(08 lectures)**

1. Degrees of Comparison
2. Transformation of Sentences
3.

UNIT 4: Composition and Comprehension **(06 lectures)**

1. Paragraph Writing
2. Comprehension of Newspaper Advertisement

Reference Books:

1. Horizons, A Textbook for College Students (MacMillan Publishers India Private Ltd)
2. English Grammar in Use (Cambridge)

Mapping of Program Outcomes with Course Outcomes

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

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

Justification for the mapping:

CO1: The students understand the functionality of the English language through strong prose articles.

- **PO1:** Critical and Creative Thinking
  - **Justification**: Analyzing and evaluating prose articles requires critical thinking to understand themes, arguments, and stylistic elements.
- **PO2: Communication Skill**
  - **Justification:** Understanding and interpreting prose enhances the ability to present complex information clearly and concisely.
- **PO6: Problem-solving Abilities**
  - **Justification:** Interpreting prose articles often involves addressing complex societal and cultural issues presented in the texts.

CO2: The students understand the functionality of the English language through good poetry.

- **PO1:** Critical and Creative Thinking
  - **Justification:** Analyzing poetry involves creative interpretation and critical evaluation of language, form, and meaning.
- **PO3:** Multicultural Competence
  - **Justification:** Poetry often reflects diverse cultural perspectives, enhancing students' understanding of multiple cultures.

- **PO6:** Problem-solving Abilities
  - **Justification:** Interpreting poetic texts helps in addressing complex artistic challenges through creative approaches.

CO3: The students comprehend the functionality of English grammar through extensive grammar.

- **PO1:** Critical and Creative Thinking
  - **Justification:** Understanding grammar rules and their applications require analytical thinking.
- **PO2:** Communication Skill
  - **Justification:** Mastery of grammar is essential for effective written and oral communication.
- **PO9:** Digital and technological skills
  - **Justification:**Applying grammar knowledge in digital communication platforms.

CO4: The learners understand the functionality of English composition through practice exercises in paragraph writing.

- **PO1: Critical and Creative Thinking**
  - **Justification:** Writing exercises enhance creative and critical thinking by structuring ideas cohesively.
- **PO2: Communication Skill**
  - **Justification:** Practicing paragraph writing improves the ability to express thoughts clearly in writing.

CO5: The learners understand the functionality of English comprehension through practice exercises in Newspaper Advertisement.

- **PO2: Communication Skill**
  - **Justification:** Analyzing and creating newspaper advertisements require clear and concise communication skills.
- **PO4: Research Skills**
  - **Justification:** Understanding the target audience and crafting messages for advertisements involves research and inquiry.

CO6: The students are enriched in their vocabulary through world-class English literature.

- **PO2: Communication Skill**
  - **Justification:** Enhanced vocabulary improves overall communication abilities.
- **PO3: Multicultural Competence**
  - **Justification:** Exposure to diverse literature enriches understanding of different cultures and perspectives.
- **PO6: Problem-solving Abilities**
  - **Justification:** Interpreting and analyzing world-class literature helps in addressing complex cultural and societal issues.

CO7: The students think creatively and critically.

- **PO1: Critical and Creative Thinking**
  - **Justification:** Encouraging students to think creatively and critically aligns directly with developing their analytical and imaginative skills.
- **PO6: Problem-solving Abilities**
  - **Justification:** Creative and critical thinking skills are essential for solving complex problems in various contexts.

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

Name of the Programme : B.C.A. (Science)

Programme Code : BCA

Class : F.Y.B.C.A.

Semester : I

Course Type : Open Elective [Theory]

Course Code : BCA-107 OE

Course Title : Business Statistics and Logic

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

1. To establish importance of logical reasoning in human inquiry.
2. To demonstrate data handling skills and summarize data with clarity.
3. To extend an understanding of application of relevant concepts of Statistics to a given business scenario.
4. To understand business problems and make decisions using appropriate statistical models and explain trends
5. To demonstrate the knowledge on the process of organizing a data and conduct statistical treatment.

Course Outcomes:

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

CO1: Demonstrate data handling skills with clarity and logical reasoning.

CO2: Outline the relevant concepts of Statistics to a given context/business scenario.

CO3: Organize business data and conduct statistical treatment.

CO4: Evaluate and interpret data using appropriate statistical techniques.

CO5: Explain data trends using appropriate statistical models.

CO6: Apply inferential statistics to make data-driven decisions and predictions in business scenarios.

CO7: Communicate statistical findings effectively to stakeholders, ensuring clarity and comprehension of results

Topics and Learning Points

Unit – I: Measures of Central Tendency, Dispersion, Measures of Skewness and Kurtosis

1.1 Classification and tabulation of data, frequency distribution

1.2 Diagrams and graphs, measure of central tendency- arithmetic mean weighted arithmetic mean, median, mode, geometric mean and harmonic mean (theory only) and meaning of partition values- quartiles, deciles, percentiles

1.3 Measures of dispersion - range, quartile deviation, mean deviation from mean and median, standard deviation and coefficient of variation.

1.4 Skewness - meaning, difference between dispersion and skewness, Karl Pearson's and Bowley's measures of skewness, concept of kurtosis, types of kurtoses and importance.

Unit – II: Probability and Probability distributions

2.1 Introduction to probability, basic concepts of probability- classical definition

2.2 Addition and multiplication rules, probability distributions– binomial

2.3 Poisson and normal distributions expected value.

Unit–III: Introduction to Logic

3.1 Number series, coding decoding and odd man out series

3.2 Direction sense test, seating arrangements – linear and circular, blood relations, arithmetic and geometric progressions

3.3 Inductive and deductive reasoning.

Text/Reference Books:

1. Levin R. I.& Rubin D. S. Statistics for Management. Delhi: Pearson.
2. Pillai & Bagavathi. Statistics, Theory and Practice, S Chand Publishing
3. SP Gupta. Statistical Methods, Sultan Chand and Sons
4. SC Gupta. Fundamentals of Statistics, Himalaya Publishing House
5. Sharma, Gupta, The Practice of Business Statistics, Khanna Publishing House.
6. Sharma J.K. Business Statistics, Vikas Publishing House
7. Fildes, R., & Goodwin, P. (2007). Against your better judgment? How organizations can improve their use of management judgment in forecasting. Interfaces, 37(6), 570-576.
8. Stanovich, K. E., & West, R. F. (2000). Individual differences in reasoning:Implications for the rationality debate? Behavioral and Brain Sciences, 23(5), 645-665.

Mapping of Program Outcomes with Course Outcomes

Weight age: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)														
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	3	3	3	2	3	2	2	1	1	1	2	2	1	2	1
CO2	3	2	3	2	2	2	2	1	1	1	2	3	1	2	1
CO3	2	3	2	2	3	2	2	1	1	1	2	2	1	3	1
CO4	2	3	3	2	3	2	2	1	1	1	2	3	1	3	1
CO5	2	2	3	2	3	2	2	1	1	1	2	2	1	3	1
CO6	1	3	3	3	3	3	2	1	1	1	2	3	1	3	1
CO7	1	3	2	3	2	2	2	1	1	1	2	2	1	3	1

Justification for the mapping

PO1: A Fundamental Knowledge and Coherent Understanding:

CO1: This outcome emphasizes the importance of mastering data handling techniques as a foundational skill in statistics. Effective data management is essential for accurate analysis and interpretation, forming the backbone of statistical methodology.

CO2: Concepts of statistics form the basis of coherent understanding in data analysis**.**Here, the focus is on the idea that a solid grasp of statistical concepts is crucial for performing meaningful data analysis. Understanding these concepts helps in making informed decisions based on data and contributes to a more cohesive analytical approach.

CO3: Organizing data requires understanding concepts but is more procedural.This outcome highlights that while organizing data does rely on an understanding of statistical concepts, it is primarily a procedural task. It involves following systematic steps to arrange and simplify data for analysis, ensuring clarity and accessibility.

CO4: Evaluation and interpretation rely on understanding statistical concepts.This CO points out that effectively evaluating and interpreting data is dependent on a strong understanding of statistical principles. Accurate evaluations lead to meaningful insights and enable knowledgeable conclusions regarding the data.

CO5: Explaining data trends requires knowledge of statistics frameworks.This outcome indicates that articulating data trends involves applying statistical frameworks and theories. A firm grasp of these frameworks allows individuals to communicate findings clearly and contextually to various audiences.

CO6: Inferential statistics may not directly connect to fundamental knowledge.This outcome suggests that inferential statistics, which involve making predictions or inferences about a population based on a sample, may require advanced knowledge that extends beyond basic statistical concepts. Understanding its applications may not directly relate to foundational statistics but is crucial for deeper data analysis.

CO7: While communication is important, it leans more on skills than understanding. This CO emphasizes that effective communication of statistical findings is largely based on skills such as presentation and articulation, rather than a deep understanding of the statistical concepts alone. Being able to convey information clearly is necessary for sharing insights with diverse audiences.

PO2: Procedural Knowledge for Skill Enhancement:

CO1: Demonstrating data handling skills shows proficiency in procedural knowledge. This CO underscores the importance of being able to manage and manipulate data effectively, which is a fundamental aspect of statistical analysis. Proficiency in these skills indicates a strong understanding of procedural knowledge that is essential for any data-related tasks.

CO2: Outlining statistics involves procedural elements but is less skill-based. While outlining statistical concepts requires an understanding of procedures, it leans more towards theoretical knowledge than hands-on skills. This CO highlights the distinction between procedural knowledge and application, suggesting that outlining is more about framework than execution.

CO3: Organizing data is directly procedural, enhancing practical skills. Organizing data involves concrete, step-by-step methods such as categorization and structuring. This CO emphasizes that mastering these procedures not only enhances practical skillsets but is also vital for preparing data for analysis.

CO4: Evaluating and interpreting data are key procedural skills in statistics**.** Evaluating and interpreting data are critical processes that not only require knowledge of statistical methods but also the ability to apply these methods effectively. This CO stresses that these skills are fundamental to deriving meaningful insights from data.

CO5: Explaining trends requires procedural knowledge but is more conceptual. While identifying and explaining trends involves using statistical procedures, understanding the implications and significance of these trends leans towards a more conceptual exploration. This CO highlights the integration of procedural knowledge with conceptual thinking in analysis.

CO6: Applying inferential statistics is a strong skill-enhancement aspect. This CO points to the advanced capabilities gained through the application of inferential statistics, which go beyond mere data observation to making predictions and generalizations. Mastery in this area indicates a significant enhancement of statistical skills.

CO7: Effective communication of findings is a critical procedural skill.Communicating statistical findings clearly and effectively is essential for informing stakeholders and facilitating decision-making. This CO emphasizes that proficiency in presenting data and results is a crucial procedural skill that enhances the impact of statistical work.

PO3: Critical Thinking and Problem-Solving Skills:

CO1: Handling data requires critical thinking for logical reasoning.This outcome emphasizes that effectively working with data isn't just about collecting or organizing it. It requires the ability to think critically about the data, assess its quality, and derive logical conclusions based on the information available.

CO2: Understanding statistical concepts involves critical analysis of data.This outcome highlights the need for critical analysis when learning statistical concepts. It suggests that grasping these concepts fully requires evaluating data critically to interpret results, understand distributions, and assess the validity of statistical methods.

CO3: Organizing data involves some problem-solving but is more procedural. Here, the focus is on the procedural nature of data organization. While it can involve some problem-solving regarding how best to structure data, the primary emphasis is on following established procedures and guidelines to effectively categorize and manage information.

CO4: Evaluation and interpretation require critical thinking for accurate conclusions. This outcome points out that evaluating and interpreting data is a complex task that demands critical thinking skills. Making accurate conclusions involves assessing data context, understanding potential biases, and questioning assumptions to reach sound interpretations.

CO5: Explaining trends necessitates critical analysis of data outcomes. In this outcome, the importance of critical analysis when identifying and explaining trends is stressed. Analyzing data trends involves looking beyond the surface to explore underlying patterns, relationships, and implications within the data.

CO6: Applying inferential statistics hinges on critical thinking for decision-making. This outcome underscores that using inferential statistics effectively requires critical thinking. Making decisions based on statistical inferences involves evaluating assumptions, considering the context, and understanding the broader implications of the findings.

CO7: Communicating findings may involve critical insight but is primarily a communication skill. While this outcome acknowledges that conveying data findings can benefit from critical insight, it primarily focuses on the communication skills required. Effectively sharing results requires clarity, eloquence, and the ability to tailor messages for different audiences, making it a central aspect of data communication.

PO4: Communication Skills:

CO1: While proficiency in data handling enhances clarity in communication by ensuring accurate and concise presentation of data, it does not directly address the nuances of effective communication itself.

CO2: Outlining concepts necessitates a foundational level of communication skills, as articulating ideas clearly is essential for conveying complex information in an understandable manner.

CO3: Organizing data systematically aids in the clear conveyance of information by making it easier for the audience to grasp and analyze the presented findings.

CO4: Effective interpretation of data hinges on the skillful communication of results, ensuring that insights are expressed clearly and understood by the audience.

CO5: Explaining trends requires not only analytical skills but also the ability to articulate analysis results clearly, making it easier for stakeholders to understand implications and significance.

CO6: When making data-driven decisions, it is critical to communicate the rationale and findings clearly to stakeholders, ensuring they understand the implications of those decisions.

CO7: Effective communication of statistical findings is essential for engaging stakeholders, as it fosters trust, clarity, and actionable insights based on the data presented.

PO5: Analytical Reasoning Skills

CO1: Data handling directly contributes to analytical reasoning capabilities. This outcome emphasizes that effectively managing and processing data is fundamental to developing strong analytical reasoning skills. The ability to sort, filter, and manipulate data is crucial for making informed decisions and drawing conclusions.

CO2: Outlining statistics encourages analytical thought but isn't purely analytical. This CO suggests that while summarizing and presenting statistical information can foster analytical thinking, it is more about communicating ideas than engaging deeply in analytical processes. It serves as a bridge between data and insights rather than a direct application of analytical reasoning.

CO3: Organizing data enhances analytical skills through systematic handling. This outcome points out that the process of systematically organizing data—such as categorizing and structuring information—improves one's ability to analyze it. By establishing order, individuals can more effectively identify patterns and draw meaningful insights.

CO4: Evaluating and interpreting data is at the core of analytical reasoning. Here, the focus is on the critical role that evaluating and interpreting data plays in analytical reasoning. This CO highlights that understanding what the data reveals and making sense of it are essential for informed decision-making and thoughtful analysis.

CO5: Analyzing data trends is a direct application of analytical reasoning skills. This outcome validates that recognizing and interpreting trends within data directly utilizes analytical reasoning. It involves examining patterns over time, which allows individuals to draw conclusions and make predictions based on observed behavior.

CO6: Making predictions through inferential statistics is strongly reliant on analytical reasoning. This CO stresses the importance of analytical reasoning in making predictions based on inferential statistics. It implies that to extrapolate findings from a sample to a broader population, one must employ sound analytical reasoning to evaluate the data's implications.

CO7: While communication is important, it isn't primarily analytical in nature. This outcome notes that effective communication of data and insights is essential in analytical work, but it is more about sharing information than engaging in analysis itself. Effective communication involves clarity and persuasion, which are different from the analytical process of reasoning through data.

PO6: Innovation, Employability and Entrepreneurial Skills:

CO1: Data handling can foster innovative solutions but is not directly tied to entrepreneurship. This statement emphasizes that while the ability to manage and manipulate data can lead to creative and innovative outcomes, it does not inherently relate to entrepreneurial activities. Effective data handling can support business ideas but isn't a standalone catalyst for entrepreneurship itself.

CO2: Understanding statistics may support innovative strategies in business.A solid grasp of statistics equips individuals with the tools to analyze data effectively, which can underpin innovative business strategies. By interpreting statistical data, entrepreneurs can identify market trends and consumer behaviors, leading to more strategic decisions.

CO3: Organizing data can lead to innovative practices, though it's primarily a skill. Organizing data is an essential skill that facilitates better insights and operational efficiencies. While it can inspire innovative practices within a business, it is more about developing the necessary skills to streamline information rather than being a direct cause of innovation.

CO4: Evaluating data contributes to innovative problem-solving in business contexts. Evaluating data allows businesses to identify challenges and opportunities effectively. This critical assessment process can lead to novel solutions and innovations that address specific problems, making it a key component of effective problem-solving in a business environment.

CO5: Analyzing trends can lead to innovative ideas for improvement. By analyzing trends within data, businesses can uncover patterns and insights that inspire new ideas for improvement. This trend analysis can drive innovation by highlighting areas where changes or enhancements can create value or competitive advantage.

CO6: Making data-driven decisions is critical for entrepreneurial success. Entrepreneurs who base their decisions on data are more likely to succeed, as data-driven insights can guide strategic choices and minimize risks. This approach facilitates informed decision-making, helping entrepreneurs adapt quickly to changing market conditions.

CO7: Communicating findings effectively can enhance employability but is not entrepreneurial-focused. Effective communication of data findings is a valuable skill that can improve job prospects and employability across various fields. However, this skill is not inherently tied to entrepreneurship, as it revolves more around the ability to convey information rather than creating and executing business ideas.

PO7: Multidisciplinary Competence:

CO1: Data handling applies to various disciplines, but has a moderate relationship. Data handling is essential across fields like science, business, and social studies, but the extent of its application can vary. While it serves as a foundational skill, its relevance might not be as pronounced in certain specialized areas.

CO2: Statistics concepts are relevant across multiple fields. Statistical concepts, such as probability and hypothesis testing, are applicable in a wide range of disciplines, from healthcare to finance. This universality makes statistics a fundamental tool for data analysis and informed decision-making in varied contexts.

CO3: Organizing data can link to various business fields and practices. Proper data organization is crucial for effective business operations, including marketing, finance, and supply chain management. This skill enables businesses to streamline processes, improve data accessibility, and enhance decision-making.

CO4: Evaluating data techniques span multiple disciplines, though primarily statistical. The evaluation of data techniques is fundamental in many fields, with a strong emphasis on statistical methods. Whether in academic research or industry applications, understanding the effectiveness of various techniques is key to drawing valid conclusions.

CO5: Explaining trends bridges different disciplines in analysis. Identifying and articulating trends is critical across disciplines, as it aids in drawing insights from data. This analytical skill enables professionals in different fields to convey meaningful findings, facilitating better understanding and collaboration.

CO6: Applying inferential statistics can often crossover various fields in business application. Inferential statistics allows for making predictions and generalizations about a population based on a sample, making it valuable in diverse business applications. Fields such as marketing, economics, and healthcare benefit from the insights gained through inferential techniques.

CO7: Communication is necessary in multidisciplinary contexts but is not a strong driver. Effective communication is essential for collaboration among professionals from different backgrounds, yet it may not always be the primary focus. While important, the emphasis might be more on the data and findings rather than the communication aspect itself.

PO8: Value Inculcation through Community Engagement:

CO1: Data handling is less directly related to community engagement values. This indicates that the processes involved in managing and processing data do not strongly connect with the core principles of community involvement, suggesting a gap between technical data skills and community-centric initiatives.

CO2: While statistics can be used in community studies, it is not directly measurable. This suggests that while statistical methods can aid in understanding community issues, the impact of these statistics on individual community experiences or outcomes is difficult to quantify directly.

CO3: Data organization has a weak link with community values. This statement implies that how data is structured and categorized does not significantly reflect or support the values and priorities that are important to community members.

CO4: The evaluation of data doesn't specifically relate to community engagement. This indicates that assessing data for accuracy or relevance lacks a direct connection to how communities engage or interact with their members, which may limit its effectiveness in community contexts.

CO5: Trend analysis has limited connection to community value. This suggests that analyzing patterns in data over time does not necessarily align with or enhance the fundamental values of community members, indicating a disconnect between statistical trends and community interests.

CO6: Inferential statistics may inform community decisions but is not directly related. This means that while inferential statistics can provide insights that may guide community decision-making, there is not a direct correlation to the communities' values or experiences, which could limit their applicability.

CO7: Communication of findings has a weak relation due to community context. This highlights that how data findings are shared and communicated may not resonate well with community members due to varying contexts, hindering effective understanding and engagement with the community.

PO9: Traditional Knowledge into Modern Application:

CO1: Data handling is primarily about managing and processing data, which often centers around modern methodologies and technologies. While traditional knowledge may provide context or insights, it is not a core aspect of the data handling process itself.

CO2: Outlining statistics involves summarizing and presenting data in a structured manner. This process typically relies on quantitative analysis and does not inherently draw from traditional knowledge or cultural frameworks.

CO3: Organizing data is essential for analysis and interpretation, but it usually follows standardized procedures that do not directly integrate traditional applications or indigenous practices, resulting in an indirect relationship.

CO4: valuating data focuses on assessing its validity, relevance, and reliability, and while traditional knowledge might offer complementary insights, it is not distinctly integrated into the evaluation framework.

CO5: Explaining trends in data analysis often relies on modern statistical techniques and theories. While traditional knowledge can occasionally inform these trends, it typically does not play a notable role in their explanation.

CO6: Applying statistics in modern business contexts uses sophisticated tools and techniques that are designed for current industry practices. This application does not explicitly incorporate traditional knowledge systems, as it primarily focuses on contemporary analytical frameworks.

CO7: Communicating statistical findings aims to present data-driven conclusions clearly and effectively. This communication typically employs standard scientific conventions, leaving little room for traditional knowledge to be included in the narrative.

PO10: Design and Development of System

CO1: This outcome suggests that the skills for handling data, such as collecting, processing, and analyzing data, do not play a direct role in the design of systems. While data handling is important for the effectiveness of a system, it is distinct from the actual design and architecture of the system itself.

CO2: This statement indicates that the foundational concepts of statistics are not directly utilized in the process of systems development. Although statistical insights can inform decision-making, the core activities involved in building a system typically rely more on software engineering principles and methodologies than on statistical frameworks.

CO3: This CO implies that organizing data—while a crucial task for data management—does not inherently lead to effective system design or developmental outcomes. The structure of data may support certain functions, but it does not automatically translate into actionable designs or features for a system.

CO4: This outcome states that evaluation techniques, which are valuable in assessing system performance or quality, do not have a direct correlation to the initial phases of system development. While evaluation is important in a broader context, the techniques themselves may not influence the design processes directly.

CO5: This CO posits that the ability to explain trends, such as data trends over time, has a tenuous relationship with system design. While understanding trends can provide insights, it does not necessarily inform the actual design choices or frameworks utilized in systems development.

CO6: This outcome indicates that inferential statistics, which involve drawing conclusions about populations from sample data, do not have a clear link to system design. While inferential statistics might play a role in analyzing user behavior or system performance post-implementation, they do not directly inform the design itself.

CO7: This statement reflects that while communication skills are essential in almost all professional settings, they may not be specifically relevant to the technical aspects of system design. Effective communication is necessary for team collaboration but does not directly contribute to the design technicalities of systems.

PO11: Ethical and Social Responsibility:

CO1: While data handling itself doesn't directly lead to ethical decisions, it plays a crucial role in shaping the context in which ethical considerations arise. Proper data management lays the foundation for responsible analysis and interpretation, ultimately influencing decision-making processes.

CO2: A solid understanding of statistical concepts enables individuals to recognize the implications of data usage, particularly in ethical contexts. This awareness helps inform decisions that respect privacy, fairness, and the integrity of the data being analyzed.

CO3: Organizing data systematically helps ensure that it aligns with social responsibility standards. By maintaining clear structures in data management, organizations can promote ethical practices and accountability in their analyses and reporting.

CO4: Evaluating data systematically reveals potential ethical issues that may affect its interpretation. By critically assessing data sources and methodologies, analysts can identify biases or misrepresentations that could lead to misleading conclusions.

CO5: Explaining trends derived from data analysis encourages the consideration of ethical implications in how these trends are communicated to stakeholders. This awareness brings attention to potential consequences that may affect individuals or communities.

CO6: Inferential statistics can provide insights that support ethical decision-making, such as understanding population trends and making predictions. However, it is essential to remember that ethical considerations must extend beyond statistical methods to encompass broader impacts and societal implications.

CO7: Effectively communicating findings fosters transparency and responsibility, essential components of ethical data practices. By openly sharing results and methodologies, organizations build trust and encourage responsible discourse around data usage and its consequences.

PO12: Research-Related skills

CO1: Data handling is just one aspect of the research process. While it involves collecting, organizing, and managing data, other components such as formulating research questions, designing experiments, and analyzing results are also critical.

CO2: Understanding statistical concepts is essential for robust research. It enables researchers to appropriately select methods, analyze data, and interpret results accurately, which is crucial for drawing valid conclusions.

CO3: Organizing data is a key part of research methodology, facilitating effective analysis and interpretation. However, organization alone does not encompass all necessary steps in the research process, such as hypothesis testing and synthesis of findings.

CO4: Evaluating and interpreting data is fundamental to research-related skills. This process involves critically assessing the data's quality and relevance and making sense of it to provide insights and conclusions that inform the research objectives.

CO5: Analyzing data trends is an important skill within the broader context of research. Identifying patterns or changes over time helps researchers understand phenomena and supports evidence-based conclusions.

CO6: Making data-driven decisions is crucial in research-related applications, allowing researchers to base their conclusions and recommendations on empirical evidence rather than intuition or guesswork.

CO7: Communicating findings is vital in research, ensuring that results are shared effectively with the intended audience. This skill overlaps with others, such as data presentation and writing clarity, emphasizing the importance of delivering clear and impactful messages.

PO13: Teamwork

CO1: Data handling skills are often seen as personal abilities, with individuals usually performing data manipulation or processing tasks on their own rather than as part of a team.

CO2: When outlining statistical concepts, it typically involves personal understanding and application rather than requiring group efforts or collaborative discussions among team members.

CO3: Organizing business data is frequently a task assigned to individuals, where they independently structure and format the data without significant input or collaboration from others.

CO4: The process of evaluating data is often done individually, with each person analyzing information based on their perspective, which may not reflect the benefits of collaborative insight.

CO5: While explaining trends can be a part of a team's efforts, the act itself is not inherently structured to enhance teamwork outcomes, as it can often be done by a single individual.

CO6: The application of statistics is usually a solitary pursuit, where individuals apply statistical methods and techniques independently rather than as part of a cooperative team effort.

CO7: Communicating findings can be a team endeavor; however, the act of communication itself does not always necessitate teamwork, as individuals can also present their findings independently.

PO14: Area Specific Expertise:

CO1: Data handling can contribute to specific area expertise but not exclusively.This objective emphasizes that while managing and processing data is important for developing expertise in a specific field, it should not be the only focus. It suggests that other skills and knowledge areas are also crucial for a well-rounded understanding.

CO2: Understanding statistics supports area-specific application knowledge. This implies that a solid grasp of statistical concepts enables individuals to better apply their expertise in a particular domain. Statistics provide the tools needed to analyze and interpret data, which is essential for informed decision-making in specialized areas.

CO3: Data organization plays a role in mastering area-specific expertise. This CO highlights the importance of structuring and organizing data effectively. Proper data organization aids in clarity and accessibility, which in turn supports deeper analysis and understanding, helping to achieve mastery in a specific field.

CO4: Evaluating data is essential to gaining expertise in any specific field. This objective underscores the importance of critical assessment in the learning process. By evaluating data rigorously, individuals can derive meaningful insights, validate findings, and enhance their expertise in their chosen area.

CO5: Understanding trends is crucial for developing area-specific insights. Recognizing and interpreting trends is vital for making informed predictions and decisions in a specific field. This CO stresses that trend analysis helps professionals identify patterns and adapt their strategies accordingly.

CO6: The application of inferential statistics is vital for specialized expertise.This objective points out that inferential statistics, which involves making predictions or generalizations about a population based on sample data, is a key component in developing expertise. Mastery of inferential techniques allows professionals to draw meaningful conclusions about their specific area.

CO7: Effectively communicating findings enhances area-specific expertise.This CO emphasizes the importance of sharing insights and results clearly and effectively. Strong communication skills not only help convey complex ideas but also foster collaboration and knowledge exchange, ultimately supporting the growth of expertise in a particular field.

PO15: Environmental Awareness:

CO1: Data handling does not intrinsically relate to environmental awareness. This statement suggests that the skills involved in managing and manipulating data, such as sorting, coding, or storage, do not inherently convey an understanding or concern for environmental issues.

CO2: Concepts of statistics are not directly tied to environmental matters. This implies that fundamental statistical concepts, such as mean, median, or standard deviation, are abstract mathematical tools that do not have a specific relevance or application to environmental topics by themselves.

CO3: Organizing data may have weak ties to environmental considerations. Here, it is suggested that while organizing data can sometimes relate to environmental matters (such as categorizing data on pollution levels), the connection is generally not strong or consistently relevant.

CO4: Evaluation techniques do not directly correlate with environmental awareness. This indicates that methods for assessing data, such as qualitative or quantitative evaluation techniques, do not inherently promote an understanding of or awareness about environmental issues.

CO5: Explaining trends has no intrinsic link to environmental awareness. This posits that identifying and discussing trends within data can be done independently of environmental contexts, and that these trends do not naturally connect to environmental issues unless deliberately framed that way.

CO6: Inferential statistics have limited direct application to environmental matters. This suggests that while inferential statistics — used to make inferences about populations based on sample data can be applied to environmental studies, their use is not confined or uniquely applicable to environmental concerns.

CO7: Communicating findings lacks a significant connection to environmental issues. This statement indicates that the process of conveying data findings does not inherently include or emphasize environmental considerations unless explicitly incorporated into the communication.