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 –II

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

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

Program Code : BCA

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

Semester : II

Course Type : Core Courses

Course Name : Advanced C Programming

Course Code : BCA-151 GEN

No. of Teaching Hours : 30

No. of Credits : 2

Course Objectives:

1. Introduce students to the advanced concepts of C programming
2. Learn to develop complex programs
3. Enhanced ability to define and manage data structures based on problem subject domain
4. Define and use of pointers with simple applications
5. Master the use of strings, structures, pointers
6. Gain proficiency in working with files and pre-processor directives
7. Introduce file handling and basic I/O operations

Course Outcomes:

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

CO1: Develop programs using control structures, pointers, strings, structures and files

CO2: Design and develop solutions to real world problems using C.

CO3: Explore algorithmic approaches to problem solving.

CO4: Develop programs using control structures and arrays in 'C'.

CO5: Gain proficiency in C programming syntax and semantics

CO6: Basic Input/ Output Operations

CO7: Ability to Write and Debug C Code

Topics and Learning Points

Teaching Hours

Unit 1: Pointers **10**

1.1 Pointer declaration, initialization
1.2 Dereferencing pointers
1.3 Pointer arithmetic
1.4 Pointer to pointer
1.5 Arrays and pointers
1.6 Functions and pointers – passing pointers to functions, function returning pointers
1.7 Dynamic memory allocation

Unit 2: Structures and Unions **10**

2.1 Creating structures
2.2 Accessing structure members (dot Operator)
2.3 Structure initialization
2.4 Typedef
2.5 Array of structures
2.6 Passing structures to functions
2.7 Nested structures
2.8 Pointers and structures
2.9 Self-referential structure
2.10 Unions
2.11 Difference between structures and unions

Unit 3: File Handling **06**

3.1 Concept and importance of errors
3.2 Streams
3.3 Types of Files
3.4 Operations on files
3.5 Random access to files

Unit 4: C Pre-processor **04**

4.1 Format of Pre-processor directive
4.2 File Inclusion directive
4.3 Macro substitution, nested macro, argument macro
4.4 Macros VS Functions

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

Mapping of this course with Programme Outcomes & Justification

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

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:PO1-Mastery of these programming constructs is essential for a deep understanding of computer science principles, directly contributing to comprehensive knowledge in the field.

CO2:PO1- Applying theoretical concepts to practical problems demonstrates a profound understanding and the ability to use methodologies effectively in a broader context.

CO3:PO1-Algorithmic thinking is fundamental to computer science, requiring an in-depth understanding of key concepts and principles, strongly relating to comprehensive knowledge.

CO4:PO1-While crucial for foundational knowledge in programming, this CO is more specific and less broad compared to others, providing a moderate but essential understanding.

CO5:PO1-Proficiency in syntax and semantics is necessary for foundational knowledge but does not alone encompass the broader multidisciplinary context as strongly as other COs.

CO6:PO1-Basic I/O operations are fundamental skills that contribute to partial understanding, forming the building blocks for more complex concepts.

CO7:PO1-Debugging skills are crucial for understanding the intricacies of programming and developing robust solutions, moderately contributing to comprehensive knowledge.

2. Justification of PO2 to ALL COs:

CO1:PO2-These programming constructs are fundamental practical skills essential for professional tasks in software development, reflecting industry standards and best practices.

CO2:PO2- Solving real-world problems with C programming demonstrates the application of professional and procedural knowledge in practical scenarios, adhering to industry standards.

CO3:PO2-Algorithmic problem-solving is crucial for professional expertise, involving best practices and effective application of procedural knowledge in real-world tasks.

CO4:PO2-While important for practical skills, this CO is more specific and less broad compared to others, providing moderate but essential knowledge for professional tasks.

CO5:PO2-Proficiency in syntax and semantics is necessary for foundational practical skills but is more technical and less focused on procedural knowledge

CO6:PO2-Basic I/O operations are fundamental skills that provide the groundwork for more complex practical applications, contributing partially to professional knowledge.

CO7:PO2-Writing and debugging code are critical practical skills for professional tasks, involving industry standards and best practices, and essential for effective application in real-world scenarios.

3. Justification of PO3 to ALL COs:

CO1:PO3-Technical skills with minimal contribution to entrepreneurial mindset.

CO2:PO3-Directly supports innovation and opportunity identification, essential for entrepreneurship.

CO3:PO3-Fosters innovative thinking and creative solutions, moderately contributing to entrepreneurship.

CO4:PO3-Specific programming skills with partial relevance to business principles and market dynamics.

CO5:PO3-Foundational proficiency with limited impact on entrepreneurial thinking.

CO6:PO3-Fundamental skills with limited direct influence on entrepreneurial mindset and innovation.

CO7:PO3-Supports problem-solving and practical application, moderately fostering entrepreneurial skills through solution-oriented thinking.

4. Justification of PO4 to ALL COs:

CO1:PO4-Mastering these constructs demonstrates proficiency in technical skills and analytical abilities.

CO2:PO4- Designing solutions showcases problem-solving skills, technical proficiency, and adaptability.

CO3:PO4-Algorithmic problem-solving requires strong analytical abilities and technical skills, critical for specialized competencies.

CO4:PO4- Developing programs with these constructs show technical skill and problem-solving ability.

CO5:PO4-Proficiency in syntax and semantics is fundamental for technical skills, contributing moderately to specialized competencies.

CO6:PO4-Basic I/O operations are foundational technical skills with limited direct impact on broader specialized competencies.

CO7:PO4-Writing and debugging code requires strong problem-solving skills and technical proficiency, essential for specialized competencies.

5. Justification of PO5 to ALL COs:

CO1:PO5-These programming constructs are essential for applying concepts in practical settings and solving complex problems.

CO2:PO5-Designing and developing real-world solutions requires critical thinking, creativity, and problem-solving skills.

CO3:PO5-Algorithmic problem-solving is at the core of analytical reasoning and capacity for complex problem-solving.

CO4:PO5-Developing programs with these constructs showcase problem-solving ability and application of learned concepts.

CO5:PO5-Proficiency in syntax and semantics is crucial for effective problem-solving and application.

CO6:PO5-Basic I/O operations are foundational skills that contribute partially to the capacity for application and problem-solving.

CO7:PO5-Writing and debugging code requires strong problem-solving skills and analytical reasoning.

6. Justification of PO6 to ALL COs:

CO1:PO6 -Developing programs is primarily a technical skill with limited direct impact on communication and collaboration.

CO2:PO6 -Designing real-world solutions involves teamwork and effective communication.

CO3:PO6 -Exploring algorithmic approaches enhances problem-solving skills that benefit teamwork, though direct impact on communication is moderate.

CO4:PO6 -Developing specific programs is a technical skill with limited contribution to communication and collaboration.

CO5:PO6 -Proficiency in syntax and semantics is fundamental but does not significantly impact communication or collaboration.

CO6:PO6 -Basic I/O operations are technical skills with minimal relevance to communication and teamwork.

CO7:PO6 -Writing and debugging code requires clear thinking and can benefit from collaboration, with moderate impact on communication skills.

7. Justification of PO7 to ALL COs :

CO1:PO7 -Developing programs is primarily a technical skill with limited direct impact on observational and inquiry skills needed for research.

CO2:PO7 -Designing solutions for real-world problems involves formulating questions and methodologies, aligning closely with research-related skills.

CO3:PO7 -Exploring algorithmic approaches requires inquiry skills and analytical thinking, which are crucial for research.

CO4:PO7 -While developing specific programs is a technical skill, it has limited direct relevance to research methodologies and inquiry skills.

CO5:PO7 -Proficiency in syntax and semantics is a foundational skill with minimal impact on research-related skills.

CO6:PO7 -Basic I/O operations are technical skills with limited direct relevance to research inquiry and methodologies.

CO7:PO7 -Writing and debugging code involves problem-solving and attention to detail, which moderately supports research-related skills.

8. Justification of PO8 to ALL COs:

CO1:PO8 -Developing complex programs requires self-directed learning and adaptation to new programming constructs.

CO2:PO8 -Developing complex programs requires self-directed learning and adaptation to new programming constructs.

CO3:PO8 -Exploring and implementing algorithmic solutions requires critical thinking and self-directed learning to adapt and innovate.

CO4:PO8 -Developing programs with control structures and arrays involves learning new concepts and applying them independently.

CO5:PO8 -Gaining proficiency in syntax and semantics requires self-directed study and practice.

CO6:PO8 -Basic I/O operations are fundamental skills with limited demand for ongoing self-directed learning.

CO7:PO8 -Writing and debugging code requires continuous learning, problem-solving, and adapting to new challenges.

9. Justification of PO9 to ALL COs:

CO1:PO9 -Developing programs using these constructs requires proficiency in programming, a key technological skill

CO2:PO9 -Designing and developing solutions involves using programming tools and accessing various information sources.

CO3:PO9 -Exploring algorithmic approaches requires using software tools and ICT for designing, testing, and optimizing algorithms.

CO4:PO9 -Developing programs with these constructs demonstrates proficiency in coding and use of technological tools.

CO5:PO9 -Proficiency in programming syntax and semantics is fundamental to digital skills, focusing on language specifics.

CO6:PO9 -Basic I/O operations are essential programming skills but are more foundational and less comprehensive in demonstrating digital proficiency.

CO7:PO9 -Writing and debugging code requires extensive use of ICT and software tools, crucial for demonstrating technological proficiency.

10. Justification of PO10 to ALL COs:

CO1:PO10 -This CO focuses on technical skills with limited direct relevance to multicultural competence or empathy.

CO2:PO10 -Designing real-world solutions can involve teamwork and consideration of diverse user needs.

CO3:PO10 -This CO is centered on technical problem-solving with limited direct relevance to engaging in multicultural settings or demonstrating empathy.

CO4:PO10 -Developing programs with control structures and arrays is primarily a technical task with minimal impact on multicultural competence or empathy.

CO5:PO10 -Gaining proficiency in programming syntax and semantics is a technical skill with limited direct relevance to multicultural competence or empathy.

CO6:PO10 -Basic I/O operations are foundational programming skills with minimal impact on multicultural competence or empathy.

CO7:PO10 -Writing and debugging code can involve collaboration and understanding of different

11. Justification of PO11 to ALL COs:

CO1:PO11 -This CO primarily focuses on technical programming skills with limited direct relevance to ethical values or environmental awareness.

CO2:PO11 -Designing solutions involves considering ethical implications of solutions and their impact on society, moderately related to ethical values.

CO3:PO11 -Algorithmic problem-solving primarily addresses technical challenges with minimal direct impact on ethical values or environmental awareness.

CO4:PO11 -Developing programs with control structures and arrays focuses on technical skills with limited relevance to ethical or environmental considerations.

CO5:PO11 -Proficiency in programming syntax and semantics is fundamental but does not directly contribute to ethical values or environmental awareness.

CO6:PO11 -Basic I/O operations are foundational technical skills with minimal impact on ethical values or environmental awareness.

CO7:PO11 -Writing and debugging code involves understanding the consequences of errors and responsible coding practices, moderately related to ethical values.

12. Justification of PO12 to ALL COs:

CO1:PO12 -Developing programs require independent application of knowledge and skills, demonstrating autonomy in coding and project management.

CO2:PO12 -Designing solutions to real-world problems involve managing projects effectively and demonstrating accountability for outcomes.

CO3:PO12 -Exploring algorithmic approaches require independent problem-solving skills and accountability for the effectiveness of algorithms developed.

CO4:PO12 -Developing programs with control structures and arrays demonstrate responsibility in ensuring code functionality and efficiency.

CO5:PO12 -Proficiency in syntax and semantics is foundational but does not directly demonstrate autonomy or accountability.

CO6:PO12 -Basic I/O operations are essential skills but have limited impact on demonstrating autonomy or accountability.

CO7:PO12 -Writing and debugging code requires taking responsibility for the correctness and efficiency of the code, demonstrating accountability.

13. Justification of PO13 to ALL COs:

CO1:PO13 -Developing programs can involve creating software solutions that directly benefit community-engaged projects, moderately supporting community engagement.

CO2:PO13 -Designing solutions to real-world problems often involves addressing community needs and contributing to societal well-being.

CO3:PO13 -Algorithmic approaches can be applied to solve community-oriented problems, supporting community engagement efforts.

CO4:PO13 -Developing programs that utilize control structures and arrays can contribute to community projects by enhancing efficiency and effectiveness.

CO5:PO13 -Proficiency in syntax and semantics is foundational but has limited direct impact on community engagement.

CO6:PO13 -Basic I/O operations are essential but have minimal direct relevance to community engagement activities.

CO7:PO13 -Writing and debugging code effectively supports the development of software solutions for community needs, moderately relating to community engagement.

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 : II

Course Type : Major Mandatory [Practical]

Course Code : BCA-152 GEN

Course Title : Lab Course on BCA-151 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 Pointers: Create, Declare, Initialize.
2	Assignment to demonstrate Pointers to function, Array of pointers, Dynamic memory allocation
3	Assignment to demonstrate Pointers with strings, passing strings to functions
4	Assignment to demonstrate Use of Structures.
5	Assignment to demonstrate Use of Union.
6	Assignment to demonstrate Passing structure to function, Union.
7	Assignment to demonstrate Command line arguments
8	Assignment to demonstrate Use of File handling.
9	Assignment to demonstrate use C Preprocessor directives
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)

Program Code : BCA

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

Semester : II

Course Type : Major Mandatory [Theory]

Course Name : Introduction to Microcontroller

Course Code : BCA-153 GEN

No. of Teaching Hours : 30

No. of Credits : 2

Course Objectives:

1. To study the basics of microcontroller.
2. To learn 8051 Programming.
3. To study the interfacing techniques of 8051microcontroller.
4. To learn to design simple applications using 8051microcontroller.
5. To apply knowledge of 8051 to design different application circuits.
6. To introduce the basic concepts of advanced Microcontrollers.
7. To learn the Embedded C programming language.

Course Outcomes:

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

CO1: Get familiar with general microcontroller and their working.

CO2: Knowledge about architecture and programming syntaxes of microcontroller.

CO3: Design simple microcontroller-based applications.

CO4: Interfacing of input output peripherals to the 8051 microcontrollers.

CO5: Interface I/O peripherals to 8051 microcontroller.

CO6: Write programs using instruction set of 8051 microcontroller.

CO7: Comparing Assembly Language and Embedded C language.

Topics and Learning Points

Teaching Hours: 30

UNIT-I **(4)**

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

UNIT-II **(5L)**

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

UNIT-III **(8L)**

8051: Programmer's Model: Introduction to Assembly programming, Compilers, Assemblers, Instruction classification, Instruction set, Addressing Modes: Immediate, register, direct, indirect, assembler directives (ORG, END), features with examples. Introduction to Embedded C Programming, C data types in 8051C, Port programming in 8051C.

UNIT-IV **(7L)**

Timers and Counters: Timer / counter: TMOD, TCON Registers, Programming of timer/counter in 8051C, Introduction to serial communication, SCON, SBUF, PCON register and serial communication programming in 8051C.

UNIT-V **(6L)**

Interrupts and Interfacing:

Interrupts: Introduction to concept of interrupt, Interrupt types and their vector addresses, Interrupt enable register and interrupt priority register (IE, IP).

Basics of Interfacing: ADC, DAC, LCD, stepper motor.

ReferenceBooks:

1. The 8051 microcontroller and Embedded system using assembly and C :Mazidi and McKinley, Pearson publications.
2. The 8051 microcontroller – Architecture, programming and applications: K.UmaRao and AndhePallavi, Pearson publications.
3. Microcontrollers [Theory and Applications] Deshmukh Ajay V. TMH
4. The 8051 Microcontroller Architecture, Programming and application [Second Edition] Kenneth J. Ayala, Penram International (1999)

Mapping of Program Outcomes with Course Outcomes

Weightage: 1=Weak or low relation, 2=Moderate or partial relation, 3=Strong or direct relation

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

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding:

CO1: Understanding microcontrollers is fundamental to embedded systems.

CO2: Deep knowledge of architecture and syntax is essential for programming.

CO3: Designing applications requires applying theoretical knowledge in practice.

CO4: Practical understanding of interfacing is crucial for real-world applications.

CO5: Interfacing peripherals enhances system functionality and performance.

CO6: Writing programs demonstrates knowledge of instruction sets.

CO7: Comparing languages builds a broader understanding of programming approaches.

PO2: Practical, Professional, and Procedural Knowledge:

CO1: Basic familiarity with microcontrollers is essential for practical applications.

CO2: Knowledge of architecture and programming is crucial for professional development.

CO3: Designing applications demonstrates hands-on expertise in microcontroller-based systems.

CO4: Practical interfacing of peripherals is necessary for real-world embedded applications.

CO5: Interfacing I/O peripherals is a key professional skill in embedded system design.

CO6: Writing programs using instruction sets is fundamental for embedded system implementation.

CO7: Comparing languages helps understand industry practices and optimization techniques.

PO3: Entrepreneurial Mind set and Knowledge:

CO2: Understanding architecture and programming can lead to innovative product development.

CO3: Designing applications fosters creativity and entrepreneurial product development.

CO4: Practical interfacing is key for developing market-ready embedded solutions.

CO5: I/O interfacing enables real-world applications, fostering entrepreneurial innovation.

CO6: Programming skills are crucial for developing and commercializing embedded products.

CO7: Comparing programming languages aids in optimizing solutions for market needs.

PO4: Specialized Skills and Competencies:

CO1: Understanding microcontrollers provides foundational technical knowledge.

CO2: Knowledge of architecture and programming enhances technical proficiency.

CO3: Designing applications strengthens problem-solving and analytical skills.

CO4: Interfacing peripherals requires technical expertise and adaptability.

CO5: Practical I/O interfacing develops hands-on technical competency.

CO6: Writing programs sharpens technical and analytical skills.

CO7: Comparing languages builds adaptability and deeper analytical thinking.

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

CO1: Understanding microcontrollers helps in problem identification and application.

CO2: Knowledge of architecture and programming is essential for logical problem-solving.

CO3: Designing applications requires analytical reasoning and creativity.

CO4: Interfacing peripherals involves troubleshooting and problem-solving skills.

CO5: I/O interfacing requires critical thinking to ensure proper integration.

CO6: Writing programs strengthens analytical skills and debugging abilities.

CO7: Comparing languages enhances adaptability in choosing optimal solutions.

PO6: Communication Skills and Collaboration:

CO2: Knowledge of architecture aids in explaining technical concepts.

CO3: Designing applications requires documentation and teamwork.

CO4: Interfacing peripherals involves collaborative troubleshooting.

CO5: Effective communication is needed to integrate and debug interfaces.

CO6: Writing programs requires clear documentation and knowledge sharing.

CO7: Comparing languages enhances the ability to communicate technical choices.

PO7: Research-related Skills:

CO2: Knowledge of architecture supports research in embedded systems.

CO3: Designing applications involves problem-solving and inquiry-based learning.

CO4: Interfacing peripherals requires testing and data analysis.

CO5: I/O interfacing fosters experimental research and troubleshooting.

CO6: Writing programs requires analysis of performance and optimization.

CO7: Comparing languages involves research on efficiency and suitability.

PO8: Learning How to Learn Skills:

CO1: Understanding microcontrollers lays the foundation for continuous learning.

CO2: Learning architecture and programming requires self-directed study and adaptation.

CO3: Designing applications enhances problem-solving and independent learning.

CO4: Interfacing peripherals demands hands-on learning and troubleshooting.

CO5: Working with I/O peripherals requires adapting to new technologies.

CO6: Writing programs fosters self-learning through debugging and optimization.

CO7: Comparing languages encourages exploration of evolving programming paradigms.

PO9: Digital and Technological Skills:

CO1: Understanding microcontrollers builds foundational technological knowledge.

CO2: Knowledge of architecture and programming enhances digital proficiency.

CO3: Designing applications requires using development tools and software.

CO4: Interfacing peripherals involves handling digital components and protocols.

CO5: I/O interfacing enhances technical skills relevant to embedded systems.

CO6: Writing programs improves coding and debugging skills.

CO7: Comparing languages helps in selecting optimal digital solutions.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy:

CO3: Designing applications can involve teamwork with diverse individuals.

CO4: Interfacing peripherals requires collaboration, respecting different viewpoints.

CO5: Working with I/O interfaces can promote teamwork and inclusion in projects.

CO7: Comparing languages encourages understanding of different technological approaches.

PO11: Value Inculcation and Environmental Awareness:

CO3: Designing applications can incorporate energy-efficient and sustainable technologies.

CO4: Interfacing peripherals can involve optimizing resource usage for sustainability.

CO5: Efficient I/O interfacing contributes to minimizing power consumption.

PO12: Autonomy, Responsibility, and Accountability:

CO1: Understanding microcontrollers enables independent learning and problem-solving.

CO2: Learning architecture and programming fosters self-reliance in technical work.

CO3: Designing applications requires independent thinking and accountability.

CO4: Interfacing peripherals involves taking responsibility for system functionality.

CO5: Effective I/O interfacing demands precision and accountability in implementation.

CO6: Writing programs independently strengthens responsibility in coding and debugging.

CO7: Comparing languages requires independent analysis and decision-making.

PO13: Community Engagement and Service:

CO3: Designing applications can contribute to community-based projects.

CO4: Interfacing peripherals can be used in assistive and community-driven technologies.

CO5: I/O interfacing skills can be applied to social service and smart community projects.

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

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

Program Code : BCA

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

Semester : II

Course Type : Major Mandatory [Practical]

Course Name : Lab Course on BCA-153 GEN

Course Code : BCA-154 GEN

No. of Teaching Hours : 04/Batch

No. of Credits : 02

Course Objectives:

1. To study the basics of microcontroller.
2. To learn 8051 Programming.
3. To understand interfacing techniques of 8051microcontroller.
4. To learn to design simple applications using 8051microcontroller.
5. To introduce the basic concepts of advanced Microcontrollers.
6. To introduce advance microcontrollers.
7. To learn the Embedded C programming language.

Course Outcomes:

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

CO1: Get familiar with general microcontroller.

CO2: Interface I/O peripherals to 8051 microcontroller.

CO3: Design simple microcontroller-based applications.

CO4: Write programs using instruction set of 8051 microcontroller.

CO5: Designing microcontroller based hobby projects.

CO6: Run the programs on the Compiler “Keil”.

CO7: Comparing Assembly Language and Embedded C language.

Suggestive Laboratory Experiments

1. Study of 8051 microcontroller chip, keil µvision.
2. Study of proteus simulator for 8051 simulation.
3. Program to find Largest/smallest from a series.
4. Program to perform Addition / subtraction / multiplication/division of 8/16 bit data.
5. Program to perform Arithmetic, logical & code conversion problems.
6. Program to perform data transfer/exchange between specified memories locations.
7. Interfacing of LED/LEDs to 8051 microcontroller.
8. Interfacing of switch & LED to 8051 microcontroller.
9. Waveform generation using DAC Interface to 8051 Microcontroller.
10. Traffic light controller using 8051 microcontroller.
11. Interfacing LCD to 8051Microcontroller.
12. Interfacing with IR sensor to 8051 microcontroller and LCD.
13. ADC interfacing to 8051 Microcontroller.
14. Stepper motor interfacing to 8051 microcontroller.
15. DC motor interfacing to 8051 microcontroller.

Mapping of Program Outcomes with Course Outcomes

Weightage: 1=Weak or low relation, 2=Moderate or partial relation, 3=Strong or direct relation

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

Justification of Mapping

PO1: Comprehensive Knowledge and Understanding:

CO1: Understanding microcontrollers builds foundational knowledge in embedded systems.
CO2: Interfacing I/O peripherals requires knowledge of microcontroller architecture.
CO3: Designing applications strengthens conceptual understanding of embedded design.
CO4: Writing programs enhances knowledge of instruction sets and coding methodologies.
CO5: Designing hobby projects applies theoretical concepts in practical settings.
CO6: Running programs on Keil fosters hands-on learning of debugging and execution.
CO7: Comparing languages deepens understanding of programming methodologies and trade-offs.

PO2: Practical, Professional, and Procedural Knowledge:

CO1: Understanding microcontrollers lays the foundation for professional skills in embedded systems.
CO2: Interfacing I/O peripherals is a core practical skill in embedded development.
CO3: Designing applications ensures hands-on experience with real-world problem-solving.
CO4: Writing programs using 8051 instruction sets enhances coding and debugging proficiency.
CO5: Hobby projects allow learners to apply professional knowledge in creative ways.
CO6: Running programs on Keil provides experience with industry-standard tools.
CO7: Comparing Assembly and Embedded C improves programming efficiency and optimization skills.

PO3: Entrepreneurial Mindset and Knowledge:

CO2: Interfacing I/O peripherals enables product development and innovation.
CO3: Designing applications fosters creativity and problem-solving for entrepreneurial ventures.
CO4: Writing programs is essential for developing microcontroller-based products.
CO5: Hobby projects encourage innovation and can lead to entrepreneurial opportunities.
CO6: Running programs on Keil builds proficiency in using industry-standard tools for product development.
CO7: Comparing languages enhances efficiency in embedded development, important for cost-effective solutions.

PO4: Specialized Skills and Competencies:

CO1: Understanding microcontrollers builds a foundation for specialized technical skills.
CO2: Interfacing I/O peripherals enhances problem-solving and technical proficiency.
CO3: Designing applications strengthens analytical thinking and hands-on technical skills.

CO4: Writing programs develops logical reasoning and coding proficiency.
CO5: Hobby projects encourage innovation and adaptation to new challenges.
CO6: Running programs on Keil builds debugging and tool usage skills.
CO7: Comparing languages enhances technical decision-making and efficiency.

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

CO1: Understanding microcontrollers helps in identifying problem-solving opportunities.
CO2: Interfacing peripherals requires troubleshooting and analytical skills.
CO3: Designing applications fosters creativity and hands-on problem-solving abilities.
CO4: Writing programs develops logical thinking and structured problem-solving approaches.
CO5: Hobby projects encourage innovation, adaptability, and applying knowledge in practical settings.
CO6: Running programs on Keil involves debugging and analytical reasoning for troubleshooting.
CO7: Comparing languages enhances decision-making and problem-solving in coding efficiency.

PO6: Communication Skills and Collaboration:

CO2: Interfacing peripherals requires documentation and explanation for team collaboration.
CO3: Designing applications involves teamwork and effective communication of design ideas.
CO4: Writing programs requires proper commenting and structured code for better readability and teamwork.
CO5: Hobby projects involve sharing ideas and collaborating with peers for implementation.
CO7: Comparing languages requires communicating technical differences effectively.

PO7: Research-related Skills:

CO2: Interfacing peripherals involves collaboration for debugging and implementation.
CO3: Designing applications requires teamwork, idea exchange, and effective documentation.
CO4: Writing programs involves proper structuring, commenting, and sharing code with peers.
CO5: Hobby projects encourage teamwork, collaboration, and presentation of ideas.
CO6: Running programs on Keil often requires discussion and collaboration for troubleshooting.
CO7: Comparing languages enhances technical communication and collaborative decision-making.

PO8: Learning How to Learn Skills:

CO1: Learning about microcontrollers builds a foundation for self-directed exploration in embedded systems.
CO2: Interfacing peripherals requires continuous learning and adaptation to new technologies.
CO3: Designing applications fosters problem-solving and independent learning skills.
CO4: Writing programs involves learning new instructions, debugging, and improving coding skills.

CO5: Hobby projects require self-motivation, research, and experimentation to build innovative applications.
CO6: Running programs on Keil involves troubleshooting and exploring compiler functionalities.
CO7: Comparing languages enhances analytical thinking and continuous learning of programming paradigms.

PO9: Digital and Technological Skills:

CO1: Understanding microcontrollers builds foundational knowledge in digital and embedded systems.
CO2: Interfacing peripherals requires hands-on experience with digital hardware and communication protocols.
CO3: Designing microcontroller-based applications enhances proficiency in embedded technology and digital systems.
CO4: Writing programs develops programming skills essential for digital and technological applications.
CO5: Hobby projects involve practical applications of digital technology and innovation.
CO6: Running programs on Keil improves the ability to use software tools for embedded development.
CO7: Comparing languages enhances understanding of digital coding techniques and their practical implementation.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy:

CO3: Designing applications may encourage collaboration across diverse teams, fostering inclusive teamwork.
CO5: Hobby projects encourage creativity and teamwork, which can support diverse collaborations.
CO7: Comparing programming languages fosters understanding of different technological approaches used worldwide.

PO11: Value Inculcation and Environmental Awareness:

CO3: Designing applications can incorporate energy-efficient solutions and responsible design choices.
CO5: Hobby projects can focus on sustainable applications such as IoT-based environmental monitoring or energy-saving devices.
CO7: Comparing programming languages can highlight energy-efficient coding practices, reducing power consumption in embedded systems.

PO12: Autonomy, Responsibility, and Accountability:

CO1: Understanding microcontrollers builds foundational knowledge, promoting self-learning and independent exploration.
CO2: Interfacing peripherals requires troubleshooting and decision-making, fostering accountability in technical implementations.
CO3: Designing applications independently encourages problem-solving, innovation, and project management skills.
CO4: Writing programs develops coding discipline and precision, essential for taking responsibility for software reliability.
CO5: Developing hobby projects promotes independent learning, accountability, and the ability to complete tasks responsibly.
CO6: Running programs on Keil requires debugging skills and taking responsibility for the correctness of program execution.
CO7: Comparing programming languages enables critical evaluation and responsible selection of appropriate tools for a given task.

PO13: Community Engagement and Service:

CO1: Understanding microcontrollers can help in developing technical solutions for community needs.
CO3: Designing applications can lead to the creation of useful projects for social good, like assistive devices.
CO4: Writing programs enables the development of applications that can address community issues.
CO5: Hobby projects often involve innovation for community service, such as smart farming or healthcare solutions.

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

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

Program Code : BCA

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

Semester : II

Course Type : Major Mandatory [Theory]

Course Name : Foundation of Mathematics for Computer Science-II

Course Code : BCA-155 GEN

No. of Teaching Hours : 30

No. of Credits : 2

Course Objectives:

1. Understand the concepts of row echelon form and reduced row echelon form of a matrix.
2. Learn to determine the rank of a matrix using row echelon or reduced row echelon form.
3. Solve systems of linear equations using matrix form and understand the concept of row equivalent matrices.
4. Analyze the consistency of homogeneous and non-homogeneous systems using rank and conditions for consistency.
5. Apply the Gauss elimination and Gauss-Jordan elimination methods to solve systems of equations.
6. Explore vector spaces, subspaces, linear dependence, independence, and the concept of a basis.
7. Investigate eigenvalues, eigenvectors, diagonalization, and linear transformations, including the rank-nullity theorem.

Course Outcomes:

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

CO1: Student will be able to analyze and compute the row echelon and reduced row echelon forms of matrices, and determine their rank.

CO2: Student will able to formulate and solve systems of linear equations using matrix representations and understand the concept of row equivalent matrices.

CO3: Students will able to evaluate the consistency of both homogeneous and non-homogeneous systems of linear equations using the rank method.

CO4: Student will apply Gauss elimination and Gauss-Jordan elimination methods to find solutions to systems of linear equations.

CO5: Student will able to understand and demonstrate the properties of vector spaces, subspaces, and identify linear dependence and independence.

CO6: Student will Compute the dimension of vector spaces and analyze the row space, column space, and null space of matrices.

CO7: Student will determine eigenvalues, eigenvectors, and diagonalize matrices, and understand the concepts of linear transformations, kernel, range, and the rank-nullity theorem.

Topics and Learning Points

Teaching Hours

Unit 1: Systems of Linear Equations and Matrices **06**

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

Unit 2: Vector Spaces – I **06**

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

Unit 3: Vector Spaces – I **06**

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

Unit 4: Eigen values and Eigen vectors **06**

4.1 Eigen values
4.2 Eigen vectors
4.3 Diagonalization

Unit 5: Linear Transformations **06**

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

Text Books:

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

Reference Books:

1. K. Hoffman and R. Kunze, Linear Algebra, 2nd edition(2014), Prentice Hall of India, New Delhi
2. Steven J. Leon, Linear Algebra with Applications, 4th edition(1994), Prentice Hall of India. New Delhi
3. Vivek Sahai, Vikas Bist, Linear Algebra, 4th Reprint 2017, Narosa Publishing House, New Delhi.Davis W. M., (1909), Geographical Essay, Ginnia Co.

Mapping of Programe Outcomes with Course Outcomes

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	3	3	2	2	2
PO 2	3	3	3	3	2	3	2
PO 3	1	2	2	2	2	2	2
PO 4	3	3	2	3	2	3	3
PO 5	3	3	3	3	3	3	3
PO 6	2	2	2	2	2	2	2
PO 7	2	2	2	2	2	2	2
PO8	3	3	3	3	3	3	3
PO9	2	2	2	3	2	2	3
PO10	1	1	1	1	1	1	1
PO11	1	1	1	1	1	1	1
PO12	3	3	2	3	2	3	3
PO13	1	1	1	1	1	1	1

Justification for the mapping

PO1 (Comprehensive Knowledge and Understanding):

- CO1-CO4: These COs involve core mathematical concepts requiring solid understanding of matrix operations and linear equations, directly connecting to PO1.
- CO5-CO7: While these concepts are more specialized, they still build on comprehensive knowledge of linear algebra.

PO2 (Practical, Professional, and Procedural Knowledge):

- CO1-CO4: These COs are foundational in solving practical problems using matrix techniques and systems of equations, directly aligned with PO2.
- CO5-CO6: These outcomes involve procedural knowledge in handling vector spaces and related mathematical techniques.
- CO7: Requires some practical application in diagonalizing matrices and understanding transformations.

PO3 (Entrepreneurial Mindset and Knowledge):

- CO1-CO4: These COs have limited direct impact on entrepreneurial skills but provide foundational knowledge for future applications.
- CO5-CO7: The application of linear algebra in innovation and problem-solving may indirectly support entrepreneurial skills.

PO4 (Specialized Skills and Competencies):

- CO1-CO4: These COs develop specialized competencies in matrix manipulation, systems of equations, and linear algebra techniques.
- CO5-CO7: These outcomes require more advanced, specialized skills, particularly in vector spaces and eigenvalues.

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

- CO1-CO7: All course outcomes focus on mathematical problem-solving, application of algebraic concepts, and logical reasoning, making a strong alignment with PO5.

PO6 (Communication Skills and Collaboration):

- CO1-CO7: While the course involves individual problem-solving, group discussions and collaboration on complex problems may develop communication skills, leading to a moderate relation.

PO7 (Research-related Skills):

- CO1-CO7: The course provides foundational knowledge that can be applied in research, particularly in fields that use linear algebra for computational or theoretical studies.

PO8 (Learning How to Learn Skills):

- CO1-CO7: These outcomes promote self-learning, particularly with topics like matrix algebra and vector spaces, which require students to engage deeply with content to understand and apply the material.

PO9 (Digital and Technological Skills):

- CO1-CO3: These outcomes might require the use of computational tools to solve systems of equations and perform matrix manipulations.
- CO4-CO7: These COs directly involve computational tools (e.g., MATLAB, Python) to apply advanced matrix operations and linear transformations.

PO10 (Multicultural Competence, Inclusive Spirit, and Empathy):

- CO1-CO7: This course is primarily technical, with no direct connection to multicultural competence or empathy.

PO11 (Value Inculcation and Environmental Awareness):

- CO1-CO7: This course focuses on mathematical techniques and does not directly connect to environmental awareness or values.

PO12 (Autonomy, Responsibility, and Accountability):

- CO1-CO7: These COs require independent work, decision-making, and taking responsibility for problem-solving, aligning with PO12.

PO13 (Community Engagement and Service):

- CO1-CO7: As the course is focused on mathematical theory and problem-solving, there is little direct connection to community engagement or service.

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

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

Program Code : BCA

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

Semester : II

Course Type : Major Mandatory [Practical]

Course Name : Lab Course on BCA-155 GEN

Course Code : BCA-156 GEN

No. of Teaching Hours : 4hrs. /Batch

No. of Credits : 2

Course Objectives:

1. Solve problems related to systems of linear equations using various methods, including row echelon and reduced row echelon forms.
2. Apply Gauss elimination and Gauss-Jordan elimination techniques to solve systems of linear equations.
3. Analyze and solve problems involving vector spaces, subspaces, linear dependence, and independence.
4. Compute and interpret the row space, column space, and null space of matrices, along with their dimensions.
5. Understand and calculate eigenvalues, eigenvectors, and diagonalize matrices.
6. Explore linear transformations and their properties, including kernel, range, and the rank-nullity theorem.
7. Utilize Scilab software to solve practical problems related to systems of linear equations, vector spaces, and matrix operations.

Course Outcomes:

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

CO1: Student will be able to Solve and analyze systems of linear equations using manual methods such as row echelon and reduced row echelon forms.

CO2: Students will apply the Gauss elimination and Gauss-Jordan methods to efficiently solve systems of linear equations.

CO3: Student will able to understanding of vector spaces, subspaces, and linear dependence/independence through written problem-solving.
CO4: Student will be able to compute and interpret the rank, row space, column space, and null space of matrices and their applications.

CO5: Student will able to determine eigenvalues, eigenvectors, and perform matrix diagonalization for practical problems.

CO6: Student will understand and solve problems involving linear transformations, including kernel, range, and the rank-nullity theorem.

CO7: Students will able to use Scilab software to implement and solve problems related to systems of linear equations, vector spaces, and matrix operations effectively.

Suggested List of Laboratory Assignments

Assignments based on following topics

1. Practical 1: Problems on Unit 1 based on Systems of Linear Equations-I (Written).
2. Practical 2: Problems on Unit 1 based on Systems of Linear Equations-II (Written).
3. Practical 3: Problems on Unit 2 (Written).
4. Practical 4: Problems on Unit 3 (Written).
5. Practical 5: Problems on Unit 4 (Written).
6. Practical 6: Problems on Unit 5 (Written).
7.

Assignments to be performed using Scilab Software

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

Mapping of Programe Outcomes with Course Outcomes

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	3	3	3	3	3
PO 2	3	3	2	3	3	3	3
PO 3	1	2	2	2	2	2	2
PO 4	3	3	2	3	3	3	3
PO 5	3	3	3	3	3	3	3
PO 6	2	2	2	2	2	2	3
PO 7	2	2	2	2	2	3	2
PO8	3	3	3	3	3	3	3
PO9	2	2	2	2	2	3	3
PO10	1	1	1	1	1	1	1
PO11	1	1	1	1	1	1	1
PO12	3	3	3	3	3	3	3
PO13	1	1	1	1	1	1	1

Justification for the mapping

PO1 (Comprehensive Knowledge and Understanding):

- **CO1-CO7**: These COs involve a deep understanding of linear algebra concepts, matrix operations, eigenvalues, and linear transformations, all of which contribute significantly to PO1. Hence, the relation is strong.

PO2 (Practical, Professional, and Procedural Knowledge):

- **CO1-CO7**: These COs are closely tied to applying practical methods for solving linear equations and performing operations on matrices. The use of Gauss elimination, matrix analysis, and Scilab software all contribute to professional skills, with the exception of CO3, which has a moderate relation due to the focus on vector spaces.

PO3 (Entrepreneurial Mindset and Knowledge):

- **CO1-CO7**: The course content, while offering technical knowledge, may have limited direct impact on entrepreneurial skills. The relation is moderate for CO2 and CO4, where problem-solving and analytical skills may be useful in practical applications. The rest of the COs are weakly related.

PO4 (Specialized Skills and Competencies):

- **CO1-CO7**: These COs develop specialized skills in matrix operations, systems of equations, eigenvalue computation, and using Scilab for solving complex mathematical problems. The relation is strong across most COs.

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

- **CO1-CO7**: All COs emphasize problem-solving, analysis, and application of mathematical concepts, particularly in the context of linear algebra and computational tools. Hence, they all have a strong relation.

PO6 (Communication Skills and Collaboration):

- **CO1-CO6**: While the course is heavily focused on technical problem-solving, collaborative problem-solving and the ability to explain solutions will strengthen communication skills. CO7 has a strong relation as it involves the practical use of software and might require more teamwork. Other COs have a moderate relation.

PO7 (Research-related Skills):

- **CO1-CO6**: The course supports the development of analytical thinking that can be used for research, especially in solving linear equations, performing matrix analysis, and understanding theoretical concepts like linear transformations. CO6 and CO7 have a more direct relation, while others are moderately related.

PO8 (Learning How to Learn Skills):

- **CO1-CO7**: These COs promote deep learning and self-study of mathematical concepts and computational tools (e.g., Scilab), making them strongly related to PO8. All COs have a strong relation.

PO9 (Digital and Technological Skills):

- **CO1-CO7**: The use of computational tools like Scilab in solving matrix-related problems is a key skill developed in this course, making CO7 the most directly related to PO9. The rest are moderately related.

PO10 (Multicultural Competence, Inclusive Spirit, and Empathy):

- **CO1-CO7**: This course focuses primarily on technical concepts with no direct impact on multicultural competence or empathy. Hence, the relation is weak.

PO11 (Value Inculcation and Environmental Awareness):

- **CO1-CO7**: The technical nature of the course does not emphasize environmental awareness or values, resulting in a weak relation.

PO12 (Autonomy, Responsibility, and Accountability):

- **CO1-CO7**: The course encourages self-study, individual problem-solving, and responsible handling of complex mathematical operations, which supports autonomy and accountability. Hence, the relation is strong.

PO13 (Community Engagement and Service):

- **CO1-CO7**: The course content does not directly connect to community service or engagement, so the relation is weak.

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

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

Program Code : BCA

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

Semester : II

Course Type : Open Elective [Pratical]

Course Name : Data Science Using Spread Sheet

Course Code : BBA-154 OE

No. of Teaching Hours : 4 Hrs. / Batch

No. of Credits : 2

Course Objectives:

1. To know spreadsheet concepts
2. To learn functions and formulas.
3. To understand charts and graphics.
4. To be familiar with filters and sorting of table data.
5. Understand the working on advanced data manipulation with spread sheets.

Course Outcomes:

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

CO1: Perform computations on data using formulas.

CO2: Present the data in graphical form.

CO3: Analyze data by applying various functions and filters.

CO4: Learn about the importance of proper data management;

CO5: Perform statistical analysis of data

CO6: Apply statistical and computational tools to real-world problems.

CO7: To create budgets, produce graphs and charts, and for storing and sorting data.

Suggested List of Assignments

Guidelines for Instructor's Manual
The instructor shall frame at least 14 assignments. Instructor's manual consisting of University syllabus, conduction & Assessment guidelines is to be developed.
Guidelines for Student Journal
The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up for each assignment. Write-up shall include Title, Problem Statement, software and Hardware requirements, Date of Completion. Program codes with sample output of all performed assignments are to be submitted as softcopy. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints.
Guidelines for Assessment
Continuous assessment of laboratory work is to be carried out based on overall performance of students. For each lab assignment, the instructor will assign grade/marks based on parameters such as timely completion, understanding, neatness etc. with appropriate weightage.
List of Assignments
Assignment 1: To explore interface and basic features of Excel. Make a Start with Excel from simple to complex spreadsheet. Creating templates in Excel.
Assignment 2: Using Autocomplete and formatting features. Data entry in Excel with different data types and formatting. Formatting Cells with Number formats, Font formats, Alignment, Borders, etc.
Assignment 3: Printing Workbooks - Setting Up Print Area, Print Titles –Repeat Rows / Columns, Designing the structure of a template, Customizing Headers & Footers.
Assignment 4: Filtering and Sorting - Filtering on Text, Numbers & Colours, Sorting Options, Sorting and Filtering Lists.
Assignment 5: Calculations in MS-Excel using Basic Functions (Sum, Average, Max, Min, Count, etc). Use of Text Functions (Upper, Lower, Proper, Left, Mid, Right , Trim, Len, Exact, Concatenate, Find, Substitute). Use of Arithmetic Functions (SumIf, SumIfs CountIf, CountIfs ,AverageIf, AverageIfs).
Assignment 6: What-If Analysis - Goal Seek, Data Tables, Solver Tool, Scenario Analysis.

Assignment 7: Data Validation- Number, Date & Time Validation, Dynamic Dropdown List Creation using Data Validation – Dependency List, Custom validations based on a formula for a cell, Text and List Validation.
Assignment 8: Generating different types of charts.Using SLICERS, Filter data with Slicers, Various Charts i.e. Bar Charts / Pie Charts / Line Charts, Manage Primary and Secondary Axis.
Assignment 9: Use of conditional functions. Applying IF functions. Conditional formatting in MS-Excel. Use of OFFSET function.
Assignment 10: Recording macros and buttons. Protecting Excel- Excel Security (File Level Protection Workbook, Worksheet Protection).
Assignment 11: Excel Dashboard, Planning a Dashboard, Adding Dynamic Contents to Dashboard, Adding Tables and Charts to Dashboard.
Assignment 12: Use of Lookup functions. (Vlookup / HLookup), Creating Smooth User Interface Using Lookup, Reverse Lookup using Choose Function.
Assignment 13: Creating Simple Pivot Tables, Classic Pivot table, Basic and Advanced Value Field Setting, Calculated Field & Calculated Items, Grouping based on numbers and Dates.
Assignment 14: Arrays Functions - What are the Array Formulas, Use of the Array Formulas? Array with if, len, and mid functions formulas, Basic Examples of Arrays (Advanced Use of formulas with Array, Array with Lookup functions).
Reference Books 1. Beginning Excel 2019, Authors: Noreen Brown, Barbara Lave, Julie Romey, Open Oregon Educational Resources 2. Excel Step by Step (Office 2021 and Microsoft 365) Published with the authorization of Microsoft Corporation by: Pearson Education, Inc. 3. Excel Bible: The Comprehensive Tutorial Resource 4. Excel: Quick Start Guide from Beginner to Expert (Excel, Microsoft Office) 5. Building Financial Models with Excel: A Guide for Business Professionals, (MISL- WILEY) 6. Predictive Analytics: Excel 7. Excel from Scratch: Excel course with demos and exercises
E-Resources:
1. https://www.udemy.com/course/microsoft-excel-2013-from-beginner-to-advanced-and-beyond/ 2. https://edu.gcfglobal.org/en/excel/ 3. https://support.microsoft.com/en-us/excel 4. https://www.coursera.org/projects/introduction-microsoft-excel 5. https://www.coursera.org/learn/microsoft-excel-work-smarter 6. https://www.udemy.com/course/excel-for-analysts/

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

Weight: 1-Partiallyrelated 2 – Moderately Related 3–Strongly Related

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

1 Justification of PO1 to ALL COs:

CO1: As performing computations requires a deep understanding of formulas and data processing.

CO2: Presenting data graphically requires knowledge of visualization techniques.

CO3: As analyzing data with functions and filters demonstrates comprehension of data manipulation.

CO4: As understanding proper data management contributes to overall knowledge but is more application-focused.

CO5: Since statistical analysis requires conceptual understanding of statistical methods.

CO6: As applying statistical and computational tools involves theoretical and practical knowledge.

CO7: As creating budgets, graphs, and sorting data requires understanding but is primarily skill-based.

2 Justification of PO2 to ALL COs:

CO1: As performing computations using formulas is a key procedural skill in data handling.

CO2: Since presenting data graphically is an essential practical skill in professional settings.

CO3: As analysing data using functions and filters is crucial for professional data processing.

CO4: As understanding data management is important but more theoretical than procedural.

CO5: As performing statistical analysis is a key professional and practical competency.

CO6: Since applying statistical and computational tools to real-world problems is a core practical skill.

CO7: As creating budgets, graphs, and sorting data are essential procedural and professional tasks.

3 Justification of PO3 to ALL COs:

CO1: As performing computations is useful for financial and business decision-making.

CO2: Since graphical data presentation is essential for business insights and decision-making.

CO3: As analysing data helps in market research and strategic planning.

CO4: As proper data management supports efficient business operations.

CO5: Since statistical analysis aids in business forecasting and risk assessment.

CO6: As applying statistical and computational tools is crucial for data-driven entrepreneurship.

CO7: As budgeting, charting, and data organization are fundamental to business planning.

4 Justification of PO4 to ALL COs:

CO1: As performing computations using formulas is a fundamental specialized skill in data handling.

CO2: Since presenting data graphically requires proficiency in visualization techniques.

CO3: As analysing data using functions and filters is a key competency in data processing.

CO4: As proper data management is essential but more about best practices than specialized skills.

CO5: Since statistical analysis is a specialized skill needed for data interpretation.

CO6: As applying statistical and computational tools requires technical expertise.

CO7: Because creating budgets, charts, and sorting data are specialized skills crucial for data-driven decision-making.

5 Justification of PO5 to ALL COs:

CO1: As performing computations using formulas is essential for problem-solving and data analysis.

CO2: Since graphical representation aids in analytical reasoning and decision-making.

CO3: As analysing data using functions and filters enhances problem-solving skills.

CO4: As proper data management supports effective problem-solving but is more of a foundational concept.

CO5: Since statistical analysis is key to drawing meaningful insights and solving data-driven problems.

CO6: As applying statistical and computational tools directly contributes to analytical reasoning and real-world problem-solving.

CO7: Because budgeting, graphing, and sorting data help in strategic decision-making and problem-solving.

6 Justification of PO6 to ALL COs:

CO1: As performing computations helps in conveying accurate data but is not directly communication-focused.

CO2: Since presenting data graphically enhances communication and understanding of complex information.

CO3: As analysing data using functions and filters supports clear data-driven communication.

CO4: As proper data management facilitates organized collaboration and data sharing.

CO5: Since statistical analysis helps in making data-driven arguments but is more technical than communicative.

CO6: As applying statistical and computational tools improves the ability to present and discuss findings effectively.

CO7: Because creating budgets, graphs, and sorting data enhances collaborative decision-making and reporting.

7 Justification of PO7 to ALL COs:

CO1: As performing computations using formulas is essential for data analysis in research.

CO2: since presenting data graphically is crucial for visualizing research findings.

CO3: As analysing data using functions and filters is key in data-driven research.

CO4: As proper data management ensures the reliability and accuracy of research data.

CO5: Since statistical analysis is a fundamental research skill for drawing valid conclusions.

CO6: As applying statistical and computational tools is critical for conducting research effectively.

CO7: Because creating budgets, graphs, and sorting data supports research but is not the primary focus.

8 Justification of PO8 to ALL COs:

CO1: As learning to perform computations helps develop problem-solving and independent learning skills.

CO2: Since presenting data graphically enhances the ability to interpret and communicate information effectively.

CO3: As analysing data with functions and filters promotes critical thinking and adaptability in learning.

CO4: As understanding proper data management fosters self-directed learning and organization skills.

CO5: Since performing statistical analysis requires continuous learning and application of new techniques.

CO6: As applying statistical and computational tools encourages lifelong learning in data science and analytics.

CO7: Because creating budgets, graphs, and sorting data aids in learning but is more application-focused.

9 Justification of PO9 to ALL COs:

CO1: As performing computations using formulas requires proficiency in digital tools like spreadsheets.

CO2: Since presenting data graphically involves using digital visualization tools.

CO3: As analysing data with functions and filters requires technological competency.
CO4: Because proper data management involves using digital storage, databases, and organizational tools.
CO5: Since statistical analysis is performed using digital software and computational tools.
CO6: As applying statistical and computational tools relies on technology-driven methodologies.
CO7: Because creating budgets, graphs, and sorting data requires expertise in digital applications.

10 Justification of PO10 to ALL COs:

CO1: Data computations help in understanding diverse data perspectives, fostering inclusivity in decision-making.
CO2: Graphical representation of data aids in communicating information effectively across multicultural settings.
CO3: Data analysis enhances empathy by providing insights into diverse social and cultural trends.
CO4: Proper data management ensures fair representation and ethical handling of multicultural data.
CO5: Statistical analysis helps in understanding social issues, promoting inclusivity through data-driven insights.
CO6: Applying statistical tools to real-world problems fosters empathy and multicultural awareness.
CO7: Budgeting, graphing, and sorting data support equitable resource distribution and inclusivity.

11 Justification of PO11 to ALL COs:

CO1: Computations help assess environmental data and resource utilization efficiently.
CO2: Graphical data representation raises awareness about environmental trends and values.
CO3: Data analysis supports decision-making in sustainability and ethical considerations.
CO4: Proper data management ensures responsible use of environmental and ethical data.
CO5: Statistical analysis aids in evaluating environmental impact and promoting sustainability.
CO6: Computational tools provide insights into real-world environmental challenges.
CO7: Budgeting and data organization contribute to sustainable planning and resource management.

12 Justification of PO12 to ALL COs:

CO1: Accurate computations ensure accountability and responsibility in data-driven decision-making.
CO2: Presenting data graphically enhances transparency and autonomy in reporting.
CO3: Data analysis fosters responsibility by ensuring informed and ethical decision-making.
CO4: Proper data management promotes accountability in handling and storing critical information.
CO5: Statistical analysis supports responsible interpretation and application of data.
CO6: Applying tools to real-world problems enhances autonomy in problem-solving and decision-making.
CO7: Creating budgets and organizing data ensures responsible financial and resource management.

13 Justification of PO13 to ALL COs:

CO1: Computations support data-driven decision-making in community service initiatives.
CO2: Graphical presentation of data raises awareness and enhances community engagement.
CO3: Analysing data helps assess community needs and improve service effectiveness.
CO4: Proper data management ensures transparency and efficiency in community projects.
CO5: Statistical analysis helps evaluate the impact of community programs.
CO6: Computational tools aid in solving real-world community challenges effectively.
CO7: Budgeting and organizing data facilitate sustainable and responsible 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 : II

Course Type : Skill Enhancement Course (SEC) [Practical]

Course Code : BCA-151 SEC

Course Title : Software Tools for Business Communication

No. of Teaching Hours : 4 Hrs. /Batch

No. of Credits : 02

Course Objectives:

1. To develop proficiency in creating, editing, formatting, and managing documents using Word processing software and Google Docs.
2. To understand and apply advanced formatting features such as tables, columns, objects, and special effects in documents.
3. To enhance productivity by effectively working with spreadsheets, utilizing formulas, functions, and charts in MS Excel and Google Sheets.
4. To create visually appealing presentations using MS PowerPoint and Google Slides while integrating multimedia elements.
5. To efficiently use Google Forms, Google Drive, and Google Calendar for collaboration and organization.
6. To develop essential email communication skills, including email etiquette, email groups, and attachment handling.
7. To explore and apply Generative AI tools such as ChatGPT for content creation and automation.

Course Outcomes:

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

CO1. Create, edit, format, and enhance documents using Microsoft Word and Google Docs with appropriate text alignments, effects, and styles.

CO2. Design and manage spreadsheets using Microsoft Excel and Google Sheets, utilizing functions, formulas, charts, and integration features.

CO3. Develop and present visually appealing and interactive presentations using PowerPoint and Google Slides with text, images, and animations.

CO4. Utilize Google Forms, Drive, and Calendar for online collaboration, data collection, file organization, and scheduling tasks efficiently.

CO5. Manage email communications effectively, apply email etiquette, and collaborate using email groups and shared resources.

CO6. Work collaboratively using cloud-based tools, sharing and co-editing documents, spreadsheets, and presentations in real-time.

CO7. Leverage Generative AI tools like ChatGPT to automate content creation, enhance productivity, and improve workflow efficiency.

Topic No.	Topics and Learning Points	No. of Assignment
Unit I:	**Word processing and Google DOCs** Create, Save, Open and Edit Documents, Text Alignments, Enhancements, and Effects Basic Document Formatting and Editing, Additional Document Formatting and Editing Work with Multiple-Page Documents and Multiple Documents, Work with Columns and Tables Work with Objects, Lines, and Text Boxes, Drawing Tools, Add Special Effects Create and manipulate Google DOC using various features	**04**
Unit II:	**Spreadsheets and Google Sheets** Create, Save, and Print a Worksheet, Use Formulas; Copy a Formula; Format and Enhance Use Functions, Additional Formatting, and Editing, Create and Edit Charts, Integrate Worksheets with Other Applications Create and manipulate Google Sheets using various features	**04**
Unit III:	**Presentations and Google Slides** Create, Save, and Print a Presentation, Enhance Slides; Work with Text and Objects, Work with Slide Shows; Integrate Presentations with Other Applications Create and manipulate Google Slides using various features	**02**

Unit IV:	**Google Forms, Drives and Calendar** Create, Save, Open and Edit Google form using essential features Google Drive: Create folders and subfolders, upload documents, share drive files and folders, Google Calendar: essential features	**03**
Unit V:	**Emails, Groups and Generative AI Tools** Create and send, receive emails, email folders and fields, attach documents, address book, email signatures and other essential settings, Email etiquettes Create, join email groups, send and receive emails on groups Using Generative AI tools such as ChatGPT	**04**

References:

1. Office 2019 in Easy Steps, Michael Price, BPB Publications
2. The Ridiculously Simple Guide to Google Apps (G Suite): A Practical Guide to Google Drive Google Docs, Google Sheets, Google Slides, and Google Forms, Scott La Counte, SL Editions

Mapping of Program Outcomes with Course Outcomes

Weightage:

1=weak or low relation, 2=Moderate or partial relation, 3=Strong or direct relation

CO-PO Mapping Table

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

Justification:

PO1: Comprehensive Knowledge and Understanding

CO1, CO2 Strongly mapped as they involve fundamental knowledge of document processing and spreadsheets.

CO3, CO4, CO5, CO6 & CO7 Moderately mapped since they contribute to technical knowledge in presentations, cloud tools, and AI.

PO2: Practical, Professional, and Procedural Knowledge

All COs Strongly mapped as they involve hands-on experience with digital tools (Word, Excel, PowerPoint, AI).

PO3: Entrepreneurial Mindset and Knowledge

CO3, CO6, CO7 Moderately mapped as presentation, collaboration, and AI tools encourage creativity and innovation.

CO1, CO2, CO4, CO5 Weakly mapped as they provide indirect support for entrepreneurship.

PO4: Specialized Skills and Competencies

CO2, CO3, CO4, CO5, CO6 & CO7 Strongly mapped as they require technical proficiency, problem-solving, and effective communication.

CO1Moderately mapped since document formatting is a fundamental skill.

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

CO2, CO3, CO4, CO5, CO6 & CO7 Strongly mapped as they involve applying skills in spreadsheets, presentations, cloud tools, and AI.

CO1 Moderately mapped as document processing requires some logical structuring.

PO6: Communication Skills and Collaboration

CO3, CO4, CO5, CO6 & CO7 Strongly mapped as presentations, email communication, and real-time collaboration tools enhance teamwork and communication.

CO1, CO2 Moderately mapped as documents and spreadsheets contribute to structured communication.

PO7: Research-related Skills

CO7 Mapped because AI tools support research and content automation.

CO1, CO2, CO3, CO4, CO5, CO6 Weakly mapped since research is not the primary focus but still relevant for data handling and organization.

PO8: Learning How to Learn Skills

CO6, CO7 Strongly mapped as collaborative tools and AI encourage adaptability and self-learning.

CO1, CO2, CO3, CO4, CO5 Moderately mapped since working with digital tools involves continuous learning.

PO9: Digital and Technological Skills

All COs Strongly mapped since the course is entirely based on ICT and digital tool proficiency.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

CO5, CO6, CO7 Moderately mapped as email communication and collaborative tools support diverse interactions.

CO1, CO2, CO3 & CO4 Weakly mapped since they contribute indirectly to inclusive communication.

PO11: Value Inculcation and Environmental Awareness

All COs Weakly mapped as using digital tools reduces paper usage and promotes environmental awareness.

PO12: Autonomy, Responsibility, and Accountability

CO6, CO7 Strongly mapped as collaborative tools and AI encourage independent learning and accountability.

CO1, CO2, CO3, CO4, CO5Moderately mapped since digital tools require responsible usage and management.

PO13: Community Engagement and Service

CO4, CO5, CO6 & CO7 Moderately mapped as collaborative tools enable teamwork and shared resources, benefiting communities.

CO1, CO2 & CO3 Weakly mapped as they provide indirect support for community engagement through document sharing and presentations.

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

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

Program Code : BCA

Class : FYBCA

Semester : II

Course Type : Ability Enhancement Course

Course Name : General English - II

Course Code : ENG-151-AEC

No. of Lectures : 30

No. of Credits : 02

Course Objectives:

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

Course Outcomes:

At the end of the course:

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

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

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

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

CO5. The learners understand 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. The Child (Prem Chand)
2. Love Across the Salt Desert (K N Daruwala)

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

1. Still I Rise (Maya Angelou)
2. Success is Counted Sweetest (Emily Dickinson)

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

1. Active Passive
2. Synthesis
3. Identification of Noun, Verb, Adjective and Adverb

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

1. Letter Writing
2. Email Writing
3. Idioms and Phrasal verbs

References:

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
CO 1	2	2	3	1	2	3	2	1	2	2
CO 2	1	1	1	1	1	1	1	1	1	1
CO 3	3	2	2	2	3	3	1	3	2	3
CO 4	2	2	2	2	2	2	2	2	2	2
CO 5	3	3	2	3	2	1	3	2	3	3
CO 6	3	3	3	1	3	3	3	3	3	3
CO 7	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.Sc. (Computer Science) (2024 Pattern)

Name of the Programme	: B.Sc. Computer Science
Program Code	: USCOS
Class	: F.Y. B.Sc., F. Y. B. Sc. (Computer Science), F.Y. B. Com., F. Y. BBA (CA), FYBBA, All B. Voc.
Semester	: II
Course Type	: VEC
Course Name	: Digital and Technological Solutions (TH)
Course Code	: COS-155-VEC
No. of Practical's	: 30
No. of Credits	: 02

Course Objectives:

- To gain familiarity with digital paradigms
- To sensitize about role & significance of digital technology.
- To provide know how of communications & networks
- To bring awareness about the e-governance and Digital India initiatives
- To provide a. flavour of emerging technologies - Cloud, Big Data, AI 3D printing

Course Outcome:

- CO1: Knowledge about digital paradigm.
- CO2:Realisation of importance of digital technology, digital financial tools, e-commerce.
- CO3: Know-how of communication and networks.
- CO4: Familiarity with the e-governance and Digital India initiatives
- CO5: An understanding of use & applications of digital technology.
- CO6: Basic knowledge of all machine learning and big data.
- CO7: Knowledge about social networking.

Units	Course Contents	No. of Lectures
Unit - I	**Introduction & Evolution of Digital Systems**: Role & Significance of Digital Technology. Information & Communication Technology & Tools. Computer System & it's working, Software and its types. **Operating Systems:** Types and Functions. Problem Solving: Algorithms and Flowcharts. Communication Systems: Principles, Model & Transmission Media.	8
Unit - II	**Computer Networks & internet:** Concepts & Applicators, WWW, Web Browsers, Search Engines, Messaging, Email, Social Networking. **Computer Based information System:** Significance & Types.	7

	E-commerce & Digital Marketing: Basic Concepts, Benefits & Challenges.	
Unit –III	**Digital India & e-Governance:** Initiatives, infrastructure, Services and Empowerment. **Digital Financial Tools:** Unified Payment interface, Aadhar Enabled Payment System, USSD, Credit/Debit Cards, e-Wallet's internet Banking, NEFT/RTGS and IMPS, Online Bill Payments and pos.	8
Unit-IV	**Cyber Security:** Threats, Significance, Challenges, Precautions, Safety Measures, & Tools **Emerging Technologies & their applications:** Overview of Cloud Computing, Big Data, internet of Things, Virtual Reality, Block chain, Robotics, Artificial intelligence, 3-D Printing. Future of Digital Technologies.	7

REFERENCE BOOKS:

1. Fundamentals of Computers by E Balagurusamy- Tata Mc GrawHill
2. Data Communications and Networking by Behrouz A. Forouzan - McGraw Hill
3. "Cloud Computing- Principals and Paradigms" by Buvya, Broberg, and Gosciniski- Wiley
4. "E commerce" by Laudon.
5. "Artificial lntelligence- A Modern Approach by Russel and Norving" - Pearson Education.
6. "lnternet of Things" by Samuel Greengard - MIT press
7. "lntroduction to Computers by Peter Norton" - Tata McGraw Hill
8. "E-Commerce Concepts, Models, Strategies"- C.S.V. Murthy
9. "Basics of Artificial lntelligence and Machine Learning" by Dheeraj Mehrotra - Notion press.
10. "Big Data for dummies" by Hurwith, Nugent,Halper, Kaufman, Wiley & Sons – Wile

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	3
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	2
CO4	2	2	2	3	3	1	2	3	3	1	1	3	3
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	3

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

1. Justification of PO1 to ALL COs:

• **CO1: Knowledge about digital paradigm.** (Weightage: 3) Justification: PO1 focuses on comprehensive knowledge, which includes understanding the digital paradigm deeply. CO1 directly aligns with this objective as it emphasizes knowledge about the digital paradigm.

- **CO2: Realization of importance of digital technology, digital financial tools, e-commerce.** (Weightage: 3) Justification: PO1 emphasizes understanding the importance of digital technology and related tools. CO2 directly relates to this by focusing on the realization of the significance of digital technology, financial tools, and e-commerce.
- **CO3: Know-how of communication and networks.** (Weightage: 3) Justification: PO1 requires understanding communication and networks as part of digital knowledge. CO3 directly supports this by focusing on the know-how of communication and networks.
- **CO4: Familiarity with the e-governance and Digital India initiatives.** (Weightage: 2) Justification: While important, familiarity with e-governance and Digital India initiatives is somewhat narrower than the broader scope of PO1. It is moderately related as it contributes to understanding specific initiatives within the digital paradigm.
- **CO5: An understanding of use & applications of digital technology.** (Weightage: 3) Justification: PO1 includes understanding the use and applications of digital technology broadly. CO5 directly aligns with this by focusing on understanding how digital technology is used and applied.
- **CO6: Basic knowledge of machine learning and big data.** (Weightage: 2) Justification: While machine learning and big data are important components of digital technology, they represent specific areas within a broader digital paradigm. Hence, CO6 is partially related to the comprehensive knowledge and understanding outlined in PO1.
- **CO7: Knowledge about social networking.** (Weightage: 2) Justification: Social networking is a specific aspect of digital technology and its applications. While relevant, it is not as comprehensive as the broader digital knowledge emphasized in PO1. Therefore, CO7 is moderately related.

2. **Justification of PO2 to ALL COs:**

- **CO1: Knowledge about digital paradigm.** (Weightage: 3) Justification: PO2 emphasizes practical and professional knowledge, which includes understanding the digital paradigm deeply. CO1 directly aligns with this objective as it focuses on knowledge about the digital paradigm.
- **CO2: Realization of importance of digital technology, digital financial tools, e-commerce.** (Weightage: 3) Justification: PO2 requires realizing the importance of digital technology and related tools in a practical and professional context. CO2 directly relates to this by focusing on the realization of their significance, which is crucial for practical application.
- **CO3: Know-how of communication and networks.** (Weightage: 3) Justification: PO2 emphasizes practical know-how of communication and networks, which are essential in professional settings. CO3 directly supports this by focusing on the practical aspects of communication and networks.
- **CO4: Familiarity with the e-governance and Digital India initiatives.** (Weightage: 2) Justification: Understanding e-governance and Digital India initiatives is important in a professional context, albeit somewhat narrower than the broader practical and procedural knowledge emphasized in PO2. Hence, it is moderately related.
- **CO5: An understanding of use & applications of digital technology.** (Weightage: 3) Justification: PO2 requires understanding the practical use and applications of digital technology in professional scenarios. CO5 directly aligns with this by focusing on understanding how digital technology is practically used and applied.
- **CO6: Basic knowledge of machine learning and big data.** (Weightage: 2) Justification: While machine learning and big data are important, they represent specific technical skills within the digital paradigm. CO6 is partially related as it contributes to professional knowledge but may not cover all aspects of procedural knowledge emphasized in PO2.

- **CO7: Knowledge about social networking.** (Weightage: 2) Justification: Social networking knowledge is relevant in a professional context but is more specific and narrower in scope compared to the broader professional and procedural knowledge outlined in PO2. Hence, CO7 is moderately related.

3. Justification of PO3 to ALL COs:

- **CO1: Knowledge about digital paradigm.** (Weightage: 2) Justification: PO3 requires understanding the digital paradigm to foster an entrepreneurial mindset. CO1 provides foundational knowledge about the digital paradigm, which is moderately related as it sets the context for entrepreneurial thinking.
- **CO2: Realization of importance of digital technology, digital financial tools, e-commerce.** (Weightage: 3) Justification: PO3 emphasizes realizing the importance of digital technologies and tools in entrepreneurial ventures. CO2 directly supports this by focusing on the significance of digital technology, financial tools, and e-commerce, which is strongly related to fostering an entrepreneurial mindset.
- **CO3: Know-how of communication and networks.** (Weightage: 3) Justification: Effective communication and networking are crucial for entrepreneurial success. PO3 includes developing know-how in these areas, and CO3 directly contributes by focusing on practical skills related to communication and networks, which is strongly related.
- **CO4: Familiarity with the e-governance and Digital India initiatives.** (Weightage: 1) Justification: While understanding e-governance and Digital India initiatives can be beneficial for entrepreneurs, it is less directly related to fostering an entrepreneurial mindset compared to other COs. Hence, it is partially related.
- **CO5: An understanding of use & applications of digital technology.** (Weightage: 2) Justification: PO3 requires understanding how digital technology can be practically applied in entrepreneurial ventures. CO5 directly aligns with this by focusing on understanding the use and applications of digital technology, which is moderately related.
- **CO6: Basic knowledge of machine learning and big data.** (Weightage: 1) Justification: While machine learning and big data are important in various fields, including entrepreneurship, basic knowledge of these areas is less critical for developing an entrepreneurial mindset compared to other COs. Hence, it is partially related.
- **CO7: Knowledge about social networking.** (Weightage: 2) Justification: Social networking knowledge is directly relevant for entrepreneurs to build connections and partnerships. PO3 includes developing knowledge about social networking, and CO7 directly contributes to this aspect, which is moderately related.

4. Justification of PO4 to ALL COs:

- **CO1: Knowledge about digital paradigm.** (Weightage: 2) Justification: PO4 requires foundational knowledge about the digital paradigm to develop specialized skills and competencies. CO1 provides this foundational knowledge, which is moderately related as it sets the context for specialized skill development.
- **CO2: Realization of importance of digital technology, digital financial tools, e-commerce.** (Weightage: 2) Justification: Understanding the importance of digital technology and related tools is essential for developing specialized skills in these areas. CO2 directly supports this understanding, which is moderately related to developing specialized competencies.
- **CO3: Know-how of communication and networks.** (Weightage: 2) Justification: Effective communication and networking skills are specialized competencies required in various professional contexts. PO4 includes developing know-how in these areas, and CO3 directly contributes by focusing on practical skills related to communication and networks, which is moderately related.

- **CO4: Familiarity with the e-governance and Digital India initiatives.** (Weightage: 1) Justification: While familiarity with e-governance and Digital India initiatives can be beneficial, it is less directly related to developing specialized skills and competencies compared to other COs. Hence, it is partially related.
- **CO5: An understanding of use & applications of digital technology.** (Weightage: 3) Justification: PO4 emphasizes developing specialized skills in the practical use and applications of digital technology. CO5 directly aligns with this by focusing on understanding how digital technology is practically used and applied, which is strongly related.
- **CO6: Basic knowledge of machine learning and big data.** (Weightage: 2) Justification: Machine learning and big data are specialized areas within the digital paradigm. CO6 provides basic knowledge in these areas, which is moderately related to developing specialized skills and competencies in these fields.
- **CO7: Knowledge about social networking.** (Weightage: 1) Justification: While knowledge about social networking is important, it is less directly related to developing specialized skills and competencies compared to other COs. Hence, it is partially related

5. Justification of PO5 to ALL COs:

- **CO1: Knowledge about digital paradigm.** (Weightage: 2) Justification: PO5 requires a foundational understanding of the digital paradigm to apply problem-solving and analytical reasoning skills in digital contexts. CO1 provides this foundational knowledge, which is moderately related as it supports the application of these skills in digital scenarios.
- **CO2: Realization of importance of digital technology, digital financial tools, e-commerce.** (Weightage: 2) Justification: Understanding the importance of digital technology and related tools is crucial for applying problem-solving and analytical reasoning in digital environments. CO2 directly supports this understanding, which is moderately related to developing application and problem-solving capacities.
- **CO3: Know-how of communication and networks.** (Weightage: 2) Justification: Effective communication and networking skills are essential for problem-solving and analytical reasoning in professional contexts. PO5 includes developing know-how in these areas, and CO3 directly contributes by focusing on practical skills related to communication and networks, which is moderately related.
- **CO4: Familiarity with the e-governance and Digital India initiatives.** (Weightage: 1) Justification: While familiarity with e-governance and Digital India initiatives can provide context, it is less directly related to developing problem-solving and analytical reasoning skills compared to other COs. Hence, it is partially related.
- **CO5: An understanding of use & applications of digital technology.** (Weightage: 3) Justification: PO5 emphasizes the practical understanding and application of digital technology in problem-solving and analytical reasoning. CO5 directly aligns with this by focusing on understanding how digital technology is practically used and applied, which is strongly related.
- **CO6: Basic knowledge of machine learning and big data.** (Weightage: 2) Justification: Machine learning and big data skills are increasingly important for analytical reasoning and problem-solving in digital contexts. CO6 provides basic knowledge in these areas, which is moderately related to developing these capacities.
- **CO7: Knowledge about social networking.** (Weightage: 1) Justification: Knowledge about social networking, while useful, is less directly related to developing problem-solving and analytical reasoning skills compared to other COs. Hence, it is partially related.

6. Justification of PO6 to ALL COs:

- **CO1: Knowledge about digital paradigm.** (Weightage: 2) Justification: PO6 requires a foundational understanding of the digital paradigm to effectively communicate and

collaborate in digital contexts. CO1 provides this foundational knowledge, which is moderately related as it supports communication and collaboration in digital settings.

- **CO2: Realization of importance of digital technology, digital financial tools, e-commerce.** (Weightage: 2) Justification: Understanding the importance of digital technology and tools is essential for effective communication and collaboration in digital environments. CO2 directly supports this understanding, which is moderately related to developing communication skills and collaboration.
- **CO3: Know-how of communication and networks.** (Weightage: 3) Justification: PO6 emphasizes practical know-how in communication and networks, which are crucial for effective collaboration. CO3 directly contributes to this by focusing on developing practical skills related to communication and networks, which is strongly related.
- **CO4: Familiarity with the e-governance and Digital India initiatives.** (Weightage: 1) Justification: Familiarity with e-governance and Digital India initiatives, while important, is less directly related to developing communication skills and collaboration compared to other COs. Hence, it is partially related.
- **CO5: An understanding of use & applications of digital technology.** (Weightage: 2) Justification: Understanding the practical use and applications of digital technology is important for effective communication and collaboration in digital contexts. CO5 directly aligns with this by focusing on understanding how digital technology is used and applied, which is moderately related.
- **CO6: Basic knowledge of machine learning and big data.** (Weightage: 1) Justification: While machine learning and big data are important, basic knowledge in these areas is less directly related to developing communication skills and collaboration compared to other COs. Hence, it is partially related.
- **CO7: Knowledge about social networking.** (Weightage: 2) Justification: Knowledge about social networking is directly relevant for fostering collaboration and effective communication. PO6 includes developing knowledge about social networking, and CO7 directly contributes to this aspect, which is moderately related.

7. Justification of PO7 to ALL COs:

- **CO1: Knowledge about digital paradigm.** (Weightage: 2) Justification: PO7 requires a foundational understanding of the digital paradigm to conduct research effectively in digital contexts. CO1 provides this foundational knowledge, which is moderately related as it supports research activities within the digital paradigm.
- **CO2: Realization of importance of digital technology, digital financial tools, e-commerce.** (Weightage: 2) Justification: Understanding the importance of digital technology and tools is essential for conducting research related to digital environments. CO2 directly supports this understanding, which is moderately related to developing research-related skills.
- **CO3: Know-how of communication and networks.** (Weightage: 2) Justification: Effective communication and networking skills are crucial for conducting collaborative research. PO7 includes developing know-how in these areas, and CO3 directly contributes by focusing on practical skills related to communication and networks, which is moderately related.
- **CO4: Familiarity with the e-governance and Digital India initiatives.** (Weightage: 1) Justification: Familiarity with e-governance and Digital India initiatives can provide context for research, but it is less directly related to developing research-related skills compared to other COs. Hence, it is partially related.
- **CO5: An understanding of use & applications of digital technology.** (Weightage: 3) Justification: PO7 emphasizes understanding the practical use and applications of digital technology in conducting research. CO5 directly aligns with this by focusing on

understanding how digital technology is practically used and applied, which is strongly related.

- **CO6: Basic knowledge of machine learning and big data.** (Weightage: 2) Justification: Machine learning and big data skills are increasingly important in research methodologies, especially in digital contexts. CO6 provides basic knowledge in these areas, which is moderately related to developing research-related skills.
- **CO7: Knowledge about social networking.** (Weightage: 1) Justification: While knowledge about social networking can aid in collaboration for research, it is less directly related to developing research-related skills compared to other COs. Hence, it is partially related.

8. Justification of PO8 to ALL COs:

- **CO1: Knowledge about digital paradigm.** (Weightage: 2) Justification: PO8 involves developing skills related to understanding and adapting to the digital paradigm. CO1 provides foundational knowledge about the digital paradigm, which is moderately related as it supports learning how to learn in digital contexts.
- **CO2: Realization of importance of digital technology, digital financial tools, e-commerce.** (Weightage: 2) Justification: Understanding the importance of digital technology and tools is crucial for adapting and learning in digital environments. CO2 directly supports this understanding, which is moderately related to developing learning how to learn skills.
- **CO3: Know-how of communication and networks.** (Weightage: 2) Justification: Effective communication and networking skills are essential for continuous learning and adaptation. PO8 includes developing know-how in these areas, and CO3 directly contributes by focusing on practical skills related to communication and networks, which is moderately related.
- **CO4: Familiarity with the e-governance and Digital India initiatives.** (Weightage: 1) Justification: Familiarity with e-governance and Digital India initiatives may provide context but is less directly related to developing learning how to learn skills compared to other COs. Hence, it is partially related.
- **CO5: An understanding of use & applications of digital technology.** (Weightage: 3) Justification: PO8 emphasizes understanding how to practically apply digital technology in learning contexts. CO5 directly aligns with this by focusing on understanding how digital technology is used and applied, which is strongly related.
- **CO6: Basic knowledge of machine learning and big data.** (Weightage: 2) Justification: Basic knowledge of machine learning and big data can enhance adaptive learning skills in digital contexts. CO6 provides this foundational knowledge, which is moderately related to developing learning how to learn skills.
- **CO7: Knowledge about social networking.** (Weightage: 1) Justification: While knowledge about social networking can support learning and adaptation, it is less directly related to developing learning how to learn skills compared to other COs. Hence, it is partially related.

9. Justification of PO9 to ALL COs:

- **CO1: Knowledge about digital paradigm.** (Weightage: 3) Justification: PO9 focuses on developing digital and technological skills, which are directly supported by a deep understanding of the digital paradigm provided by CO1. This alignment is strong because a comprehensive knowledge of the digital paradigm forms the basis for acquiring specific digital skills.
- **CO2: Realization of importance of digital technology, digital financial tools, e-commerce.** (Weightage: 3) Justification: Understanding the importance of digital technology

and related tools is crucial for developing digital skills. CO2 directly supports this understanding, which is strongly related to acquiring digital and technological skills.

- **CO3: Know-how of communication and networks.** (Weightage: 2)

Justification: Effective communication and networking skills are essential components of digital and technological proficiency. CO3 contributes by focusing on practical skills related to communication and networks, which are moderately related to digital skills development.

- **CO4: Familiarity with the e-governance and Digital India initiatives.** (Weightage: 1)

Justification: While familiarity with e-governance and Digital India initiatives provides context, it is less directly related to developing hands-on digital and technological skills compared to other COs. Hence, it is partially related.

- **CO5: An understanding of use & applications of digital technology.** (Weightage: 3)

Justification: PO9 emphasizes understanding and applying digital technology effectively. CO5 directly aligns with this by focusing on practical applications of digital technology, which is strongly related to acquiring digital and technological skills.

- **CO6: Basic knowledge of machine learning and big data.** (Weightage: 2) Justification: Basic knowledge of machine learning and big data enhances digital skills, particularly in data-driven environments. CO6 provides this foundational knowledge, which is moderately related to developing digital and technological skills.

- **CO7: Knowledge about social networking.** (Weightage: 1) Justification: While knowledge about social networking is important in a digital context, it is less directly related to acquiring core digital and technological skills compared to other COs. Hence, it is partially related.

10. Justification of PO10 to ALL COs:

CO1: Knowledge about digital paradigm: Weightage: 1

Justification: Understanding the digital paradigm contributes indirectly to multicultural competence by exposing students to global digital trends and practices.

CO2: Realization of importance of digital technology, digital financial tools, e-commerce **Weightage: 2**

Justification: Realizing the importance of digital technology and e-commerce enhances inclusive spirit and empathy by appreciating diverse global economic interactions and financial inclusion.

CO3: Know-how of communication and networks: **Weightage: 3**

Justification: Strongly related as communication and networks are fundamental to fostering multicultural competence and empathy through global connectivity and interactions.

CO4: Familiarity with the e-governance and Digital India initiatives: Weightage: 2

Justification: Moderately related since understanding e-governance initiatives promotes inclusivity and empathetic governance, especially in diverse societies like India.

CO5: An understanding of use & applications of digital technology: Weightage: 1

Justification: Partially related as it provides a foundational understanding which indirectly supports multicultural competence through various applications.

CO6: Basic knowledge of all machine learning and big data: Weightage: 1

Justification: Partially related, as the knowledge of machine learning and big data can help in creating inclusive solutions but is not directly tied to multicultural competence.

CO7: Knowledge about social networking: Weightage: 3

Justification: Strongly related since social networking platforms are crucial for fostering multicultural interactions and empathy in a global context.

11. Justification of PO11 to ALL COs:

- **CO1: Knowledge about digital paradigm**: Weightage: 1

Justification: Partially related as understanding the digital paradigm can foster an appreciation for digital tools that support environmental awareness but is not directly tied to value inculcation.

- **CO2: Realization of importance of digital technology, digital financial tools, e-commerce**: Weightage: 2

Justification: Moderately related as realizing the importance of digital tools and e-commerce can lead to sustainable practices and financial inclusivity, promoting environmental awareness indirectly.

- **CO3: Know-how of communication and networks**: Weightage: 1

Justification: Partially related as communication and networks provide platforms for sharing information on values and environmental issues but the direct impact is limited.

- **CO4: Familiarity with the e-governance and Digital India initiatives**: Weightage: 3

Justification: Strongly related as e-governance initiatives often include policies on environmental sustainability and value inculcation, promoting these aspects at a societal level.

- **CO5: An understanding of use & applications of digital technology**: Weightage: 2

Justification: Moderately related as understanding the applications of digital technology can lead to the development of solutions that enhance environmental awareness and sustainable practices.

- **CO6: Basic knowledge of all machine learning and big data**: Weightage: 3

Justification: Strongly related since machine learning and big data can be used to analyze and address environmental issues, fostering a data-driven approach to sustainability.

- **CO7: Knowledge about social networking**: Weightage: 2

Justification: Moderately related as social networking can spread awareness about environmental issues and values but is not exclusively focused on these areas.

12. Justification of PO12 to ALL COs:

- **CO1: Knowledge about digital paradigm**: Weightage: 2

Justification: Moderately related as understanding the digital paradigm empowers individuals to independently navigate and leverage digital landscapes responsibly and accountably.

- **CO2: Realisation of importance of digital technology, digital financial tools, e-commerce:** Weightage: 3

Justification: Strongly related because realizing the significance of digital tools and e-commerce promotes responsible and accountable behavior in financial transactions and business activities, fostering autonomy in managing personal and professional digital tools.

- **CO3: Know-how of communication and networks**: Weightage: 2

Justification: Moderately related as proficiency in communication and networks supports autonomous work and responsible use of digital communication tools.

- **CO4: Familiarity with the e-governance and Digital India initiatives**: Weightage: 3

Justification: Strongly related as familiarity with e-governance initiatives requires individuals to understand and adhere to digital policies and responsibilities, enhancing accountability in digital interactions.

- **CO5: An understanding of use & applications of digital technology**: Weightage: 2

Justification: Moderately related as understanding the applications of digital technology can foster responsible use and enhance accountability in utilizing these technologies independently.

- **CO6: Basic knowledge of all machine learning and big data**: Weightage: 1

Justification: Partially related since basic knowledge of machine learning and big data contributes to responsible data management but does not directly impact autonomy and accountability significantly.