Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science & Commerce, Baramati

(Autonomous)

Three/Four Year Honours/Honours with Research B.Sc. (Computer Science) Degree

Program in Computer Science

(Faculty of Science)

CBCS Syllabus

F. Y. B.Sc. (Computer Science)

For Department of Computer Science

NEP-2.0

Choice Based Credit System Syllabus

(2024 Pattern)

(As Per NEP-2020)

To be implemented from Academic Year 2024-2025

Title of the Programme: F. Y. B.Sc. (Computer 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, and 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.

The rapid changes in science and technology and new approaches in different areas of Computer Science and related subjects, Board of Studies in Computer Science of Tuljaram Chaturchand College, Baramati - Pune has prepared the syllabus of F. Y. B.Sc. (Computer Science)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.

A degree in Computer Science subject equips students with the knowledge and skills necessary for a diverse range of fulfilling career path. Career in Computer Science is considered one of the most high-paying jobs and is full of opportunities; particularly when India's prowess in information technology industry is recognized across the globe. The pool of talented computer professionals working in IT companies of the USA, Canada and other countries shows that IT can take a person to higher levels. Numerous IT companies from India employ huge number of computer professionals in their Indian and overseas offices. Students who are interested in **programming,** software development, and have good analytical and reasoning skills may pursue this course. Job opportunities are available for Graduates and Post Graduates in Government as well as Private sector. Graduates may take up the following job posts- Software Engineer, Software Tester, and Data Analyst, Project Manager, Network Administrator, database administrator and Application Developer.

Overall, revising the Computer 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 Specific Outcomes (PSOs)
B.Sc. (Computer Science)

PSO1: Apply fundamental principles and methods of Computer Science to a wide range of applications.

PSO2: Design, correctly implement and document solutions to significant computational problems.

PSO3: Impart an understanding of the basics of our discipline.

PSO4: Prepare for continued professional development.

PSO5: Understand the impact of the IT analyst solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

PSO6: Develop proficiency in the practice of computing.

PSO7: Develop the capacity to study and research independently that will help to develop skills for transition to employment in hardware/software companies.

Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Autonomous)

Board of Studies (BOS) in Computer Science

From 2022-23 to 2024-25

Sr. No.	Name	Designation
1.	Dr. Upendra Choudhari	Chairman
2.	Dr. Vilas Kardile	Member
3.	Mr. Abhijeet Mankar	Member
4.	Mr. Vishal Shaha	Member
5.	Mrs. Prajakta Kulkarni	Member
6.	Mr. Rahul Shah	Member
7.	Mrs. Asmita Bhagat	Member
8.	Dr. Shashikant Nakate	Member
9.	Mr. Purushottam Dixit	Member
10.	Mr. Swapnil Chemte	Member
11.	Mrs. Kalyani Londhe	Member
12.	Mrs. Poornima Gavimath	Member
13	Dr. Kavita A. Khobragade	Vice-Chancellor Nominee
14	Dr. Sudhakar Bhoite	Expert from other University
15	Dr. Suhas S. Satonkar	Expert from other University
16	Mr. Rohit Shah	Industry Expert
17	Mr. Yogesh More	Meritorious Alumni
18	Mr. Abhijeet Chopade	Student Representative
19	Miss. Rutuja Harihar	Student Representative
20	Mr. Akshada Kulkarni	Student Representative
21	Mr. Prajwal Nimbalkar	Student Representative

Course and Credit Distribution Structure for B.Sc. (Computer Science) -2024-2025

Level	Semester	Sub. DSC-I Languages	Sub. DSC-II Social Science-I	Sub. DSC-III Social Science-II	OE	SEC	IKS	AEC	VEC	CC	Degree/Cum.Cr.
4.5	I	2 T + 2 P	2 T + 2 P	2 T + 2 P	2 T (from other faculty)	2 P	2 T (Generic)	2 T (C. Eng.)	2 T	--	22
	I	2 T + 2 P	2 T + 2 P	2 T + 2 P	2 P (from other faculty)	2 P	--	2 T (C. Eng.)	2 T	2 T YOG/PES/ CUL/NSS/ NCC	22
										Total Credits	44

*** 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** *** CC = Cocurricular Courses**

NEP-2.0 Course Structure for F. Y. B.Sc. (Computer Science) (2024 Pattern)

Sem	Course Type	Course Code	Course Title	Theory / Practical	Credits
I	DSC-I (General)	-101-GEN	-------	Theory	02
		-102-GEN	-------	Practical	02
	DSC-II (General)	-101-GEN	-------	Theory	02
		-102-GEN	-------	Practical	02
	DSC-III(General)	COS-101-GEN	Basic C Programming	Theory	02
		COS-102-GEN	Computer Science Practical – I	Practical	02
	Open Elective (OE)	COS-103-OE	Internet Awareness	Theory	02
	Skill Enhancement Course (SEC)	COS-104-SEC	DBMS Using PostgreSQL	Practical	02
	Ability Enhancement Course (AEC)	ENG-104-AEC	-----	Theory	02
	Value Education Course (VEC)	ENV-105-VEC	Environmental science	Theory	02
	Generic Indian Knowledge System (GIKS)	GEN-106-IKS	------	Theory	02
				Total Credits	**22**
II	DSC-I (General)	-151-GEN	------	Theory	02
		-152-GEN	------	Practical	02
	DSC-II (General)	-151-GEN	------	Theory	02
		-152-GEN	------	Practical	02
	DSC-III (General)	COS-151-GEN	Advanced C Programming	Theory	02
		COS-152-GEN	Computer Science Practical – II	Practical	02
	Open Elective (OE)	COS-153-OE	Introduction to MS-Office	Practical	02
	Skill Enhancement Course (SEC)	COS-154-SEC	RDBMS Using PostgreSQL	Practical	02
	Ability Enhancement Course (AEC)	ENG-154-AEC	----	Theory	02
	Value Education Course (VEC)	COS-155-VEC	Digital & Technological solutions	Theory	02
	CC	YOG/PES/CUL/NSS/NCC-156-CC	To be selected from the CC Basket	Theory	02
				Total Credits	**22**
				Grand Total Semester- I + Semester- II	**44**

F.Y.B.Sc. (Computer Science)

Semester – I

Syllabus

(NEP - 2024 Pattern)

w.e.f. A.Y.2024-25

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

Name of the Program : B.Sc. Computer Science
Program Code : USCOS
Class : F. Y. B.Sc. (Computer Science)
Semester : I
Course Type : DSC-III (General)
Course Name : Basic C Programming (TH)
Course Code : COS-101-GEN
No. of Lectures : 30
No. of Credits : 02

A) Course Objectives

1 .Introduce students to the C programming language
2. Develop problem-solving skills
3. Learn how to write and execute C programs
4. Understand the basic syntax and structure of C
5. Master the use of functions and modular programming
6. Gain proficiency in working with arrays and strings
7. Introduce file handling and basic I/O operation

B) Course Outcomes:

CO1- Understand the fundamentals of C programming language.
CO2- Develop problem-solving skills
CO3-Gain proficiency in C programming syntax and semantics
CO4- Gain a foundation for advanced programming concepts.
CO5- Apply C programming concepts to real-world problems.
CO6- Improve code efficiency and optimization.
CO7- Develop debugging and error handling skills

UNIT	TOPICS/CONTENT	No. of Lectures
UNIT -I	**Problem solving skills** 1.1 Problem solving using a computer. 1.2 Algorithms & flowcharts 1.3 Programming tools 1.4 Structure of a C program 1.5 C program development cycle 1.6 Programming Languages	**4**
UNIT-II	**C Tokens** 2.1 Keywords 2.2 Identifiers 2.3 Variables 2.4 Constants–character, integer, float, string, escape sequences 2.5 Data types–built-in and user defined 2.6 Operators and Expressions	**4**

UNIT-III	**Control structures** 3.1 Decision making structures if, if-else, switch-case 3.2 Loop Control structures While, do-while, for 3.3 Jumping Statements break, continue and go to statement 3.4 Nested control structures	**8**
UNIT – IV	**Functions in C** 4.1 What is a function 4.2 Advantages of Functions 4.3 Standard library functions 4.4 User defined functions :Declaration, definition, function call, parameter passing (by value), return keyword 4.5 Scope of variables, storage classes 4.6 Recursion	**8**
UNIT – V	**Arrays** 5.1 Array Concept 5.2 Types – one, two and multidimensional 5.3 Array Operations – declaration, Initialization, accessing array elements 5.4 Passing arrays to functions 5.5 Array Applications	**6**

Book References:

1. YashavantKanetkar:LetUsC 7thEdition,PBPPublications
2. E Balaguruswamy : Programming in ANSI C 7th Edition, Tata Mc-Graw HillPublishingCo.Ltd.-NewDelhi
3. BrianW. KernighanandDennisM. Ritchie:TheCProgrammingLanguage2nd Edition, PrenticeHallPublication
4. HerbertSchildt,TheCompleteReferencetoC
5. Harrow,ProblemSolvingwithC

Web References:

1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.w3schools.com/c/index.php
3. https://www.guru99.com/c-programming-tutorial.html
4. https://www.geeksforgeeks.org/c-programming-language/
5. https://nptel.ac.in/courses

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

CO7	2	3	2	3	3	2	2	3	3	2	1	3	1

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

1. Justification of PO1 to ALL COs :

CO1:PO1-Understanding the digital paradigm provides foundational context for designing computational solutions that leverage digital technologies effectively.

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

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

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

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

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

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

2. Justification of PO2 to ALL COs :

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

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

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

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

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

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

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

3. Justification of PO3 to ALL COs:

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

CO2:PO3-Problem-solving skills are crucial for identifying opportunities and fostering innovation, key in entrepreneurship.
CO3:PO3-Proficiency in programming supports innovation, aiding entrepreneurial activities.
CO4:PO3-Advanced programming concepts enhance innovation, contributing to entrepreneurial ventures.
CO5:PO3-Applying programming to real-world problems is tied to innovation and business opportunities, essential for entrepreneurship.
CO6:PO3-Efficient and optimized code can lead to competitive products, aiding entrepreneurial success.
CO7:PO3-Debugging and error handling ensure robust solutions, valuable in entrepreneurial ventures.

4. Justification of PO4 to ALL COs:

CO1:PO4-Fundamentals of C programming build the foundational technical skills necessary for specialized competencies.
CO2:PO4-Problem-solving is critical for analytical abilities and adaptability, essential for specialized skills.
CO3:PO4-Proficiency in programming syntax and semantics is a fundamental technical skill required for specialized competencies.
CO4:PO4-Advanced programming concepts enhance technical skills and analytical abilities, key for specialized competencies.
CO5:PO4-Applying programming to real-world problems involves technical skills and problem-solving, aligning with specialized competencies.
CO6:PO4-Code efficiency and optimization demonstrate analytical abilities and innovation, crucial for specialized skills.
CO7:PO4-Debugging and error handling require problem-solving and analytical abilities, contributing to specialized competencies.

5. Justification of PO5 to ALL COs :

CO1:PO5-Fundamentals of C programming are crucial for basic application and problem-solving, but they form the starting point.
CO2:PO5-Problem-solving skills are essential for tackling complex problems and applying analytical reasoning effectively.
CO3:PO5-Proficiency in C programming syntax and semantics is crucial for accurate application and effective problem-solving.
CO4:PO5-Advanced programming concepts enhance analytical reasoning and the ability to solve complex problems creatively.
CO5:PO5-Applying programming to real-world problems is key for practical application, critical thinking, and adaptability.
CO6:PO5-Code efficiency and optimization are vital for solving complex problems effectively and enhancing analytical reasoning.
CO7:PO5-Debugging and error handling are critical for solving problems and require strong analytical reasoning and adaptability.

6. Justification of PO6 to ALL COs:

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

CO2:PO6-Problem-solving often requires teamwork and effective communication to address challenges.
CO3:PO6-Proficiency in programming syntax and semantics is essential for technical tasks, with limited impact on communication and collaboration.
CO4:PO6-Advanced programming concepts are important for technical competence but not directly related to communication or collaboration.
CO5:PO6-Applying programming concepts to real-world problems involve teamwork and effective communication of solutions.
CO6:PO6-Improving code efficiency is a technical skill that may involve some communication but is not primarily focused on collaboration.
CO7:PO6-Debugging and error handling involve communicating with team members to resolve issues, enhancing communication and collaboration.

7. Justification of PO7 to ALL COs:

CO1:PO7-Fundamentals of C programming provide a base but only indirectly support research-related skills.
CO2:PO7-Problem-solving is critical for formulating research questions, designing methodologies, and analyzing data.
CO3:PO7-Proficiency in syntax and semantics supports writing code for research activities, indirectly aiding research skills.
CO4:PO7-Advanced programming concepts aid in developing methodologies for research but vary in direct impact on research skills.
CO5:PO7-Applying programming concepts to real-world problems is essential for conducting practical research.
CO6:PO7-Code efficiency and optimization are important for handling large datasets and analyses in research.
CO7:PO7-Debugging and error handling ensure the accuracy and reliability of research findings, supporting research skills.

8. Justification of PO8 to ALL COs:

CO1:PO8-Fundamentals of C programming provide base knowledge necessary for self-directed learning and adapting to new concepts.
CO2:PO8-Problem-solving skills are essential for self-directed learning, adapting to challenges, and independently achieving goals.
CO3:PO8-Proficiency in syntax and semantics provides a foundation for independent learning of advanced topics.
CO4:PO8-Advanced programming concepts encourage continuous learning and adaptation to new technologies.
CO5:PO8-Applying programming concepts to real-world problems promote practical, self-directed learning and goal achievement.
CO6:PO8-Improving code efficiency and optimization involves ongoing learning and adaptation to best practices.
CO7:PO8-Debugging and error handling are crucial for independent problem-solving and learning from mistakes.

9. Justification of PO9 to ALL COs:

CO1:PO9-Fundamentals of C programming provide a base for developing digital and technological skills needed for ICT proficiency.
CO2:PO9-Problem-solving skills are crucial for effectively using ICT tools and software, enabling efficient data analysis.
CO3:PO9-Proficiency in programming syntax and semantics is directly related to using and understanding software development tools.
CO4:PO9-Advanced programming concepts are essential for mastering digital and technological skills, enabling software development.
CO5:PO9-Applying programming concepts to real-world problems show practical use of ICT tools in solving issues and data analysis.
CO6:PO9-Code efficiency and optimization are vital for developing robust software, enhancing technological proficiency.
CO7:PO9-Debugging and error handling are essential for effective software use and development, contributing to technological proficiency.

10. Justification of PO10 to ALL COs:

CO1:PO10-Understanding the fundamentals of C programming are primarily a technical skill and have limited direct impact on multicultural competence and empathy.
CO2:PO10-Problem-solving skills can be enhanced through collaboration in diverse teams, fostering an inclusive spirit and understanding different perspectives.
CO3:PO10-Proficiency in programming syntax and semantics is technical and has limited direct relevance to multicultural competence.
CO4:PO10-Advanced programming concepts are important for technical expertise but do not directly contribute to multicultural competence.
CO5:PO10-Applying programming concepts to real-world problems often involve working in diverse teams, enhancing multicultural competence.
CO6:PO10-Improving code efficiency and optimization is technical with limited direct impact on multicultural competence.
CO7:PO10-Debugging and error handling require collaboration and communication with diverse team members, fostering inclusivity.

11. Justification of PO11 to ALL COs:

CO1:PO11-Fundamentals of C programming are technical skills with limited direct impact on value inculcation or environmental awareness.
CO2:PO11-Problem-solving skills can be applied to ethical and environmental issues, promoting responsible citizenship and sustainability.
CO3:PO11-Proficiency in programming syntax and semantics is technical and does not directly relate to values or environmental awareness.
CO4:PO11-Advanced programming concepts are important for technical expertise but do not inherently promote values or environmental awareness.
CO5:PO11-Applying programming concepts to real-world problems can involve creating solutions that address ethical issues and promote sustainability.
CO6:PO11-Improving code efficiency and optimization can lead to sustainable computing practices, reducing resource consumption and environmental impact.
CO7:PO11-Debugging and error handling are technical skills with limited direct impact on promoting values or environmental awareness.

12. Justification of PO12 to ALL COs:

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

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

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

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

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

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

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

13. Justification of PO13 to ALL COs:

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

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

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

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

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

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

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

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

Name of the Program	: B.Sc. Computer Science
Program Code	: USCOS
Class	: F. Y. B.Sc. (Computer Science)
Semester	: I
Course Type	: DSC-III (General)
Course Name	: Computer science Practical-I (PR)
Course Code	: COS-102-GEN
No. of Practical's	: 15(60 Hours)
No. of Credits	: 02

A) Course Objectives:

1. To understand and design algorithm for problem solving
2. To develop Problem Solving abilities using computers
3. To develop skills for writing programs using 'C'
4. Master C Syntax and Semantics
5. Explore Algorithmic Approaches
6. Acquire Debugging Skills
7. Develop Modular Programs

B) Course Outcomes:

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

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

	defined functions)
8	Assignment to demonstrate recursive functions.
9	Assignment to demonstrate use of arrays (1-d arrays) and functions
10	Assignment to demonstrate use of arrays (2-d arrays) and functions

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 are 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 enable 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 endeavours.
CO4:PO3-Debugging and error handling skills, while important, have less direct impact on entrepreneurial mindset and knowledge.
CO5:PO3-Understanding programming fundamentals indirectly support entrepreneurial activities by enabling effective technical communication.
CO6:PO3-Developing problem-solving skills are 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 support effective communication and technical skills relevant to the field.
CO6:PO4-Developing problem-solving skills directly contribute 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 demonstrate 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 enhance 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 foster 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 facilitate algorithm implementation and analysis relevant to research tasks.
CO6:PO7-Developing problem-solving skills support 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 support independent learning of new programming languages and concepts.
CO6:PO8-Developing problem-solving skills enable 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 support 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 involve 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 require 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.Sc. (Computer Science) (2024 Pattern)

Name of the Programme	: B.Sc. Computer Science
Program Code	: USCOS
Class	: B.A/ B.com
Semester	: I
Course Type	: OE
Course Name	: Internet Awareness (TH)
Course Code	: COS-103-OE
No. of Lectures	: 30
No. of Credits	: 2

Course Objectives:

1. Understand the fundamental concepts and history of the Internet, including its infrastructure, protocols, and governance.
2. Identify and explain the various components of Internet infrastructure, such as ISPs, data centers, and content delivery networks.
3. Demonstrate knowledge of essential web technologies, including HTTP, HTML, and web development basics.
4. Explore and analyze different forms of online communication, such as email, instant messaging, social media, and online communities.
5. Recognize and address online safety and security threats.
6. Develop a sense of digital citizenship and ethical responsibility in online environments.
7. Cultivate information literacy skills and critical thinking abilities for evaluating online sources, recognizing biases, and identifying misinformation.
8. Examine the social, cultural, and political implications of the Internet, including topics such as the digital divide, online commerce, censorship, and freedom of speech.
9. Explore emerging trends and technologies shaping the future of the Internet, including the Internet of Things,

Course Outcomes:

CO1: Explain the historical development and key concepts of the Internet, including its Infrastructure, protocols, and governance.

CO2: Identify and describe the components of Internet infrastructure, such as ISPs, data centres, and content delivery networks.

CO3: Apply web technologies, including HTML, HTTP, and basic web development principles, to create and navigate web content.

CO4: Communicate effectively using various online communication tools, such as email, instant messaging, and social media platforms.

CO5: Evaluate and implement strategies to enhance online safety and security, Including recognizing and mitigating common online threats.

CO6: Demonstrate ethical behaviour and responsible digital citizenship in online interactions.

CO7: Analyse the social, cultural, and political implications of the Internet, including Its impact on access, commerce, censorship, and freedom of speech.

UNIT	CONTENT	No. of Lectures
UNIT I	**Introduction to the Internet** 1.1 Definition and evolution of the Internet. 1.2 Key concepts: networks, protocols, IP addresses, domain names 1.3Internet governance and organizations	**4**
UNIT-II	**Internet Infrastructure** 2.1 Internet Service Providers (ISPs) 2.2Wired and wireless technologies (e.g. fibre optics, Wi-Fi, cellular, networks) 2.3Data centres and cloud computing	**5**
UNIT-III	**Web Technologies** 3.1 Hypertext Transfer Protocol (HTTP) and Hypertext Markup Language (HTML) 3.2Web browsers and search engines 3.3Web standards and accessibility	**5**
UNIT – IV	**Online Communication** 4.1 Email and instant messaging 4.2Voice over IP (VoIP) and video conferencing 4.3Social media platforms and their impact 4.4Online communities and forums	**5**
UNIT – V	**Online Safety and Security** 5.1 Password security and two-factor authentication 5.2 Protecting personal information online 5.3Cyberbullying and online harassment	**5**
UNIT – VI	**Emerging Trends and Future of the Internet** **6.1** Internet of Things (IoT) 6.2 Artificial intelligence and machine learning 6.3 Virtual reality (VR) and augmented reality (AR)	**5**

CO and PO Mapping Internet Awareness

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

Justifications:

PO1 with all Cos:
CO1 (3): Explains historical development and key concepts of the Internet, providing a strong foundation for understanding the Internet.
CO2 (3): Identifies and describes components of Internet infrastructure, critical for a comprehensive understanding of Internet operations.
CO3 (2): Applies web technologies to create web content, offering practical knowledge which moderately contributes to a comprehensive understanding.
CO4 (1): Involves communication tools, offering partial relevance to a broad understanding of the Internet.
CO5 (2): Focuses on online safety and security, providing essential knowledge for secure Internet usage, moderately contributing to comprehensive understanding.
CO6 (1): Covers ethical behaviour and responsible digital citizenship, which is partially relevant to a comprehensive understanding of the Internet.
CO7 (2): Analyzes social, cultural, and political implications, providing moderate insight into the broader impact of the Internet.

PO2 with all Cos:
CO1: Explains historical development and key concepts of the Internet, providing foundational theoretical knowledge which moderately supports professional understanding.
CO2: Identifies and describes components of Internet infrastructure, essential for practical and professional application in Internet-related fields.
CO3: Applies web technologies to create web content, crucial for hands-on experience and practical skills in web development.
CO4: Involves communication tools, which are vital for effective professional communication in various online platforms.
CO5: Focuses on strategies for online safety and security, directly applicable to professional practices and procedures.
CO6: Covers ethical behaviour and responsible digital citizenship, supporting professional conduct and practices.
CO7: Analyzes social, cultural, and political implications, providing contextual knowledge that is important for professional understanding of the broader impact of the Internet.

PO3 with all Cos:
CO1: Explains the Internet's historical development and key concepts, providing foundational knowledge useful for identifying entrepreneurial opportunities.

CO2: Identifies components of Internet infrastructure, aiding in the recognition of potential business opportunities within tech infrastructure.
CO3: Applies web technologies to create and navigate web content, crucial for developing and managing web-based entrepreneurial ventures.
CO4: Involves effective online communication tools, essential for marketing, networking, and customer engagement in entrepreneurship.
CO5: Focuses on online safety and security strategies, important for building trust and maintaining integrity in entrepreneurial activities.
CO6: Covers ethical behaviour and responsible digital citizenship, supporting sustainable and responsible entrepreneurial practices.
CO7: Analyzes broader implications of the Internet, providing entrepreneurs with insights to navigate the social, cultural, and political landscape.

PO4 with all Cos:
CO1: Explains the Internet's historical development and key concepts, providing foundational knowledge which moderately supports specialized competencies.
CO2: Identifies components of Internet infrastructure, essential for developing specialized technical skills required in networking and data management.
CO3: Applies web technologies to create and navigate web content, crucial for acquiring specialized skills in web development.
CO4: Involves effective communication using online tools, important for professional roles that require specialized communication skills.
CO5: Focuses on online safety and security strategies, critical for specialized competencies in cyber security.
CO6: Covers ethical behaviour and responsible digital citizenship, partially relevant to maintaining professional standards in specialized fields.
CO7: Analyzes broader implications of the Internet, providing contextual knowledge which moderately supports specialized roles.

PO5 with all Cos:
CO1: Explains the Internet's historical development and key concepts, providing foundational knowledge that supports analytical reasoning.
CO2: Identifies and describes components of Internet infrastructure, essential for applying knowledge and solving technical problems related to network architecture.
CO3: Applies web technologies to create and navigate web content, involving hands-on problem-solving and analytical reasoning in web development.
CO4: Involves effective communication using online tools, moderately important for collaborative problem-solving.
CO5: Focuses on online safety and security strategies, involving critical problem-solving and analytical reasoning to mitigate threats.
CO6: Covers ethical behaviour and responsible digital citizenship, which is moderately relevant to solving problems in social contexts.
CO7: Analyzes broader implications of the Internet, requiring strong analytical reasoning to understand and address complex issues.

PO6 with all Cos:
CO1: Explains the Internet's historical development and key concepts, providing foundational knowledge which moderately supports effective communication about its concepts.
CO2: Identifies and describes components of Internet infrastructure, aiding in understanding and effectively communicating technical aspects related to networks.

CO3: Applies web technologies for content creation, partially related to collaborative efforts in digital environments.
CO4: Involves effective communication using online tools, crucial for developing strong communication skills required for collaboration.
CO5: Focuses on online safety and security strategies, involving communication and collaboration to implement effective mitigation measures.
CO6: Covers ethical behaviour and responsible digital citizenship, supporting constructive online collaboration and communication.
CO7: Analyzes broader implications of the Internet, partially related to communicating and collaborating in diverse social, cultural, and political contexts.

PO7 with all Cos:
CO1: Explains the Internet's historical development and key concepts, crucial for conducting comprehensive research on Internet evolution.
CO2: Identifies and describes components of Internet infrastructure, providing foundational knowledge for researching network architecture and operations.
CO3: Applies web technologies for creating and navigating web content, moderately related to researching web development trends and technologies.
CO4: Involves effective communication using online tools, necessary for collaborative research efforts.
CO5: Focuses on evaluating online safety and security strategies, involving research into cyber security threats and mitigation measures.
CO6: Covers ethical behaviour and responsible digital citizenship, partially relevant to ethical considerations in conducting research.
CO7: Analyzes social, cultural, and political implications of the Internet, providing critical insights for conducting research in these areas.

PO8 with all Cos:
CO1: Explains the Internet's historical development and key concepts, providing foundational knowledge which moderately supports ongoing learning about its evolution.
CO2: Identifies and describes components of Internet infrastructure, aiding in understanding foundational concepts necessary for continuous learning in this field.
CO3: Applies web technologies for creating and navigating web content, involving hands-on learning and skill development in web development.
CO4: Involves effective communication using online tools, crucial for collaborative learning and ongoing skill development.
CO5: Focuses on evaluating online safety and security strategies, involving continuous learning and adaptation to mitigate emerging threats.
CO6: Covers ethical behaviour and responsible digital citizenship, supporting ongoing learning and professional development.
CO7: Analyzes social, cultural, and political implications of the Internet, requiring continuous learning to understand and navigate complex issues.

PO9 with all Cos:
CO1: Explains the historical development and key concepts of the Internet, foundational for developing comprehensive digital and technological skills.
CO2: Identifies and describes components of Internet infrastructure, directly enhancing knowledge and skills in digital and technological domains.
CO3: Applies web technologies like HTML and HTTP, directly enhancing practical skills crucial for digital content creation and navigation.

CO4: Involves effective communication using online tools, important for utilizing digital platforms and enhancing digital communication skills.
CO5: Focuses on evaluating online safety and security strategies, enhancing practical knowledge in digital security implementation.
CO6: Covers ethical behaviour and responsible digital citizenship, supporting ethical considerations in the use of digital technologies.
CO7: Analyzes social, cultural, and political implications of the Internet, requiring understanding of digital impacts on broader societal issues.

PO10 with all Cos:
CO1: Explains the historical development and key concepts of the Internet, providing foundational knowledge relevant to understanding diverse perspectives on its evolution.
CO2: Identifies components of Internet infrastructure, contributing partially to understanding technological diversity but less directly impacting multicultural competence.
CO3: Applies web technologies, partially related to fostering inclusive web design practices that accommodate diverse users.
CO4: Involves effective communication using online tools, crucial for fostering empathy and understanding in diverse digital interactions.
CO5: Focuses on evaluating online safety and security strategies, partially related to promoting safe and inclusive digital environments.
CO6: Covers ethical behaviour and responsible digital citizenship, directly fostering empathy and inclusivity in online interactions.
CO7: Analyzes social, cultural, and political implications of the Internet, crucial for understanding and navigating cultural and political diversity in digital spaces.

PO11 with all Cos:
CO1: Explains the historical development and key concepts of the Internet, providing foundational knowledge relevant to understanding its environmental impact and sustainability efforts.
CO2: Identifies components of Internet infrastructure, contributing partially to understanding environmental considerations in data center operations and digital infrastructure.
CO3: Applies web technologies, partially related to promoting sustainable practices in web development and digital content creation.
CO4: Involves effective communication using online tools, important for advocating environmental awareness and promoting values related to sustainability.
CO5: Focuses on evaluating online safety and security strategies, partially related to promoting safe and sustainable practices in digital environments.
CO6: Covers ethical behaviour and responsible digital citizenship, directly contributing to fostering environmental awareness and values in online interactions.
CO7: Analyzes social, cultural, and political implications of the Internet, crucial for understanding and advocating for environmental values in digital contexts.

PO12 with all Cos:
CO1: Explains the historical development and key concepts of the Internet, providing foundational knowledge essential for understanding autonomy and responsibility in digital contexts.
CO2: Identifies components of Internet infrastructure, directly contributing to understanding roles and responsibilities in managing digital resources and networks.
CO3: Applies web technologies, involving practical skill development in creating and managing web content, moderately related to autonomy.

CO4: Involves effective communication using online tools, crucial for demonstrating responsibility and accountability in digital interactions.
CO5: Focuses on evaluating online safety strategies, moderately related to responsible management of digital security and privacy.
CO6: Covers ethical behaviour and responsible digital citizenship, directly contributing to accountability and autonomy in online interactions.
CO7: Analyzes social, cultural, and political implications of the Internet, moderately related to understanding accountability in digital policy and governance.

PO13 with all Cos:
CO1: Explains the historical development and key concepts of the Internet, providing foundational knowledge relevant to understanding its role in fostering community engagement and service.
CO2: Identifies components of Internet infrastructure, moderately related to understanding how digital connectivity supports community engagement.
CO3: Applies web technologies for content creation, partially supporting community outreach and engagement efforts online.
CO4: Involves effective communication using online tools, crucial for facilitating community engagement and service delivery through digital platforms.
CO5: Focuses on evaluating online safety strategies, ensuring safe and secure community interactions online.
CO6: Covers ethical behaviour and responsible digital citizenship, directly contributing to positive community interactions and service through ethical online practices.
CO7: Analyzes social, cultural, and political implications of the Internet, moderately related to understanding its role in facilitating community engagement and service initiatives.

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. (Computer Science)
Semester	: I
Course Type	: SEC
Course Name	: DBMS Using PostgreSQL (PR)
Course Code	: COS-104-SEC
No. of Practical's	: 15 (60 Hours)
No. of Credits	: 02

A) Course Objectives:

1. Understand creation, manipulation and querying of data in databases.
2. Understand the set operation.
3. Understand the SQL commands.
4. Understand the Primary key constraint & Foreign Key constraint.
5. Understand design and implementation of a database system.
6. Study physical, logical database designs and database modelling.
7. Understanding and development of essential DBMS concepts.

B) Course Outcomes:

CO1. Gain knowledge about query execution and its performance.
CO2. Demonstrate the basic elements of a relational database management system.
CO3. Gain a foundation for database management system concepts
CO4. Gain Knowledge about Aggregate Operation.
CO5. Master the basics of database concepts and database management system.
CO6. Model an application's data requirements using conceptual modelling tools Like ER & relational model.
CO7. Write SQL commands to create tables, insert, update, delete and query data.

	Title of Experiment/ Practical
1	Create simple tables, with only the primary key Constraint
2	Create more than one table with integrity constraint.
3	Create more than one table, with referential integrity constraint.
4	Drop a table from database, Alter the table.
5	Insert statements.
6	Update statements.
7	Delete statements.
8	Query for the tables using simple form of Select Statement
9	Query solving for table operations (Aggregate function)
10	Nested Query solving for table operations (Union)
11	Nested Query solving for table operations (Intersect)
12	Nested Query solving for table operations (Except)
13	Nested Query solving for table operations (Set membership, Cardinality)
14	Nested Query solving for table operations (Set Comparison)
15	Small Case Studies.

Mapping of this course outcomes with Programme outcomes

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

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- Knowing syntax enables autonomy in writing database logic independently.

CO2:PO1- Understanding RDBMS elements supports responsibility in data management tasks.

CO3:PO1- Understanding SQL & PL/pgSQL techniques fosters responsibility in database querying and management.

CO4:PO1- Analyzing PL/SQL structures requires accountability for ensuring efficient database operations.

CO5:PO1- Mastering database concepts enhances autonomy in managing database systems.

CO6:PO1- Applying advanced SQL features like views demonstrates responsibility in optimizing database performance.

CO7:PO1- Writing SQL commands reflects accountability in data manipulation and retrieval tasks.

2. Justification of PO2 to ALL COs:

CO1:PO2- Knowledge of query execution and performance is crucial for practical database management.

CO2:PO2- Demonstrating basic elements of an RDBMS is essential for practical application in database management.

CO3:PO2- Gaining a foundation in DBMS concepts is necessary for practical understanding and application.

CO4:PO2- Knowledge of aggregate operations is important but slightly less directly related to practical procedures compared to other COs.

CO5:PO2- Mastering basics of database concepts and DBMS is essential for practical proficiency in database management.

CO6:PO2-Modeling data requirements using ER and relational models supports practical application but is more specific.

CO7:PO2-Writing SQL commands for data manipulation and querying is directly related to practical database management skills.

3. Justification of PO3 to ALL COs:

CO1:PO3- Understanding query execution and performance can support entrepreneurial decisions but is not directly entrepreneurial in nature.

CO2:PO3- Demonstrating RDBMS elements is foundational but does not directly correlate with entrepreneurial mindset.

CO3:PO3- Gaining a foundation in DBMS concepts provides technical background but does not directly relate to entrepreneurial mindset.

CO4:PO3- Knowledge of aggregate operations is less directly related to entrepreneurial mindset compared to other COs.

CO5:PO3- Mastering database concepts supports technical proficiency rather than entrepreneurial mindset directly.

CO6:PO3- Modelling data requirements is useful for application development but not directly entrepreneurial.

CO7:PO3-Writing SQL commands are fundamental but not directly related to entrepreneurial mindset.

4. Justification of PO4 to ALL COs:

CO1:PO4- Knowledge of query execution and performance is crucial for specialized database optimization and tuning.

CO2:PO4- Demonstrating RDBMS elements is fundamental for specialized database management tasks.

CO3:PO4- Gaining a foundation in DBMS concepts is essential for specialized database management roles.

CO4:PO4- Knowledge of aggregate operations is crucial for specialized data analysis and reporting tasks.

CO5:PO4- Mastering database concepts is essential for specialized database design and optimization.

CO6:PO4- Modelling data requirements using conceptual modelling tools are crucial for specialized database design and architecture.

CO7:PO4- Writing SQL commands proficiently is essential for specialized database development and maintenance tasks.

5. Justification of PO5 to ALL COs:

CO1:PO5- Knowledge about query execution and performance is essential for solving complex database performance issues.

CO2:PO5- Understanding RDBMS elements is crucial for applying database solutions and solving database-related problems.

CO3:PO5- A strong foundation in DBMS concepts enables effective problem-solving and analytical reasoning in database management.

CO4:PO5- Knowledge about aggregate operations is vital for analyzing and solving data-related queries and problems.

CO5:PO5- Mastering database concepts is essential for applying solutions to various database management problems.

CO6:PO5-Modeling data requirements using conceptual tools aids in problem-solving and designing effective database solutions.

CO7:PO5- Writing SQL commands is critical for applying database solutions and solving data manipulation problems.

6. Justification of PO6 to ALL COs:

CO1:PO6- Justification: Understanding query execution and performance is a technical skill that has limited direct impact on communication and collaboration.

CO2:PO6- Demonstrating basic elements are primarily a technical task, with minimal influence on communication and collaboration.

CO3:PO6- Gaining foundational knowledge is essential for communication within technical teams but has limited direct impact on broader collaboration skills.

CO4:PO6- Knowledge about aggregate operations is a technical detail that does not directly enhance communication or collaboration skills.

CO5:PO6- Mastering basic database concepts is primarily a technical competency with limited direct relation to communication and collaboration.

CO6:PO6- Modelling data requirements often involves teamwork and collaboration, as it requires understanding and integrating input from various stakeholders.

CO7:PO6- Writing SQL commands is a technical skill, but collaborating on database operations and ensuring data integrity often requires communication within a team.

7. Justification of PO7 to ALL COs:

CO1:PO7- Understanding query execution and performance involves analyzing and optimizing queries, which are key research-related skills in database management.

CO2:PO7- Demonstrating basic elements are foundational knowledge that supports research but is not directly research-focused.
CO3:PO7- A foundational understanding is essential for conducting research but does not directly involve research activities.
CO4:PO7- Understanding aggregate operations can lead to researching more efficient data processing techniques and applications.
CO5:PO7- Mastery of database concepts is crucial for conducting research in database systems, though it is not the sole focus of research activities.
CO6:PO7- Modelling data requirements involves investigative and analytical skills, which are essential for research in database design and optimization.
CO7:PO7- Writing SQL commands is a technical skill that supports research but is not directly involved in research methodology.

8. Justification of PO8 to ALL COs:

CO1:PO8- Understanding query execution and performance necessitates continuous learning and adaptation to new techniques, fostering a robust ability to learn independently.
CO2:PO8-Demonstrating basic elements involve foundational learning skills, which support the ability to learn and grasp more advanced topics independently.
CO3:PO8- Building a strong foundation in DBMS concepts is critical for ongoing learning, enabling students to comprehend more complex aspects of database management as they advance.
CO4:PO8- Learning about aggregate operations helps develop analytical skills, which are crucial for understanding and applying more advanced database functions.
CO5:PO8- Mastering the basics is key to lifelong learning, as it provides the foundational knowledge necessary to explore advanced topics and stay updated with new developments in the field.
CO6:PO8-Using conceptual modelling tools involve learning new methods and approaches, promoting the ability to learn and apply novel techniques and methodologies.
CO7:PO8- Writing SQL commands involves learning specific syntax and commands, supporting the development of skills to learn new programming languages and database management tools.

9. Justification of PO9 to ALL COs:

CO1:PO9- Understanding query execution and performance directly involves technological skills related to optimizing database operations and enhancing system performance.
CO2:PO9- Demonstrating the basic elements of an RDBMS requires a solid grasp of digital and technological concepts essential for managing and operating database systems.
CO3:PO9- Gaining foundational knowledge in DBMS concepts is fundamental to developing digital and technological skills necessary for effective database management.
CO4:PO9- Learning about aggregate operations involves using specific functions and techniques that enhance technological skills in data manipulation and analysis.
CO5:PO9- Mastering the basics of database concepts is crucial for acquiring digital and technological skills needed for efficient database management and operations.
CO6:PO9- Using conceptual modelling tools involve applying technological skills to design and represent data structures and relationships effectively.

CO7:PO9- Writing SQL commands requires a strong command of digital and technological skills to manipulate and manage data within a database system.

10. Justification of PO10 to ALL COs:

CO1:PO10- Understanding query execution and performance has limited direct influence on developing multicultural competence, but the inclusive spirit can be indirectly nurtured through collaborative and diverse team efforts in database optimization projects.

CO2:PO10- Demonstrating basic elements of an RDBMS primarily enhance technical skills, with a minor connection to multicultural competence through collaborative learning and teamwork.

CO3:PO10- Gaining foundational DBMS concepts is predominantly technical but can contribute to multicultural competence by fostering teamwork in diverse groups.

CO4:PO10- Knowledge of aggregate operations is technical, with partial relevance to multicultural competence through shared learning experiences and inclusive group work.

CO5:PO10- Mastering basic database concepts is primarily technical but can involve multicultural competence in collaborative and inclusive educational settings.

CO6:PO10- Modelling data requirements using conceptual tools can enhance multicultural competence by promoting inclusive teamwork and understanding diverse perspectives in data representation.

CO7:PO10- Writing SQL commands is mainly a technical skill, with some partial relevance to multicultural competence through inclusive practices and collaboration in diverse teams.

11. Justification of PO11 to ALL COs:

CO1:PO11- Understanding query execution and performance mainly involves technical skills, but partially relates to value inculcation through fostering accuracy and efficiency.

CO2:PO11- Demonstrating the basic elements of an RDBMS has limited direct impact on value inculcation and environmental awareness but can foster an appreciation for systematic and organized approaches.

CO3:PO11- Gaining foundational DBMS concepts is primarily technical, with partial relevance to value inculcation through disciplined learning and structured thinking.

CO4:PO11- Knowledge of aggregate operations is mainly technical, with limited direct influence on value inculcation or environmental awareness.

CO5:PO11- Mastering database concepts and systems can moderate value inculcation through promoting thoroughness, integrity, and responsibility in data management.

CO6:PO11- Modelling data requirements using conceptual tools moderately relates to value inculcation and environmental awareness by promoting a holistic and conscientious approach to data representation and its impact.

CO7:PO11- Writing SQL commands is predominantly a technical skill with limited direct impact on value inculcation or environmental awareness but can partially promote careful and ethical handling of data.

12. Justification of PO12 to ALL COs:

CO1:PO12- Understanding query execution and performance is moderately related to autonomy and responsibility in optimizing database operations and ensuring efficiency.

CO2:PO12- Demonstrating the basic elements of an RDBMS directly correlate with responsibility and accountability in managing data effectively.

CO3:PO12- Having a foundation in DBMS concepts supports understanding the scope and implications of database management responsibilities.

CO4:PO12- While aggregate operations are relevant, they are less directly tied to autonomy and responsibility compared to other concepts.
CO5:PO12- Mastery of database concepts and management systems is strongly related to autonomy and responsibility in database administration.
CO6:PO12-Modeling data requirements demonstrate accountability in designing database structures that meet application needs.
CO7:PO12- Writing SQL commands is crucial for implementing database solutions and directly ties to responsibility and accountability in database management.

13. Justification of PO13 to ALL COs:

CO1:PO13- Understanding query execution and performance, while important, is not directly related to community engagement and service.
CO2:PO13- Demonstrating RDBMS elements is moderately related as it supports effective data management, which can be relevant in community service projects.
CO3:PO13- Understanding DBMS concepts helps in managing data effectively, which can be beneficial in projects involving community engagement.
CO4:PO13- Knowledge of aggregate operations is less directly related to community engagement and service.
CO5:PO13- Mastering database concepts supports effective data handling, which can be useful in community service initiatives involving data management?
CO6:PO13-Modeling data requirements help in structuring data effectively, which is beneficial for planning and executing community service projects.
CO7:PO13- Writing SQL commands is relevant as it facilitates data manipulation and retrieval, which can support community service activities involving data management.

F.Y.B.Sc. (Computer Science)

Semester – II

Syllabus

(NEP - 2024 Pattern)

w.e.f. A.Y.2024-25

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

Name of the Program	: B.Sc. Computer Science
Program Code	: USCOS
Class	: F. Y. B.Sc. (Computer Science)
Semester	: II
Course Type	: DSC-III (General)
Course Name	: Advanced C Programming (TH)
Course Code	: COS-151-GEN
No. of Lectures	: 30
No. of Credits	: 02

A) 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

B) Course Outcomes:

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

Units	Chapter and Sub Topics	No. of Lectures
Unit – I	Pointers 1.1Pointer 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	6
Unit – II	Strings 2.1 Declaration and initialization, format specifies 2.2 Standard library functions 2.3 Strings and pointers	6

	2.4 Array of strings 2.5 Command Line Arguments	
Unit – III	Structures and Unions 3.1 Creating structures 3.2 Accessing structure members (dot Operator) 3.3 Structure initialization 3.4 Typedef 3.5 Array of structures 3.6 Passing structures to functions 3.7 Nested structures 3.8 Pointers and structures 3.9 Self-referential structure 3.10 Unions 3.11 Difference between structures and unions	8
Unit – IV	File Handling 4.1 Streams 4.2 Types of Files 4.3 Operations on files 4.4 Random access to files	6
Unit – V	C Pre-processor 4.1Format of Pre-processor directive 4.2 File Inclusion directive 4.3 Macro substitution, nested macro, argument macro 4.4 Macros VS Functions	4

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.Sc. (Computer Science) (2024 Pattern)

Name of the Program	: B.Sc. Computer Science
Program Code	: USCOS
Class	: F. Y. B.Sc. (Computer Science)
Semester	: II
Course Type	: DSC-III (General)
Course Name	: Computer Science Practical II (PR)
Course Code	: COS-152-GEN
No. of Practical's	: 15(60 Hours)
No. of Credits	: 02

Course Objectives:

1. Implement problem solving skills using pointer concept
2. Learn the functions of Structures and Unions
3. Working with files using the programming language.
4. Master the use of functions and modular programming
5. Master the advanced concepts of pointer arithmetic, pointer to pointers,
6. Gain proficiency in memory management techniques in C, including dynamic memory allocation, memory deallocation
7. Learn advanced file handling operations in C.

Course Outcomes:

CO1: Problem solving and programming capability and develop

CO2: Advanced as well as Graphics programming capability.

CO3: To solve real world computational problems.

CO4: To define and manage data structures based on problem subject domain.

CO5: To work with textual information, characters and strings

CO6: To Manage I/O operations in your C program.

CO7: Design and implement a 'C' programs for different problems

	Title of Experiment/ Practical
1	Use of pointers and Dynamic Memory allocation
2	Concept of strings, Array of strings.
3	Strings using standard library functions
4	Use of Structures and unions
5	C Pre-processor directives
6	Command line arguments
7	File handling
8	Case study
9	Case study
10	Case study

Mapping of this course outcomes with Programme outcomes

Course Outcomes	**Programme Outcomes (POs)**												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	3	3	3	3	2	2	3	3	1	2	3	2
CO2	2	2	2	2	2	1	1	2	2	1	1	2	1
CO3	3	3	3	3	3	2	2	3	3	1	2	3	2
CO4	3	3	2	3	3	2	2	2	2	1	1	2	1
CO5	2	2	2	2	2	3	2	2	3	1	1	1	1
CO6	2	2	1	1	1	1	1	1	2	1	1	1	1
CO7	3	3	3	3	3	2	1	2	3	1	2	3	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-Developing problem-solving and programming capabilities encompasses foundational theories and methodologies.

CO2:PO1-Advanced and graphics programming involves deeper understanding of methodologies and concepts.
CO3:PO1-Solving real-world computational problems requires applying theories and principles in practical contexts.
CO4:PO1-Understanding and managing data structures involves foundational theories and methodologies.
CO5:PO1-Working with textual information requires understanding key concepts in character encoding and string manipulation.
CO6:PO1-Managing I/O operations demonstrate proficiency in practical application of programming theories and concepts.
CO7:PO1-Designing and implementing C programs encompasses applying theories, methodologies, and concepts in varied contexts.

2. Justification of PO2 to ALL COs :

CO1:PO2-Developing problem-solving and programming capabilities is foundational for practical skills essential in professional tasks.
CO2:PO2-Advanced and graphics programming skills enhance practical expertise, moderately related to professional tasks.
CO3:PO2-Solving real-world computational problems directly applies practical skills in professional scenarios.
CO4:PO2-Knowledge of data structures and their management is crucial in applying industry standards and best practices.
CO5:PO2-Working with textual data is a practical skill applicable in various professional contexts, moderately related to industry standards.
CO6:PO2-Managing I/O operations demonstrates practical knowledge in handling program inputs and outputs, moderately related to professional tasks.
CO7:PO2-Designing and implementing C programs showcases practical application of programming skills in real-world scenarios, strongly relating to professional tasks.

3. Justification of PO3 to ALL COs :

CO1:PO3-Developing problem-solving and programming capabilities fosters innovation and creativity, essential for an entrepreneurial mindset.
CO2:PO3-Advanced programming skills, including graphics, can support innovative solutions and product development.
CO3:PO3-Solving real-world problems requires identifying opportunities and applying innovative solutions, strongly related to entrepreneurial skills.
CO4:PO3-Understanding data structures is crucial for efficient product design and development, moderately related to entrepreneurial knowledge.
CO5:PO3-Working with textual data involves creativity in handling information, moderately related to fostering innovation.
CO6:PO3-I/O operations are essential but have limited direct impact on entrepreneurial mindset or innovation.
CO7:PO3-Designing and implementing programs for varied problems demonstrates entrepreneurial skills in identifying and seizing opportunities.

4. Justification of PO4 to ALL COs:

CO1:PO4-Proficiency in problem-solving and programming is fundamental to technical skills and analytical abilities required in specialized fields.
CO2:PO4-Advanced programming, including graphics, enhances technical proficiency and problem-solving abilities.
CO3:PO4-Solving real-world problems demonstrates practical problem-solving skills and adaptability, strongly relating to specialized competencies.
CO4:PO4-Managing data structures requires analytical abilities and technical skills, crucial for specialized competencies.
CO5:PO4-Working with textual data enhances communication skills and technical proficiency, moderately related to specialized skills.
CO6:PO4-I/O operations, while essential, have limited impact on specialized skills such as leadership and adaptability.
CO7:PO4-Designing and implementing programs demonstrates leadership in technical solutions and innovation, strongly related to specialized skills.

5.Justification of PO5 to ALL COs :

CO1:PO5-Developing problem-solving and programming capabilities directly enhance the capacity to solve complex problems and apply learned concepts practically.
CO2:PO5-Advanced programming skills contribute to applying complex concepts in practical settings, moderately related to analytical reasoning
CO3:PO5-Solving real-world computational problems require critical thinking and adaptability, directly related to problem-solving and analytical reasoning.
CO4:PO5-Managing data structures involve analytical reasoning and practical application of learned concepts in problem domains.
CO5:PO5-Working with textual data requires analytical reasoning and critical thinking in processing and manipulating information.
CO6:PO5-Managing I/O operations, while essential, has limited impact on analytical reasoning and problem-solving capabilities
CO7:PO5-Designing and implementing programs for various problems demonstrates the capacity for application, problem-solving, and analytical reasoning.

6.Justification of PO6 to ALL COs :

CO1:PO6-Programming enhances technical communication skills moderately but has a moderate impact on collaboration and leadership.
CO2:PO6-Advanced programming skills primarily focus on technical proficiency rather than communication and collaboration.
CO3:PO6-Solving real-world problems may involve communicating solutions effectively, moderately related to communication skills.
CO4:PO6-Understanding and managing data structures may involve communicating technical concepts, moderately related to communication skills.
CO5:PO6-Working with textual information directly enhances written communication skills, strongly related to effective communication.

CO6:PO6-I/O operations focus on technical aspects and have minimal impact on communication and collaboration skills.
CO7:PO6-Designing and implementing programs may involve collaboration and leadership in project teams, moderately related to collaboration skills.

7.Justification of PO7 to ALL COs :

CO1:PO7-Developing problem-solving skills involves structured thinking and logical reasoning, moderately related to research question formulation.
CO2:PO7-Advanced programming focuses on technical skills rather than research methodologies or data analysis.
CO3:PO7-Solving real-world problems requires systematic approaches similar to research methodologies, moderately related to research-related skills.
CO4:PO7-Managing data structures involves analytical skills relevant to research data management, moderately related.
CO5:PO7-Working with textual data involves skills in data manipulation and analysis, moderately related to research-related skills.
CO6:PO7-I/O operations are technical in nature and have limited direct relevance to research methodologies or data analysis.
CO7:PO7-Designing and implementing programs focuses on technical skills rather than research-specific methodologies or reporting.

8.Justification of PO8 to ALL COs :

CO1:PO8-Developing problem-solving and programming skills involves self-directed learning and achieving goals independently, strongly related to learning how to learn.
CO2:PO8-Advanced programming skills require continuous learning and adaptation, moderately related to learning how to learn.
CO3:PO8-Solving real-world problems demands ongoing learning and adaptation, strongly related to learning how to learn.
CO4:PO8-Managing data structures involves learning new concepts and adaptation, moderately related to learning how to learn.
CO5:PO8-Working with textual data requires continuous learning and adaptation, moderately related to learning how to learn.
CO6:PO8-I/O operations have limited impact on learning how to learn compared to other COs.
CO7:PO8-Designing and implementing programs involves learning new problem-solving strategies and adapting to various scenarios, moderately related.

9.Justification of PO9 to ALL COs :

CO1:PO9-Programming capability inherently involves using ICT and analyzing data, strongly related to digital and technological skills.
CO2:PO9-Advanced programming skills include ICT proficiency for graphics programming, moderately related.
CO3:PO9-Solving real-world problems involves utilizing ICT tools for data analysis, strongly related.
CO4:PO9-Managing data structures involves using software tools for efficient data handling, moderately related to digital skills.
CO5:PO9-Working with textual information requires ICT tools for text processing, strongly related.

CO6:PO9-Managing I/O operations involves using ICT tools for input/output handling, moderately related.
CO7:PO9-Designing and implementing programs requires ICT proficiency for software development, strongly related.

10.Justification of PO10 to ALL COs :

CO1:PO10-Programming skills have limited impact on multicultural competence and empathy development.
CO2:PO10-Graphics programming emphasizes technical skills, not interpersonal or multicultural competence.
CO3:PO10-Solving computational problems does not directly address multicultural competence or empathy.
CO4:PO10-Data structure management is technical and not directly related to multicultural competence.
CO5:PO10-Working with textual information is a technical skill without direct impact on multicultural competence.
CO6:PO10-Managing I/O operations is technical and does not contribute directly to multicultural competence.
CO7:PO10- Designing and implementing programs focuses on technical proficiency, not multicultural competence.

11.Justification of PO11 to ALL COs :

CO1:PO11-Programming capability involves ethical coding practices, moderately related to ethical values.
CO2:PO11-Graphics programming focuses on technical skills with limited impact on ethical values and environmental awareness.
CO3:PO11-Solving real-world problems often requires considering ethical implications and sustainability, moderately related.
CO4:PO11-Data structure management is technical and does not directly contribute to ethical values or environmental awareness.
CO5:PO11-Working with textual information is technical with limited impact on ethical values or environmental awareness.
CO6:PO11-Managing I/O operations is technical and does not directly relate to ethical values or environmental awareness.
CO7:PO11-Designing programs includes ethical considerations and sustainability practices, moderately related.

12. Justification of PO12 to ALL COs :

CO1:PO12-Develops problem-solving and programming skills, directly enhancing autonomy and responsibility.
CO2:PO12-Advanced programming and graphics capabilities contribute to effective project management skills.
CO3:PO12-Solving real-world problems requires autonomy and accountability in applying skills effectively.
CO4:PO12-Managing data structures involves responsibility and accountability in data management.

CO5:PO12-Working with textual data is foundational but has limited direct impact on autonomy and responsibility.
CO6:PO12-Managing I/O operations is technical with minimal impact on autonomy and responsibility.
CO7:PO12-Designing and implementing programs requires autonomy, responsibility, and accountability in project execution.

13.Justification of PO13 to ALL COs :

CO1:PO13-Developing problem-solving and programming skills can support creating technological solutions for community benefit.
CO2:PO13-Advanced programming skills are less directly related to community engagement and service activities.
CO3:PO13-Solving real-world problems can directly contribute to addressing community needs through computational solutions.
CO4:PO13-Managing data structures is technical with limited direct impact on community engagement and service.
CO5:PO13-Working with textual information is foundational but has limited direct impact on community engagement.
CO6:PO13-Managing I/O operations is technical with minimal impact on community engagement and service.
CO7:PO13-Designing and implementing programs can directly provide technological solutions to community needs.

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. (Computer Science)
Semester	: II
Course Type	: OE
Course Name	: Introduction to MS-Office (PR)
Course Code	: COS-153-OE
No. of Lectures	: 60 (15 Practical)
No. of Credits	: 2

A) Course Objectives:

1. Apply the knowledge of computer fundamentals to IT application
2. Design solution for IT applications using latest technologies and develop and implement the solutions using various latest languages.
3. Use of Microsoft Office tool.
4. Understand the impact of the Office tools in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.
5. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice using office tools.
6. Use of MS Excel in multidisciplinary environment.
7. Identify opportunity; pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

B) Course Outcomes:

CO1: Students are able to use office tools in their office work.
CO2: Students can design Pay Sheet, Own Bio-data, Projects Reports etc.
CO3: Students are familiar with Microsoft Office tool.
CO4: Understand the impact of the Office tools in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.
CO5: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice using office tools.
CO6: Use of MS Excel in multidisciplinary environment.
CO7: Identify opportunity, pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

UNITS	CONTENT	No. of Lectures
UNIT -I	**Basic of Computer** 1.1 Introduction to Computer 1.2 File Explorer 1.3 Introduction – Notepad 1.4 Introduction - WordPad 1.5 Introduction – Paint	**3**
UNIT-II	**MS Word** 2.1 Home tab Operations 2.2 Inserting Objects 2.3 Designing Page Layout 2.4 Mailing , Review , View	**4**
UNIT-III	**MS Excel** 3.1 Introduction to Excel Layout 3.2 Inserting Charts 3.3 Using Formulas 3.4 Operations on Data	**4**
UNIT – IV	**MS Power Point** 4.1 Introduction to Power Point 4.2 Designing Slides 4.3 Transition Effects 4.4 Animations	**4**

Book References:

1. Microsoft Office 2007: Essentials Concepts & Techniques , Cengage Learning India Pvt. Ltd.

2.CCL - Microsoft Office 2010 , Bittu Kumar

Web References:

1. Tutorials Point - https://www.tutorialspoint.com/word/index.htm**https://www.guru99.com/c-programming-tutorial.html**

Mapping of this course Mapping of POs with COs

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

Weight: -Partially related 2-ModeratelyRelated 3-Stronglyrelated

PO1: Comprehensive Knowledge and Understanding

- **CO1 (3)**: Cyber security landscapes and issues encompass foundational theories and principles.
- **CO2 (3)**: Analyzing and evaluating cyber-attacks involves understanding key concepts and methodologies.
- **CO3 (2)**: Applying cyber security knowledge in daily life requires understanding foundational principles.
- **CO4 (3)**: Understanding various cyber security concepts and principles is crucial for comprehensive knowledge.
- **CO5 (2)**: Characterizing privacy, legal, and ethical issues includes understanding key theories and principles.
- **CO6 (2)**: Identifying vulnerabilities requires an understanding of foundational cyber security concepts.
- **CO7 (2)**: Diagnosing attacks involves understanding key concepts within the cyber security field.

PO2: Practical, Professional, and Procedural Knowledge

- **CO1 (2)**: Familiarity with cyber security issues contributes to practical knowledge.
- **CO2 (3)**: Analyzing and evaluating attacks requires practical, professional skills.
- **CO3 (2)**: Applying cyber security knowledge in real-world scenarios involves practical expertise.
- **CO4 (2)**: Understanding cyber security principles supports professional tasks.
- **CO5 (3)**: Addressing privacy, legal, and ethical issues requires knowledge of industry standards and regulations.
- **CO6 (3)**: Identifying vulnerabilities is essential for professional expertise.
- **CO7 (3)**: Diagnosing attacks is a key professional task in the cyber security field.

PO3: Entrepreneurial Mindset and Knowledge

- **CO1 (1)**: Basic understanding of cyber security landscapes can help identify opportunities.
- **CO2 (1)**: Evaluating cyber-attacks can foster innovative approaches.

- **CO3 (2)**: Applying knowledge in everyday life can lead to entrepreneurial thinking.
- **CO4 (1)**: Understanding concepts can contribute to innovation.
- **CO5 (2)**: Addressing legal and ethical issues can uncover market opportunities.
- **CO6 (1)**: Identifying vulnerabilities may highlight business opportunities.
- **CO7 (1)**: Diagnosing attacks can lead to innovative cyber security solutions.

PO4: Specialized Skills and Competencies

- **CO1 (2)**: Familiarity with issues requires some specialized skills.
- **CO2 (3)**: Analyzing and evaluating attacks needs specialized technical skills.
- **CO3 (2)**: Applying knowledge requires specialized competencies.
- **CO4 (3)**: Understanding concepts involves specialized skills.
- **CO5 (2)**: Characterizing issues requires analytical abilities.
- **CO6 (3)**: Identifying vulnerabilities involves technical skills.
- **CO7 (3)**: Diagnosing attacks requires specialized competencies.

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

- **CO1 (2)**: Understanding issues aids in problem-solving.
- **CO2 (3)**: Analyzing and evaluating attacks involves strong problem-solving skills.
- **CO3 (3)**: Applying conceptual knowledge requires problem-solving.
- **CO4 (2)**: Understanding principles supports analytical reasoning.
- **CO5 (2)**: Addressing legal and ethical issues involves problem-solving.
- **CO6 (3)**: Identifying vulnerabilities requires analytical reasoning.
- **CO7 (3)**: Diagnosing attacks involves problem-solving.

PO6: Communication Skills and Collaboration

- **CO1 (1)**: Basic familiarity with issues aids communication.
- **CO2 (2)**: Analyzing attacks requires effective communication of findings.
- **CO3 (2)**: Applying knowledge involves explaining concepts to others.
- **CO4 (2)**: Understanding principles helps in communicating them.
- **CO5 (3)**: Addressing legal and ethical issues requires effective communication.
- **CO6 (2)**: Identifying vulnerabilities requires effective communication.
- **CO7 (3)**: Diagnosing attacks involves clear communication with stakeholders.

PO7: Research-related Skills

- **CO1 (2)**: Familiarity with issues requires research skills.
- **CO2 (3)**: Analyzing and evaluating attacks involves research methodologies.
- **CO3 (2)**: Applying knowledge involves using research skills.
- **CO4 (2)**: Understanding concepts requires research.
- **CO5 (3)**: Addressing privacy, legal, and ethical issues involves research.
- **CO6 (3)**: Identifying vulnerabilities involves data analysis and research.
- **CO7 (3)**: Diagnosing attacks involves research skills.

PO8: Learning How to Learn Skills

- **CO1 (2)**: Understanding cyber security landscapes promotes continuous learning.
- **CO2 (3)**: Evaluating attacks requires adapting new knowledge.
- **CO3 (3)**: Applying knowledge shows the ability to learn and adapt.
- **CO4 (2)**: Understanding principles involves continuous learning.
- **CO5 (2)**: Addressing ethical issues requires staying updated.
- **CO6 (2)**: Identifying vulnerabilities involves ongoing learning.
- **CO7 (3)**: Diagnosing attacks requires updating skills.

PO9: Digital and Technological Skills

- **CO1 (2)**: Familiarity with issues involves digital skills.
- **CO2 (3)**: Analyzing attacks requires technological proficiency.
- **CO3 (2)**: Applying knowledge involves using digital tools.
- **CO4 (2)**: Understanding principles involves digital skills.
- **CO5 (2)**: Addressing issues involves using technology.
- **CO6 (3)**: Identifying vulnerabilities requires technological skills.
- **CO7 (3)**: Diagnosing attacks involves digital proficiency.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

- **CO1 (1)**: Understanding issues helps appreciate diverse perspectives.
- **CO2 (2)**: Evaluating attacks involves considering different viewpoints.
- **CO3 (2)**: Applying knowledge includes recognizing diverse needs.
- **CO4 (1)**: Understanding principles involves appreciating different contexts.
- **CO5 (2)**: Addressing ethical issues involves empathy and inclusivity.
- **CO6 (1)**: Identifying vulnerabilities requires considering diverse impacts.
- **CO7 (1)**: Diagnosing attacks includes understanding diverse implications.

PO11: Value Inculcation and Environmental Awareness

- **CO1 (1)**: Understanding cyber security landscapes involves ethical considerations.
- **CO2 (1)**: Evaluating attacks includes considering ethical impacts.
- **CO3 (1)**: Applying knowledge involves responsible use.
- **CO4 (1)**: Understanding principles includes ethical awareness.
- **CO5 (3)**: Characterizing legal and ethical issues involves value inculcation.
- **CO6 (1)**: Identifying vulnerabilities involves ethical responsibility.
- **CO7 (1)**: Diagnosing attacks includes ethical considerations.

PO12: Autonomy, Responsibility, and Accountability

- **CO1 (2)**: Understanding issues promotes independent knowledge application.
- **CO2 (3)**: Evaluating attacks involves responsible analysis.
- **CO3 (2)**: Applying knowledge requires autonomy.
- **CO4 (2)**: Understanding principles supports independent work.
- **CO5 (2)**: Addressing issues involves responsibility.
- **CO6 (3)**: Identifying vulnerabilities requires accountability.
- **CO7 (3)**: Diagnosing attacks involves independent responsibility.

PO13: Community Engagement and Service

- **CO1 (1)**: Understanding issues helps in community awareness.
- **CO2 (2)**: Evaluating attacks can contribute to community safety.
- **CO3 (2)**: Applying knowledge can benefit the community.
- **CO4 (1)**: Understanding principles includes community implications.
- **CO5 (2)**: Addressing issues can involve community service.
- **CO6 (1)**: Identifying vulnerabilities has community impact.
- **CO7 (2)**: Diagnosing attacks can enhance community security.

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. (Computer Science)
Semester	: II
Course Type	: SEC
Course Name	: RDBMS Using PostgreSQL (PR)
Course Code	: COS-154-SEC
No. of Practical's	: 15 (60 Hours)
No. of Credits	: 02

A) Course Objectives:

1. Understand creation, manipulation and querying of data in databases.
2. Understand the advanced database concept.
3. Understand the SQL commands.
4. Understand the Primary key constraint & Foreign Key constraint.
5. Understand design and implementation of a database system.
6. Study physical, logical database designs and database modelling.
7. Understanding and development of essential RDBMS concepts.

B) Course Outcomes*:*

CO1. Know the syntax of trigger, function, cursor etc.

CO2. Demonstrate the basic elements of a relational database management system.

CO3. Understand database techniques such as SQL & PL/pgSQL

CO4. Analyze PL/SQL structures like functions, procedures, cursors and triggers for Database applications.

CO5. Master the basics of database concepts and database management system.

CO6. Apply advanced SQL features like views database Management

CO7. Write SQL commands to create tables, insert, update, delete and query data.

	Title of Experiment/ Practical
1	Nested Queries, using aggregate functions
2	Nested Queries, using aggregate functions
3	Queries using Views

4	Queries using Views
5	Stored Function
6	Stored Function
7	Cursors
8	Cursors
9	Exception Handling
10	Exception Handling
11	Triggers
12	Triggers
13	Case study
14	Case study

Mapping of this course outcomes with Programme outcomes

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

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- Knowing the syntax of triggers, functions, and cursors is fundamental to understanding database programming, aligning strongly with comprehensive knowledge.

CO2:PO1- Demonstrating the basic elements of RDBMS is essential for understanding database management systems, crucial for comprehensive knowledge.

CO3:PO1- Understanding SQL & PL/pgSQL techniques is central to mastering database querying and procedural languages, contributing significantly to comprehensive knowledge.

CO4:PO1- Analyzing PL/SQL structures like functions, procedures, cursors, and triggers is critical for understanding database application development, pivotal for comprehensive knowledge.
CO5:PO1- Mastering database concepts and management systems provides a solid foundation, essential for comprehensive knowledge in database fundamentals.
CO6:PO1- Applying advanced SQL features like views demonstrates proficiency in database management, enhancing comprehensive knowledge with advanced capabilities.
CO7:PO1- Writing SQL commands for database operations is fundamental in database management, integral for demonstrating comprehensive knowledge in practical applications.

2. Justification of PO2 to ALL COs:

CO1:PO2- Knowing the syntax of triggers, functions, and cursors is essential for practical application in database programming, contributing directly to professional procedural knowledge.
CO2:PO2- Demonstrating the basic elements of RDBMS is foundational for practical database management, essential for developing professional procedural knowledge.
CO3:PO2- Understanding SQL & PL/pgSQL techniques is crucial for implementing practical database solutions, fundamental for developing professional procedural knowledge.
CO4:PO2- Analyzing PL/SQL structures like functions, procedures, cursors, and triggers is necessary for developing procedural knowledge in database application development, key for practical proficiency.
CO5:PO2- Mastering database concepts and management systems is foundational for practical application in database environments, essential for professional procedural knowledge.
CO6:PO2- Applying advanced SQL features like views demonstrates proficiency in handling complex database scenarios, enhancing practical and professional knowledge.
CO7:PO2- Writing SQL commands for database operations is fundamental for practical implementation, crucial for developing procedural knowledge in database management.

3. Justification of PO3 to ALL COs:

CO1:PO3- Knowing the syntax of triggers, functions, and cursors provides technical proficiency, somewhat related to understanding foundational technical aspects in entrepreneurial contexts.
CO2:PO3- Demonstrating the basic elements of RDBMS show foundational understanding, which can be applied in entrepreneurial ventures requiring database management.
CO3:PO3- Understanding SQL & PL/pgSQL techniques supports practical implementation in database-driven entrepreneurial projects, moderately related.
CO4:PO3-Analyzing PL/SQL structures demonstrates capability in database application development, moderately related to entrepreneurial ventures involving database solutions.
CO5:PO3- Mastering database concepts is foundational but less directly related to entrepreneurial mindset unless applied in specific entrepreneurial contexts.
CO6:PO3- Applying advanced SQL features like views is technical and less directly related to entrepreneurial mindset without specific application context.
CO7:PO3- Writing SQL commands is a technical skill not directly linked to entrepreneurial mindset without specific entrepreneurial context.

4. Justification of PO4 to ALL COs:

CO1:PO4- Knowing the syntax of triggers, functions, and cursors is fundamental for developing specialized technical skills in database programming.
CO2:PO4- Demonstrating the basic elements of RDBMS is foundational for acquiring specialized skills in database management and administration.
CO3:PO4-Understanding SQL & PL/pgSQL techniques are crucial for developing specialized competencies in database querying and procedural languages.
CO4:PO4- Analyzing PL/SQL structures like functions, procedures, cursors, and triggers is essential for specialized skills in database application development.
CO5:PO4- Mastering database concepts and management systems is fundamental for acquiring specialized competencies in database fundamentals.
CO6:PO4- Applying advanced SQL features like views demonstrates proficiency and specialization in managing complex database scenarios.
CO7:PO4- Writing SQL commands for database operations is fundamental for acquiring specialized skills in practical database management.

5. Justification of PO5 to ALL COs:

CO1:PO5- Knowing the syntax of triggers, functions, and cursors supports problem-solving in database programming by enabling precise and efficient solutions.
CO2:PO5- Demonstrating the basic elements of RDBMS facilitates application and problem-solving in database management tasks, essential for analytical reasoning.
CO3:PO5- Understanding SQL & PL/pgSQL techniques enable effective application and problem-solving in database querying and procedural tasks, crucial for analytical reasoning.
CO4:PO5- Analyzing PL/SQL structures like functions, procedures, cursors, and triggers enhances problem-solving skills in database application development, promoting analytical reasoning.
CO5:PO5- Mastering database concepts and management systems provides foundational knowledge essential for effective application and problem-solving in database scenarios.
CO6:PO5- Applying advanced SQL features like views demonstrates capability in solving complex database problems, enhancing analytical reasoning skills.
CO7:PO5- Writing SQL commands for database operations fosters practical problem-solving skills in database management, crucial for application and analytical reasoning.

6. Justification of PO6 to ALL COs:

CO1:PO6- Knowing the syntax of triggers, functions, and cursors is a technical skill not directly related to communication or collaboration.
CO2:PO6- Demonstrating RDBMS elements is foundational but does not inherently develop communication or collaboration skills.
CO3:PO6- Understanding SQL & PL/pgSQL techniques is a technical proficiency not directly linked to communication or collaboration.
CO4:PO6- Analyzing PL/SQL structures is a technical skill in database development, not directly enhancing communication or collaboration.
CO5:PO6- Mastering database concepts is foundational but lacks direct correlation to communication or collaboration skills.
CO6:PO6- Applying advanced SQL features like views is a technical skill in database management, not directly related to communication or collaboration.
CO7:PO6- Writing SQL commands for database operations is a technical task not inherently linked to communication or collaboration.

7. Justification of PO7 to ALL COs:

CO1:PO7- Knowing syntax is a technical skill, not directly related to research skills.

CO2:PO7- Demonstrating RDBMS elements is foundational but does not directly develop research-related skills.
CO3:PO7- Understanding SQL & PL/pgSQL techniques is moderately related as they are essential for conducting database-related research tasks.
CO4:PO7- Analyzing PL/SQL structures involves understanding complex database operations, relevant for research in database applications.
CO5:PO7- Mastering database concepts is foundational but does not inherently contribute to research skills.
CO6:PO7- Applying advanced SQL features like views is a technical skill, not directly related to research skills.
CO7:PO7- Writing SQL commands is a technical task, not directly linked to research skills.

8. Justification of PO8 to ALL COs:

CO1:PO8- Knowing syntax is foundational for learning advanced database concepts and techniques, promoting learning how to learn.
CO2:PO8- Demonstrating RDBMS elements establishes foundational knowledge, essential for continuous learning and skill development.
CO3:PO8- Understanding SQL & PL/pgSQL techniques is crucial for continuous learning and mastering database skills.
CO4:PO8- Analyzing PL/SQL structures develops deeper understanding and problem-solving skills, crucial for ongoing learning.
CO5:PO8- Mastering database concepts lays the groundwork for continuous learning and adapting to new database management systems.
CO6:PO8- Applying advanced SQL features demonstrate advanced learning capabilities and adaptability in database management.
CO7:PO8- Writing SQL commands involves practical application and reinforces learning through hands-on experience with databases.

9. Justification of PO9 to ALL COs:

CO1:PO9- Knowing syntax is fundamental for developing digital skills in database programming and management.
CO2:PO9- Demonstrating RDBMS elements builds essential technological skills in database management.
CO3:PO9- Understanding SQL & PL/pgSQL techniques is crucial for acquiring digital skills in database querying and programming.
CO4:PO9- Analyzing PL/SQL structures enhances technological skills in complex database operations and programming.
CO5:PO9- Mastering database concepts is foundational for developing comprehensive digital skills in database management.
CO6:PO9- Applying advanced SQL features like views demonstrates advanced technological proficiency in database management.
CO7:PO9- Writing SQL commands for database operations is a practical application of digital skills in database management.

10. Justification of PO10 to ALL COs:

CO1:PO10- Knowing syntax is a technical skill, not directly related to multicultural competence or empathy.

CO2:PO10- Demonstrating RDBMS elements is foundational but does not directly contribute to multicultural competence or empathy.
CO3:PO10- Understanding SQL & PL/pgSQL techniques is a technical skill, not directly related to multicultural competence or empathy.
CO4:PO10- Analyzing PL/SQL structures focuses on technical proficiency rather than multicultural competence or empathy.
CO5:PO10- Mastering database concepts is essential but does not inherently develop multicultural competence or empathy.
CO6:PO10- Applying advanced SQL features like views is a technical task, not directly related to multicultural competence or empathy.
CO7:PO10- Writing SQL commands involves technical skills, not directly linked to multicultural competence or empathy.

11. Justification of PO11 to ALL COs:

CO1:PO11- Knowing syntax is a technical skill unrelated to value inculcation or environmental awareness.
CO2:PO11- Demonstrating RDBMS elements is technical knowledge, not directly related to environmental awareness.
CO3:PO11- Understanding SQL & PL/pgSQL techniques is technical, not directly tied to value inculcation or environmental awareness.
CO4:PO11- Analyzing PL/SQL structures focuses on technical proficiency, not environmental awareness.
CO5:PO11- Mastering database concepts is essential but does not inherently promote value inculcation or environmental awareness.
CO6:PO11- Applying advanced SQL features like views is technical and does not directly relate to environmental awareness.
CO7:PO11- Writing SQL commands is a technical skill, not directly linked to value inculcation or environmental awareness.

12. Justification of PO12 to ALL COs:

CO1:PO12- Knowing syntax enables autonomy in writing database logic independently.
CO2:PO12- Understanding RDBMS elements supports responsibility in data management tasks.
CO3:PO12- Understanding SQL & PL/pgSQL techniques fosters responsibility in database querying and management.
CO4:PO12- Analyzing PL/SQL structures requires accountability for ensuring efficient database operations.
CO5:PO12- Mastering database concepts enhances autonomy in managing database systems.
CO6:PO12- Applying advanced SQL features like views demonstrate responsibility in optimizing database performance.
CO7:PO12- Writing SQL commands reflects accountability in data manipulation and retrieval tasks.

13. Justification of PO13 to ALL COs:

CO1:PO13- Knowing syntax is technical and does not directly relate to community engagement or service.
CO2:PO13- Demonstrating RDBMS elements is technical and does not inherently involve community engagement or service.

CO3:PO13- Understanding SQL & PL/pgSQL techniques is technical and does not directly contribute to community engagement or service.
CO4:PO13- Analyzing PL/SQL structures focuses on technical proficiency, not community engagement or service.
CO5:PO13- Mastering database concepts is foundational but does not inherently promote community engagement or service.
CO6:PO13- Applying advanced SQL features like views is technical and does not directly relate to community engagement or service.
CO7:PO13- Writing SQL commands involves technical skills, not directly linked to community engagement or service.

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.

- **CO7: Knowledge about social networking**: Weightage: 3

Justification: Strongly related as knowledge of social networking requires autonomous decision-making and responsible, accountable interactions in a highly public and interconnected digital space.

13. Justification of PO13 to ALL COs:

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

Justification: Moderately related as understanding the digital paradigm can help engage communities through digital tools and platforms, fostering service and connectivity.

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

Justification: Strongly related because recognizing the importance of digital technologies and e-commerce can significantly impact community engagement by providing services and financial inclusion to underserved communities.

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

Justification: Strongly related as communication and networks are essential for effective community engagement, enabling the dissemination of information and coordinated service efforts.

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

Justification: Strongly related since e-governance and Digital India initiatives directly involve community engagement through digital services and citizen participation.

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

Justification: Moderately related as applying digital technology can enhance community services and engagement, though it is one step removed from direct engagement.

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

Justification: Partially related because while machine learning and big data can improve community services by providing insights, the direct link to community engagement is less prominent.

- **CO7: Knowledge about social networking**:Weightage: 3
  - Justification: Strongly related as social networking platforms are powerful tools for community engagement, enabling outreach, organization of services, and fostering community interactions.