Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Autonomous)

Four Year B. Sc. Degree Program in Computer Science

(Faculty of Science & Technology)

CBCS Syllabus

S. Y. B. Sc. (Computer Science) Semester –III

For Department of Computer Science

Tuljaram Chaturchand College, Baramati

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

To be implemented from Academic Year 2024-2025

Title of the Programme: S. Y. B. Sc. (Computer Science)

Preamble

AES's Tuljaram Chaturchand College has made the decision to change the syllabus of various faculties from June, 2023 by incorporating the guidelines and provisions outlined in the National Education Policy (NEP), 2020. The NEP envisions making education more holistic and effective and to lay emphasis on the integration of general (academic) education, vocational education and experiential learning. The NEP introduces holistic and multidisciplinary education that would help to develop intellectual, scientific, social, physical, emotional, ethical and moral capacities of the students. The NEP 2020 envisages flexible curricular structures and learning based outcome approach for the development of the students. By establishing a nationally accepted and internationally comparable credit structure and courses framework, the NEP 2020 aims to promote educational excellence, facilitate seamless academic mobility, and enhance the global competitiveness of Indian students. It fosters a system where educational achievements can be recognized and valued not only within the country but also in the international arena, expanding opportunities and opening doors for students to pursue their aspirations on a global scale.

In response to the rapid advancements in science and technology and the evolving approaches in various domains of Computer Science and related subjects, the Board of Studies in Computer Science at Tuljaram Chaturchand College, Baramati - Pune, has developed the Credit, Course Structure of S.Y.B.Sc.(Computer Science) Sem- III , IV and curriculum for the Third semester of S.Y.B.Sc.(Computer Science), which goes beyond traditional academic boundaries. The syllabus is aligned with the NEP 2020 guidelines to ensure that students receive an education that prepares them for the challenges and opportunities of the 21st century. This syllabus has been designed under the framework of the Choice Based Credit System (CBCS), taking into consideration the guidelines set forth by the National Education Policy (NEP) 2020, LOCF (UGC), NCrF, NHEQF, Prof. R.D. Kulkarni's Report, Government of Maharashtra's General Resolution dated 20th April and 16th May 2023, and the Circular issued by SPPU, Pune on 31st May 2023.

A degree in Computer Science subject equips students with the knowledge and skills necessary for a diverse range of fulfilling career paths. 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, 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 Outcomes (POs) for B.Sc. (Computer Science)

PO1. Comprehensive Knowledge and Understanding: Graduates will possess a profound understanding of their field of study, including foundational theories, principles, methodologies, and key concepts, within a broader multidisciplinary context.

PO2. Practical, Professional, and Procedural Knowledge: Graduates will acquire practical skills and expertise essential for professional tasks within their field. This includes knowledge of industry standards, best practices, regulations, and ethical considerations, with the ability to apply this knowledge effectively in real-world scenarios.

PO3. Entrepreneurial Mindset and Knowledge: Graduates will cultivate an entrepreneurial mindset, identifying opportunities, fostering innovation, and understanding business principles, market dynamics, and risk management strategies.

PO4. Specialized Skills and Competencies: Graduates will demonstrate proficiency in technical skills, analytical abilities, problem-solving, effective communication, and leadership, relevant to their field of study. They will also adapt and innovate in response to changing circumstances.

PO5. Capacity for Application, Problem-Solving, and Analytical Reasoning: Graduates will possess the capacity to apply learned concepts in practical settings, solve complex problems, and analyze data effectively. This requires critical thinking, creativity, adaptability, and a readiness to learn and take calculated risks.

PO6. Communication Skills and Collaboration: Graduates will effectively communicate complex information, both orally and in writing, using appropriate media and language. They will also collaborate effectively in diverse teams, demonstrating leadership qualities and facilitating cooperative efforts toward common goals.

PO7. Research-related Skills: Graduates will demonstrate observational and inquiry skills, formulate research questions, and utilize appropriate methodologies for data collection and analysis. They will also adhere to research ethics and effectively report research findings.

PO8. Learning How to Learn Skills: Graduates will acquire new knowledge and skills through self-directed learning, adapt to changing demands, and set and achieve goals independently.

PO9. Digital and Technological Skills: Graduates will demonstrate proficiency in using ICT, accessing information sources, and analyzing data using appropriate software.

PO10. Multicultural Competence, Inclusive Spirit, and Empathy: Graduates will engage effectively in multicultural settings, respecting diverse perspectives, leading diverse teams, and demonstrating empathy and understanding of others' perspectives and emotions.

PO11. Value Inculcation and Environmental Awareness: Graduates will embrace ethical and moral values, practice responsible citizenship, recognize and address ethical issues, and take appropriate actions to promote sustainability and environmental conservation.

PO12. Autonomy, Responsibility, and Accountability : Graduates will apply knowledge and skills independently, manage projects effectively, and demonstrate responsibility and accountability in work and learning contexts.

PO13. Community Engagement and Service : Graduates will actively participate in community-engaged services and activities, promoting societal well-being.

Programme Specific Outcomes (PSOs) for 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.	Mrs. Asmita Bhagat	Member
7.	Mr. Rahul Shah	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

Credit & Course Structure for S. Y. B. Sc. (Computer Science)(2023 Pattern)

Sem	Course Type	Course Code	Title of Course	Course Types	No. of Credits
III	**Major Mandatory**	COS-201-MJM	Basic Data Structures	Theory	2
	Major Mandatory	COS-202-MJM	Introduction to Web Technology	Theory	2
	Major Mandatory	COS-203-MJM	Software Engineering Principles and Techniques	Theory	2
	Major Mandatory	COS-204-MJM	Lab Course I – Based on COS-201-MJM, COS-202-MJM	Practical	2
	Minor (Any one) (For B.Sc.(CS)) Statistics, Mathematics, Electronics	COS-211-MN(A), COS-211-MN (B), COS-211-MN(C)		Theory	2
	Minor (Any one) (For B.Sc.(CS)) Statistics, Mathematics, Electronics	COS-212-MN (A), COS-212-MN(B), COS-212-MN(C)		Practical	2
	Minor *(For Others)*	COS-211-MN(D)	HTML5 using CSS	Theory	2
	Minor *(For Others)*	COS-212-MN(D)	Lab Course based on COS-211-MN (D)	Practical	2
	Open Elective (OE)	COS-216-OE	Fundamental Concepts in Computer Science	Theory	2
	Vocational Skill Course (VSC)	COS-221-VSC	Programming in C++	Theory	2
	Ability Enhancement Course (AEC)	MAR-231-AEC , HIN-231-AEC , SAN-231-AEC		Theory	2
	Co-curricular Course (CC)	YOG/PES/CUL/NSS/NCC-239-CC	To be selected form the Basket	Theory	2
	Field Project (CEP)	COS-235-FP	Field Project	Practical	2
	Generic IKS Course (IKS)	GEN-245-IKS	Generic IKS	Theory	2
			Total Credits of SEM – III :		**24**

SYLLABUS (CBCS as per NEP 2020) FOR S. Y. B. Sc. (Computer Science) Sem-III (w. e. from June, 2024)

Name of the Programme	**:** B.Sc. Computer Science
Program Code	: USCOS
Class	**:** S. Y. B. Sc. (Computer Science)
Semester	**:** III
Course Type	**:** Major (TH)
Course Name	**:** Basic Data Structures
Course Code	**:** COS-201-MJM
No. of Lectures	**: 30**
No. of Credits	**: 02**

Prerequisites:

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

Objective:

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

Course Outcome:

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

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

CO3. Understand discrete structures such as sets, relations, and lattices.

CO4. Study the basic operations of Propositional logic and Boolean Algebra.

CO5. Analyse and study various proof techniques.

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

CO7. To efficiently implement the different data structures.

Unit	Title and Contents	No. of Lectures
Unit 1	**Introduction to Data Structures** 1.1 Data type, Data object, ADT 1.2.1 Data Type , Data Object 1.2.3 ADT - Definition, Operation 1.3 Need & Types of Data Structure 1.4 Types of Data Structure 1.5 Algorithm analysis 1.5.1 Algorithm – definition, characteristics 1.5.2 Space complexity, time complexity 1.5.3 Asymptotic notation (Big O, Omega Ω, Theta Notation Θ)	**4**
Unit 2	**Linear Data Structures** 2.1 Introduction to Arrays - array representation 2.2 Sorting algorithms with efficiency – Bubble sort, Insertion sort, Merge sort, Quick Sort 2.3 Searching techniques –Linear Search, Binary search	**8**
Unit 3	**Linked List** 3.1 Introduction to Linked List 3.2 Implementation of Linked List – Static & Dynamic representation, 3.3 Types of Linked List 3.4 Operations on Linked List - create, display, insert, delete, reverse, search, sort, concatenate &merge 3.5 Applications of Linked List – polynomial manipulation 3.6 Generalized linked list – Concept and Representation	**10**
Unit 4	**Stacks** 4.1 Introduction 4.2 Representation- Static & Dynamic 4.3 Operations – Create , Init , Push , Pop & Display 4.4 Application – Expression Conversion & Evaluation 4.5 Simulating recursion using stack	**8**

References:

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

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

Mapping of CO With PO

CO1 With PO1 : As proficiency in using data structures demonstrates a profound understanding of foundational theories and principles within the field of study, essential for problem-solving in a multidisciplinary context.
CO2 With PO1 : As the ability to differentiate between different data structures and their appropriate usage showcases a deep understanding of methodologies and key concepts, contributing to a broader multidisciplinary perspective.
CO3 With PO1 : As understanding discrete structures is foundational to grasping the theoretical underpinnings of computer science, enhancing knowledge within a broader multidisciplinary context.
CO4 With PO1 : As studying propositional logic and Boolean algebra provides a theoretical framework that is crucial for understanding foundational theories and principles within the field of study, contributing to a broader multidisciplinary perspective.
CO5 With PO1 : As the ability to analyze proof techniques demonstrates proficiency in applying methodologies and key concepts within the field of study, essential for understanding foundational theories and principles in a broader multidisciplinary context.
CO6 With PO1 : As understanding memory allocation contributes to a practical understanding of computer science concepts, although it may be less directly related to multidisciplinary contexts covered in PO1.
CO7 With PO1 : As the ability to efficiently implement data structures demonstrates practical application of foundational theories and principles, essential for problem-solving within a broader multidisciplinary context.

CO1 With PO2 : As practical skills in utilizing data structures are essential for professional tasks in problem-solving within real-world scenarios, aligning with industry standards and best practices.
CO2 With PO2 : As the ability to differentiate between different data structures and select the appropriate one for problem-solving reflects expertise and practical skills needed in professional tasks, adhering to industry standards and best practices.
CO3 With PO2 : As understanding discrete structures is fundamental for applying knowledge in real-world scenarios, ensuring adherence to industry standards and best practices in problem-solving tasks.
CO4 With PO2 : As studying propositional logic and Boolean algebra provides a theoretical foundation essential for understanding industry standards, regulations, and ethical considerations in real-world scenarios.
CO5 With PO2 : As the ability to analyze proof techniques enhances problem-solving skills in professional tasks, aligning with industry standards and best practices.

CO6 With PO2: As understanding memory allocation is practical knowledge applicable to professional tasks, although it may be less directly related to industry standards and regulations.
CO7 With PO2 : As the ability to efficiently implement data structures demonstrates practical expertise essential for professional tasks, aligning with industry standards and best practices.
CO1 With PO3: As the ability to use data structures can contribute to problem-solving skills, which are important in identifying opportunities and fostering innovation, although it may not directly address business principles, market dynamics, and risk management strategies.
CO2 With PO3 : As the ability to differentiate between different data structures can enhance problem-solving abilities, which can indirectly contribute to fostering innovation and understanding market dynamics.
CO3 With PO3: As understanding discrete structures may have limited direct relevance to cultivating an entrepreneurial mindset and understanding business principles, market dynamics, and risk management strategies.
CO4 With PO3 : As studying propositional logic and Boolean algebra may have limited direct relevance to entrepreneurial mindset or business principles, although it may indirectly enhance analytical skills important for risk management.
CO5 With PO3 : As studying proof techniques may have limited direct relevance to entrepreneurship or business principles, although it may indirectly enhance critical thinking skills important for identifying opportunities and fostering innovation.
CO6 With PO3 : As understanding memory allocation may have limited direct relevance to entrepreneurial mind set or business principles, although it may indirectly contribute to problem-solving abilities.
CO7 With PO3 : As the ability to efficiently implement data structures can contribute to problem-solving skills, which are important in identifying opportunities and fostering innovation, although it may not directly address business principles, market dynamics, and risk management strategies.

CO1 With PO4 : As proficiency in utilizing data structures demonstrates technical skills, analytical abilities, and problem-solving capabilities, essential for adapting and innovating in response to changing circumstances.
CO2 With PO4 : As the ability to differentiate between different data structures showcases analytical abilities and problem-solving skills, crucial for adapting and innovating in response to changing circumstances.
CO3 With PO4 : As understanding discrete structures enhances analytical abilities and problem-solving skills, although its direct impact on technical proficiency and effective communication may be limited.
CO4 With PO4 : As studying propositional logic and Boolean algebra develops analytical abilities and problem-solving skills, although its direct impact on technical proficiency and effective communication may be limited.
CO5 With PO4 : As analyzing proof techniques enhances analytical abilities and problem-solving skills, although its direct impact on technical proficiency and effective communication may be limited.
CO6 With PO4 : As understanding memory allocation contributes to technical proficiency and problem-solving skills, although its direct impact on effective communication and leadership may be limited.

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

CO1 With PO5 : As the ability to use data structures effectively in problem-solving requires critical thinking, creativity, adaptability, and readiness to learn, essential for applying learned concepts in practical settings and solving complex problems.
CO2 With PO5 : As the ability to differentiate between different data structures demonstrates critical thinking and adaptability, crucial for analyzing data effectively and solving complex problems in practical settings.
CO3 With PO5 : As understanding discrete structures enhances critical thinking and problem-solving abilities, essential for analyzing data effectively and solving complex problems in practical settings.
CO4 With PO5 : As studying propositional logic and Boolean algebra develops analytical skills and critical thinking, although its direct impact on creativity, adaptability, and readiness to take calculated risks may be limited.
CO5 With PO5 : As analyzing proof techniques requires critical thinking and creativity, essential for solving complex problems and taking calculated risks in practical settings.
CO6 With PO5 : As understanding memory allocation contributes to problem-solving abilities, although its direct impact on critical thinking and adaptability may be limited.
CO7 With PO5 : As efficiently implementing data structures requires critical thinking, creativity, adaptability, and a readiness to learn, essential for applying learned concepts in practical settings and solving complex problems.

CO1 With PO6 : As effectively communicating complex information and collaborating in diverse teams may require the ability to articulate the usage of data structures in problem-solving, but it may not directly address communication skills or teamwork.
CO2 With PO6 : As the ability to differentiate between different data structures may indirectly contribute to effective communication and collaboration by facilitating clear explanations and discussions within teams.
CO3 With PO6: As understanding discrete structures may not directly address communication skills or teamwork but may indirectly contribute to problem-solving abilities within teams.
CO4 With PO6 : As studying propositional logic and Boolean algebra may enhance analytical skills but may not directly contribute to effective communication or teamwork.
CO5 With PO6: as studying proof techniques may improve critical thinking skills but may not directly address communication skills or teamwork.
CO6 With PO6 : as understanding memory allocation may not directly contribute to communication skills or teamwork but may indirectly support problem-solving abilities within teams.
CO7 With PO6 : as efficiently implementing data structures may indirectly support effective communication and collaboration by ensuring that team members understand and utilize appropriate structures in problem-solving tasks.

CO1 With PO7: as the ability to use data structures effectively may indirectly support observational and inquiry skills by providing a structured approach to problem-solving, although it may not directly address research methodologies or ethics.
CO2 With PO7 : as the ability to differentiate between different data structures may indirectly contribute to observational and inquiry skills by fostering critical thinking and analytical abilities, although it may not directly address research methodologies or ethics.

CO3 With PO7: as understanding discrete structures may enhance analytical skills but may not directly contribute to observational and inquiry skills, research methodologies, or ethics.
CO4 With PO7 : as studying propositional logic and Boolean algebra may improve analytical skills but may not directly address observational and inquiry skills, research methodologies, or ethics.
CO5 With PO7: as studying proof techniques may enhance critical thinking skills but may not directly contribute to observational and inquiry skills, research methodologies, or ethics.
CO6 With PO7: as understanding memory allocation may support problem-solving abilities but may not directly address observational and inquiry skills, research methodologies, or ethics.
CO7 With PO7: as efficiently implementing data structures may indirectly support observational and inquiry skills by providing practical experience with structured problem-solving, although it may not directly address research methodologies or ethics.

CO1 With PO8: as the ability to utilize data structures effectively demonstrates self-directed learning by acquiring new knowledge and skills, adapting to changing demands, and setting and achieving goals independently through problem-solving.
CO2 With PO8: as the ability to differentiate between different data structures reflects self-directed learning by acquiring a deeper understanding of their functionalities, adapting to changing demands, and setting and achieving goals independently in problem-solving tasks.
CO3 With PO8: as understanding discrete structures enhances problem-solving abilities and reflects self-directed learning, although its direct impact on adaptability to changing demands and goal achievement may be limited.
CO4 With PO8 : as studying propositional logic and Boolean algebra enhances analytical skills and reflects self-directed learning, although its direct impact on adaptability and goal achievement may be limited.
CO5 With PO8: as analyzing proof techniques develops critical thinking skills and reflects self-directed learning, although its direct impact on adaptability and goal achievement may be limited.
CO6 With PO8: as understanding memory allocation contributes to problem-solving abilities and reflects self-directed learning, although its direct impact on adaptability and goal achievement may be limited.
CO7 With PO8: as efficiently implementing data structures demonstrates self-directed learning by acquiring practical skills, adapting to changing demands, and setting and achieving goals independently in problem-solving tasks.

CO1 With PO9: as proficiency in using data structures is essential for effectively organizing and analyzing data using appropriate software, aligning with the demonstration of proficiency in ICT and data analysis.
CO2 With PO9 : as the ability to differentiate between different data structures reflects proficiency in understanding and utilizing appropriate software for data analysis, accessing information sources, and utilizing ICT effectively.
CO3 With PO9: as understanding discrete structures contributes to analytical skills, although its direct impact on using ICT and accessing information sources may be limited.
CO4 With PO9: as studying logic and algebra enhances analytical abilities, although its direct impact on using ICT and accessing information sources may be limited.
CO5 With PO9: as analyzing proof techniques enhances critical thinking skills, although its direct impact on using ICT and accessing information sources may be limited.
CO6 With PO9: as understanding memory allocation contributes to technical skills but may have limited direct relevance to using ICT and accessing information sources.

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

CO1 With PO10: as the ability to utilize data structures effectively may indirectly contribute to engaging effectively in multicultural settings by fostering problem-solving skills and analytical thinking, although its direct impact on leading diverse teams and demonstrating empathy may be limited.
CO2 With PO10 : as the ability to differentiate between different data structures may indirectly support engaging effectively in multicultural settings by promoting critical thinking and adaptability, although its direct impact on leading diverse teams and demonstrating empathy may be limited.
CO3 With PO10 : as understanding discrete structures may enhance analytical skills but may not directly address engagement in multicultural settings or leading diverse teams.
CO4 With PO10 : as studying logic and algebra may improve analytical skills but may not directly contribute to engaging in multicultural settings or leading diverse teams.
CO5 With PO10 : as analyzing proof techniques may enhance critical thinking skills but may not directly address engagement in multicultural settings or leading diverse teams.
CO6 With PO10: as understanding memory allocation contributes to technical skills but may not directly impact engagement in multicultural settings or leading diverse teams.
CO7 With PO10: as efficiently implementing data structures may indirectly support engagement in multicultural settings by fostering problem-solving skills and adaptability, although its direct impact on leading diverse teams and demonstrating empathy may be limited.

CO1 With PO11: as the ability to use data structures effectively may indirectly contribute to addressing ethical issues by promoting structured problem-solving and decision-making, although its direct impact on embracing ethical values and promoting sustainability may be limited.
CO2 With PO11: as the ability to differentiate between different data structures may indirectly support recognizing and addressing ethical issues by enhancing analytical skills and critical thinking, although its direct impact on ethical values and environmental conservation may be limited.
CO3 With PO11: as understanding discrete structures may enhance problem-solving abilities but may not directly address ethical values or environmental conservation.
CO4 With PO11: as studying logic and algebra may improve analytical skills but may not directly contribute to embracing ethical values or promoting sustainability.
CO5 With PO11: as analyzing proof techniques may enhance critical thinking skills but may not directly address ethical values or environmental conservation.
CO6 With PO11: as understanding memory allocation contributes to technical skills but may not directly impact ethical values or environmental conservation.
CO7 With PO11: as efficiently implementing data structures may indirectly support responsible citizenship by promoting effective use of resources and decision-making, although its direct impact on ethical values and environmental conservation may be limited.

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

CO2 With PO12: as the ability to differentiate between different data structures reflects analytical skills and contributes to effective project management and responsibility in work contexts.
CO3 With PO12: as understanding discrete structures enhances problem-solving abilities, which are crucial for managing projects effectively and demonstrating accountability in work contexts.
CO4 With PO12: as studying logic and algebra enhances analytical skills, which are important for independent application of knowledge and skills and effective project management.
CO5 With PO12: as analyzing proof techniques fosters critical thinking and problem-solving abilities, which are relevant for managing projects effectively and demonstrating responsibility in work contexts.
CO6 With PO12: as understanding memory allocation contributes to technical skills necessary for independent application of knowledge and skills and effective project management.
CO7 With PO12: as efficiently implementing data structures demonstrates proficiency in applying knowledge and skills independently, managing projects effectively, and showing responsibility and accountability in work and learning contexts.

CO1 With PO13: as the ability to use data structures effectively can indirectly support community-engaged services by facilitating problem-solving skills, although its direct impact on promoting societal well-being may be limited.
CO2 With PO13: as the ability to differentiate between different data structures reflects analytical skills, which can indirectly contribute to community-engaged services by fostering critical thinking, although its direct impact on promoting societal well-being may be limited.
CO3 With PO13: as understanding discrete structures may enhance problem-solving abilities but may not directly contribute to community-engaged services or promoting societal well-being.
CO4 With PO13: as studying logic and algebra enhances analytical skills but may not directly impact community-engaged services or societal well-being.
CO5 With PO13: as analyzing proof techniques fosters critical thinking skills but may not directly contribute to community-engaged services or promoting societal well-being.
CO6 With PO13 : as understanding memory allocation contributes to technical skills but may not directly impact community-engaged services or societal well-being.
CO7 With PO13: as efficiently implementing data structures demonstrates proficiency in problem-solving, which can indirectly support community-engaged services by facilitating effective solutions, although its direct impact on promoting societal well-being may be limited.

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SYLLABUS (CBCS as per NEP 2020) FOR S. Y. B. Sc. (Computer Science) Sem-III
(w. e. from June, 2024)

Name of the Programme	**:** B.Sc. Computer Science
Program Code	: USCOS
Class	**:** S. Y. B. Sc. (Computer Science)
Semester	**: III**
Course Type	**:** Major (TH)
Course Name	**:** Introduction to Web Technology
Course Code	**:** COS-202-MJM
No. of Lectures	**: 30**
No. of Credits	**: 02**

Prerequisites:

- Basic knowledge of computers and its concepts.

Course Objectives:

1. To construct HTML documents with proper basic structures and by utilizing HTML tags effectively.
2. To implement specific HTML5 elements such as lists, tables, iframes, various layout components and forms.
3. To introduce the basics of CSS and understand its role in styling HTML elements and enhancing web page aesthetics.
4. To apply CSS rules effectively to control the appearance of HTML elements.
5. To design web pages using HTML5 and CSS.
6. To design dynamic, interactive, and elegant Web sites.
7. To analyze a web page and identify its elements and attributes.

Course Outcomes:

CO1: Students will be able to construct HTML documents with proper basic structures and by utilizing HTML tags effectively.
CO2: Students will be able to implement specific HTML5 elements such as lists, tables, iframes, various layout components and forms.
CO3: Students will be able to apply the basics of CSS and understand its role in styling HTML elements and enhancing web page aesthetics.
CO4: Students will be able to apply CSS rules effectively to control the appearance of HTML elements.
CO5: Students will be able to design web pages using HTML5 and CSS.
CO6: Students will be able to design dynamic, interactive, and elegant Web sites.
CO7: Students will be able to analyze and explore a web page and identify its elements and attributes.

Unit	Title and Contents	No. of Lectures
Unit 1	**Introduction to HTML5** **1.1** Difference between HTML & HTML5 **1.2** HTML Document and Basic Structure **1.3** Working with HTML Text, Heading, Paragraph, Formatting, Styles **1.4** Block Level Elements and Inline Elements **1.5** HTML Color **1.6** HTML Hyperlink **1.7** HTML Image	8
Unit 2	**Specific Elements of HTML5** **2.1** HTML Lists **2.2** HTML Tables **2.3** HTML Iframes **2.4** HTML Layout : Header & Footer, Navigation Section, Article and Aside **2.5** Working with Forms and controls	10
Unit 3	**Basics of CSS** **3.1** Introduction of CSS **3.2** CSS Rules **3.3** CSS Selectors and Ways to add Selectors **3.4** CSS Color **3.5** CSS Border **3.6** CSS Background and CSS Display	6
Unit 4	**Working with CSS** **4.1** CSS Margins **4.2** CSS Padding **4.3** CSS Outline **4.4** CSS Links **4.5** CSS Lists **4.6** CSS Tables	6

References:

1. Html & CSS: The Complete Reference, Fifth Edition by Thomas A. Powell and published by McGraw Hill.
2. HTML 5 in simple steps by Kogent Learning Solutions Inc., Publisher Dreamtech Press
3. Headfirst HTML with CSS & XHTML Book by Elisabeth Freeman and Eric Freeman.
4. The Essential Guide to CSS and HTML Web Design Book by Craig Grannell.

Mapping of this course with Programme Outcomes

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

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

Justification of Mapping of PO1 with All CO'S

CO1: PO1: Constructing HTML documents with proper structures and utilizing HTML tags effectively directly demonstrates a profound understanding of foundational theories, principles, and methodologies in web development, aligning strongly with the comprehensive knowledge and understanding of the field of study.
CO2: PO1: Implementing specific HTML5 elements and various layout components requires a deep understanding of foundational concepts and key principles in web development, contributing significantly to the comprehensive knowledge and understanding of the field.
CO3: PO1: Applying the basics of CSS and understanding its role in styling HTML elements enhances the comprehension of foundational theories and methodologies in web design, closely linked with the broader multidisciplinary context of the field of study.
CO4: PO1: Applying CSS rules effectively to control the appearance of HTML elements demonstrates a profound understanding of CSS principles and methodologies, reinforcing the comprehensive knowledge and understanding of the field.
CO5: PO1: Designing web pages using HTML5 and CSS showcases a deep understanding of foundational theories, methodologies, and key concepts in web development, contributing significantly to the broader multidisciplinary context of the field of study.
CO6: PO1: Designing dynamic, interactive, and elegant websites requires a profound understanding of advanced concepts and principles in web development, aligning strongly with the comprehensive knowledge and understanding of the field.
CO7: PO1: Analyzing and exploring web pages to identify their elements and attributes demonstrates a deep understanding of foundational theories and methodologies in web development, reinforcing the comprehensive knowledge and understanding of the field.

Mapping of PO2 with All CO'S

CO1: PO2: Constructing HTML documents with proper structures and utilizing HTML tags effectively aligns closely with practical skills and expertise essential for professional tasks in web development, demonstrating knowledge of industry standards and best practices.
CO2: PO2: Implementing specific HTML5 elements demonstrates practical skills essential for professional tasks in web development, incorporating knowledge of industry standards and best practices to create functional and effective web pages.
CO3: PO2: Applying the basics of CSS to enhance web page aesthetics reflects practical knowledge and expertise in web design, considering industry standards and best practices to create visually appealing websites.
CO4: PO2: Applying CSS rules effectively to control the appearance of HTML elements showcases practical skills in web development, incorporating industry standards and best practices to achieve desired styling outcomes.
CO5: PO2: Designing web pages using HTML5 and CSS demonstrates practical expertise in web development, applying industry standards and best practices to create professional and functional websites.
CO6: PO2: Designing dynamic, interactive, and elegant websites requires practical skills and expertise in web development, incorporating industry standards and best practices to create engaging user experiences.
CO7: PO2: Analyzing and exploring web pages to identify their elements and attributes showcases practical knowledge essential for professional tasks in web development, incorporating industry standards and best practices to understand and manipulate web content effectively.

Mapping of PO3 with All CO'S

CO1: PO3: Constructing HTML documents demonstrates technical proficiency, which is partially related to fostering innovation and understanding business principles but is not directly linked to entrepreneurial mindset or risk management strategies.
CO2: PO3: Implementing specific HTML5 elements showcases technical skills but is only partially related to identifying opportunities and fostering innovation in entrepreneurial contexts.
CO3: PO3: Applying CSS basics to enhance web page aesthetics is partially related to understanding business principles and market dynamics, but it doesn't directly contribute to cultivating an entrepreneurial mindset.
CO4: PO3: Applying CSS rules to control the appearance of HTML elements is partially related to understanding business principles and market dynamics but doesn't directly contribute to fostering innovation or risk management strategies.
CO5: PO3: Designing web pages using HTML5 and CSS demonstrates technical skills but is only partially related to cultivating an entrepreneurial mindset.
CO6: PO3: Designing dynamic, interactive, and elegant websites may indirectly contribute to fostering innovation and understanding market dynamics but is only partially related to cultivating an entrepreneurial mindset.

CO7: PO3: Analyzing and exploring web pages is partially related to identifying opportunities and understanding market dynamics but is not directly linked to fostering innovation or risk management strategies.

Mapping of PO4 with All CO'S

CO1: PO4: Constructing HTML documents and utilizing HTML tags effectively demonstrates technical proficiency and problem-solving skills, directly related to specialized skills and competencies in web development.
CO2: PO4: Implementing specific HTML5 elements requires technical skills and problem-solving abilities, closely related to specialized competencies in web development.
CO3: PO4: Applying CSS basics to enhance web page aesthetics demonstrates technical proficiency and analytical abilities, directly relevant to specialized skills and competencies in web design.
CO4: PO4: Applying CSS rules effectively to control the appearance of HTML elements showcases technical skills and problem-solving abilities, directly related to specialized competencies in web development.
CO5: PO4: Designing web pages using HTML5 and CSS requires technical proficiency, problem-solving skills, and effective communication, all of which are specialized competencies in web development.
CO6: PO4: Designing dynamic, interactive, and elegant websites showcases technical skills, analytical abilities, and innovation, directly relevant to specialized competencies in web development.
CO7: PO4: Analyzing and exploring web pages demonstrates analytical abilities, problem-solving skills, and adaptability, all of which are specialized competencies in web development.

Mapping of PO5 with All CO'S

CO1: PO5: Constructing HTML documents and utilizing HTML tags effectively requires problem-solving and analytical reasoning, directly linked to the capacity for application and problem-solving.
CO2: PO5: Implementing specific HTML5 elements involves problem-solving and analytical reasoning to select appropriate elements and layouts, directly contributing to the capacity for application and problem-solving.
CO3: PO5: Applying CSS basics to enhance web page aesthetics requires analytical reasoning and adaptability, directly relevant to problem-solving and analytical reasoning in practical web development scenarios.
CO4: PO5: Applying CSS rules effectively to control the appearance of HTML elements involves problem-solving and analytical reasoning to achieve desired outcomes, directly related to the capacity for application and problem-solving.

CO5: PO5: Designing web pages using HTML5 and CSS necessitates problem-solving, analytical reasoning, and creativity, directly contributing to the capacity for application and problem-solving in web development.
CO6: PO5: Designing dynamic, interactive, and elegant websites requires problem-solving, creativity, and adaptability, directly linked to the capacity for application, problem-solving, and analytical reasoning.
CO7: PO5: Analyzing and exploring a web page demonstrates problem-solving, analytical reasoning, and adaptability, directly relevant to the capacity for application, problem-solving, and analytical reasoning in web development contexts.

Mapping of PO6 with All CO'S

CO1: PO6: Constructing HTML documents and utilizing HTML tags effectively may involve communication when collaborating with team members to ensure consistency and clarity in code, moderately related to effective communication in diverse teams.
CO2: PO6: Implementing specific HTML5 elements requires collaboration and communication within teams to discuss layout components and functionalities, moderately related to effective communication and collaboration.
CO3: PO6: Applying CSS basics to enhance web page aesthetics may involve communicating design preferences or requirements, moderately related to effective communication in conveying visual concepts.
CO4: PO6: Applying CSS rules effectively may involve communication with team members to ensure consistency in styling across web pages, moderately related to effective communication and collaboration.
CO5: PO6: Designing web pages using HTML5 and CSS may involve collaboration and communication to discuss design choices and functionalities, moderately related to effective communication and collaboration.
CO6: PO6: Designing dynamic, interactive, and elegant websites often requires collaboration and communication to align on design goals and functionalities, strongly related to effective communication and collaboration.
CO7: PO6: Analyzing and exploring a web page may involve communication within teams to discuss findings and implications for design changes, moderately related to effective communication and collaboration.

Mapping of PO7 with All CO'S

CO1: PO7: Constructing HTML documents and utilizing HTML tags effectively may involve some observational skills when analyzing existing web pages for inspiration or research purposes, partially related to research-related skills.
CO2: PO7: Implementing specific HTML5 elements requires some observational skills when analyzing different websites for functionality and layout ideas, partially related to research-related skills.

CO3: PO7: Applying CSS basics to enhance web page aesthetics involves observational skills when evaluating design choices, partially related to research-related skills.
CO4: PO7: Applying CSS rules effectively may involve some observational skills when examining the impact of styling changes on web page appearance, partially related to research-related skills.
CO5: PO7: Designing web pages using HTML5 and CSS may involve observational skills when researching design trends or analyzing competitor websites, partially related to research-related skills.
CO6: PO7: Designing dynamic, interactive, and elegant websites involves observational skills when researching user preferences and behaviors, partially related to research-related skills.
CO7: PO7: Analyzing and exploring a web page demonstrates strong observational and inquiry skills, directly related to research-related skills in data collection and analysis.

Mapping of PO8 with All CO'S

CO1: PO8: Constructing HTML documents and utilizing HTML tags effectively requires self-directed learning and goal setting to acquire and apply new knowledge independently.
CO2: PO8: Implementing specific HTML5 elements involves self-directed learning and adaptability to learn new techniques and functionalities independently.
CO3: PO8: Applying the basics of CSS and understanding its role in styling HTML elements necessitates self-directed learning and goal setting to master CSS techniques independently.
CO4: PO8: Applying CSS rules effectively requires self-directed learning and adaptability to keep up with evolving CSS standards and techniques independently.
CO5: PO8: Designing web pages using HTML5 and CSS involves self-directed learning and goal setting to integrate HTML and CSS effectively to achieve design goals independently.
CO6: PO8: Designing dynamic, interactive, and elegant websites requires continuous self-directed learning and adaptability to incorporate new technologies and design trends independently.
CO7: PO8: Analyzing and exploring a web page demonstrates self-directed learning and adaptability to acquire and apply analytical skills independently.

Mapping of PO9 with All CO'S

CO1: PO9: Constructing HTML documents and utilizing HTML tags effectively demonstrate proficiency in using ICT and accessing information sources to create web content.
CO2: PO9: Implementing specific HTML5 elements involves proficiency in using ICT and accessing information sources to select and integrate appropriate elements into web pages.
CO3: PO9: Applying the basics of CSS to enhance web page aesthetics requires proficiency in using ICT and accessing information sources to learn and apply styling techniques.
CO4: PO9: Applying CSS rules effectively involves proficiency in using ICT to manipulate and control the appearance of HTML elements.

CO5: PO9: Designing web pages using HTML5 and CSS demonstrates proficiency in using ICT to create functional and aesthetically pleasing websites.
CO6: PO9: Designing dynamic, interactive, and elegant websites showcases proficiency in using ICT to integrate advanced features and technologies into web design.
CO7: PO9: Analyzing and exploring a web page demonstrates proficiency in using ICT to navigate and understand web content and identify its elements and attributes.

Mapping of PO10 with All CO'S

CO1: PO10: Constructing HTML documents and utilizing HTML tags effectively doesn't directly involve engagement in multicultural settings or demonstrating empathy and understanding of diverse perspectives.
CO2: PO10: Implementing specific HTML5 elements may involve collaboration with diverse teams, but it doesn't inherently demonstrate multicultural competence or empathy.
CO3: PO10: Applying CSS to enhance web page aesthetics doesn't directly relate to engagement in multicultural settings or demonstrating empathy.
CO4: PO10: Applying CSS rules effectively also doesn't directly involve engagement in multicultural settings or demonstrating empathy.
CO5: PO10: Designing web pages using HTML5 and CSS may involve considering diverse user perspectives, but it doesn't inherently demonstrate engagement in multicultural settings or empathy.
CO6: PO10: Designing dynamic, interactive, and elegant websites may involve collaboration with diverse teams, but it doesn't directly demonstrate multicultural competence or empathy.
CO7: PO10: Analyzing and exploring a web page may involve considering diverse user perspectives, but it doesn't inherently demonstrate engagement in multicultural settings or empathy.

Mapping of PO11 with All CO'S

CO1: PO11: Constructing HTML documents and utilizing HTML tags effectively doesn't inherently involve embracing ethical and moral values, practicing responsible citizenship, or addressing environmental issues.
CO2: PO11: Implementing specific HTML5 elements may involve considering accessibility standards, but it doesn't directly relate to promoting sustainability or environmental conservation.
CO3: PO11: Applying CSS to enhance web page aesthetics doesn't directly relate to embracing ethical values or promoting environmental awareness.
CO4: PO11: Applying CSS rules effectively also doesn't directly involve embracing ethical values or promoting environmental awareness.
CO5: PO11: Designing web pages using HTML5 and CSS may involve considering the environmental impact of design choices, but it doesn't inherently promote sustainability or environmental conservation.
CO6: PO11: Designing dynamic, interactive, and elegant websites may involve considering user experience, but it doesn't directly relate to embracing ethical values or promoting environmental awareness.

CO7: PO11: Analyzing and exploring a web page may involve considering user needs, but it doesn't inherently involve embracing ethical values or promoting environmental awareness.

Mapping of PO12 with All CO'S

CO1: PO12: Constructing HTML documents and utilizing HTML tags effectively demonstrates autonomy and responsibility in applying knowledge and skills independently in web development projects.

CO2: PO12: Implementing specific HTML5 elements requires autonomy and responsibility in managing projects effectively and applying skills independently to achieve project goals.

CO3: PO12: Applying CSS to enhance web page aesthetics demonstrates autonomy and responsibility in independently managing design aspects of web development projects.

CO4: PO12: Applying CSS rules effectively showcases autonomy and responsibility in managing the appearance of HTML elements independently within web development projects.

CO5: PO12: Designing web pages using HTML5 and CSS requires autonomy and responsibility in independently managing the entire web development process.

CO6: PO12: Designing dynamic, interactive, and elegant websites demonstrates autonomy and responsibility in managing complex web development projects independently.

CO7: PO12: Analyzing and exploring a web page showcases autonomy and responsibility in independently evaluating and understanding web content within work and learning contexts.

Mapping of PO13 with All CO'S

CO1: PO13: Constructing HTML documents and utilizing HTML tags effectively doesn't directly involve community engagement or promoting societal well-being.

CO2: PO13: Implementing specific HTML5 elements may involve designing web pages for community organizations or initiatives, but it doesn't inherently involve active participation in community-engaged services and activities.

CO3: PO13: Applying CSS to enhance web page aesthetics doesn't directly relate to community engagement or promoting societal well-being.

CO4: PO13: Applying CSS rules effectively also doesn't directly involve community engagement or promoting societal well-being.

CO5: PO13: Designing web pages using HTML5 and CSS may involve creating websites for community projects, but it doesn't inherently involve active participation in community-engaged services and activities.

CO6: PO13: Designing dynamic, interactive, and elegant websites may involve creating platforms for community initiatives, but it doesn't directly demonstrate active participation in community-engaged services and activities.

CO7: PO13: Analyzing and exploring a web page may involve evaluating community-related content, but it doesn't inherently involve active participation in community-engaged services and activities.

SYLLABUS (CBCS as per NEP 2020) FOR S. Y. B. Sc. (Computer Science) Sem-III
(w. e. from June, 2024)

Name of the Programme	**:** B. Sc. Computer Science
Program Code	: USCOS
Class	**:** S. Y. B. Sc. (Computer Science)
Semester	**: III**
Course Type	**:** Major (TH)
Course Name	**:** Software Engineering Principles and Techniques
Course Code	**:** COS-203-MJM
No. of Lectures	**: 30**
No. of Credits	**: 02**

Prerequisites:

- Basic knowledge of DBMS, RDBMS and pl-pgSql.
- Knowledge of HTML5 and CSS.

Course Objective:

1. To learn system, its elements, characteristics and system types.
2. To acquire the complete and thorough knowledge of software engineering principles and practices.
3. To learn and understand the system development life cycle thoroughly.
4. To develop skills of collecting, analyzing and evaluating end user requirement data.
5. To understand various process models used in software engineering.
6. To understand relevant methods and procedures to be used while doing software project.
7. To build software documentation and applications with the help of concepts, principles and techniques learnt from this course.

Course Outcome:

CO1 : Students will be able to identify the type of system, its elements and will be able to find out the solution for the real- life problems or case studies according to the system type.

CO2 : Students will be able to implement the complete and thorough knowledge of software engineering principles and practices.

CO3 : Students will be able to master over the complete process of Software Development Life Cycle (SDLC).

CO4 : Students will be able to develop skills of collecting, analyzing and evaluating end user requirement data.

CO5 : Students will be able to explore the Process Models of software engineering in detail.

CO6 : Students will be able to implement relevant methods and procedures to be used while doing their software project.

CO7 : Students will be able to build software documentation and applications with the help of concepts, principles and techniques learnt from this course.

Unit	Title and Contents	No. of Lectures
Unit 1	**System Concepts** **1.1** System Definition **1.2** Characteristics of a System: Organization, Subsystem, Interaction, Interdependence, Integration, Central objective, Standards, Black box. **1.3** Elements of a system: Outputs, Inputs, Processor(s), Control, Feedback, Environment, Boundaries, Interface. **1.4** Types of Systems: Physical & Abstract Systems, Open & Closed Systems, Adaptive and Non-adaptive systems, Permanent or Temporary Systems, Deterministic or Probabilistic Systems Computer-based Systems (MIS : Management Information System & DSS : Decision Support System)	**06**
Unit 2	**Software and Software Engineering** **2.1** The Nature of Software **2.1.1** Defining Software **2.1.2** Software Application Domains **2.1.3** Legacy Software **2.2** Software Engineering **2.3** Software Engineering Practice **2.3.1** The Essence of Practice **2.3.2** General Principles **2.4** Fact Finding Techniques **2.4.1** Interview **2.4.2** Questionnaire **2.4.3** Record Review **2.4.4** Observation	**07**
Unit 3	**System Development Life Cycle (SDLC)** **3.1** Introduction **3.2** Activities of SDLC **3.2.1** Preliminary Investigation (Request Clarification, Feasibility Study, Request Approval) **3.2.2** Determination of System Requirements **3.2.3** Design of System **3.2.4** Development of Software **3.2.5** System Testing (Unit Testing, Integration testing, System Testing) **3.2.6** System Implementation &Evaluation **3.2.7** System Maintenance **3.3** Physical Data Flow Diagram **3.3.1** Notations	**10**

	3.3.2 Drawing a Context Diagram **3.3.3** Exploding a Context diagram into Greater detail (1st level, 2nd Level DFD etc.)	
Unit 4	**Process Models** **4.1** A Generic Process Model **4.2** Prescriptive Process Models **4.2.1** The Waterfall Model **4.2.2** Incremental Process Models **4.2.3** Evolutionary Process Models **4.2.3.1** Prototyping **4.2.3.2** Spiral Model **4.2.4** Concurrent Models	**07**

Reference Books:

1. Prof. S. Parthasarathy, Prof. B. W. Khalkar, *System Analysis, Design and Introduction to Software Engineering*., Everest Publishing House.
2. Elias M. Awad. *System Analysis and Design (Second Edition)*. Galgotia Publications Pvt. Ltd.
3. Roger Pressman. *Software Engineering: A Practitioner's Approach (Seventh Edition)*. McGraw Hill International Edition.
4. James A. Senn. *Analysis and Design of Information Systems (Second Edition)*. McGraw Hill International Editions.

Mapping of this course 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	3	3	2	2	2	3	2	2	3	3
CO2	3	3	2	3	3	2	2	2	3	2	2	3	2
CO3	3	3	2	3	3	2	2	2	3	2	2	3	2
CO4	3	3	2	3	3	2	3	2	3	2	2	3	2
CO5	3	3	2	3	3	2	2	2	3	2	2	3	2
CO6	3	3	2	3	3	2	2	2	3	2	2	3	2
CO7	3	3	2	3	3	2	3	2	3	2	2	3	2

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

Justification of Mapping of PO1 with All CO'S

CO1: PO1: Identifying system types, elements, and solving real-life problems aligns directly with possessing a profound understanding of the field of study, as it involves applying foundational theories and methodologies in practical contexts.
CO2: PO1: Implementing software engineering principles and practices reflects a profound understanding of the field, encompassing foundational theories and methodologies in software development.
CO3: PO1: Mastering the Software Development Life Cycle demonstrates a comprehensive understanding of the field, including foundational theories, principles, and methodologies involved in software development processes.
CO4: PO1: Developing skills in collecting, analyzing, and evaluating end-user requirement data is crucial for a profound understanding of the field, as it involves applying key concepts in requirements engineering and user-centered design.
CO5: PO1: Exploring process models in detail contributes to a profound understanding of the field by examining foundational theories and methodologies used in software development processes.
CO6: PO1: Implementing relevant methods and procedures in software projects demonstrates an understanding of foundational theories and methodologies in software engineering applied in practical project scenarios.
CO7: PO1: Building software documentation and applications with learned concepts, principles, and techniques directly aligns with possessing a profound understanding of the field, as it involves applying foundational theories and methodologies to develop software artifacts.

Mapping of PO2 with All CO'S

CO1: PO2: Identifying system types, elements, and solving real-life problems aligns directly with acquiring practical skills and expertise essential for professional tasks, demonstrating the ability to apply knowledge in real-world scenarios.
CO2: PO2: Implementing software engineering principles and practices reflects practical knowledge essential for professional tasks, as it involves applying industry standards and best practices in software development.
CO3: PO2: Mastering the Software Development Life Cycle is crucial practical knowledge for professional tasks, as it involves understanding and applying industry-standard processes in software development.
CO4: PO2: Developing skills in collecting, analyzing, and evaluating end-user requirement data is essential practical knowledge for professional tasks, demonstrating proficiency in understanding user needs and translating them into software solutions.
CO5: PO2: Exploring process models in detail contributes to practical knowledge essential for professional tasks, as it involves understanding different methodologies and frameworks used in software development.
CO6: PO2: Implementing relevant methods and procedures in software projects demonstrates practical expertise in applying knowledge to real-world scenarios, essential for professional tasks.

CO7: PO2: Building software documentation and applications with learned concepts, principles, and techniques directly aligns with acquiring practical skills essential for professional tasks in software development.

Mapping of PO3 with All CO'S

CO1: PO3: Identifying system types, elements, and solving real-life problems can foster an entrepreneurial mindset by recognizing opportunities and innovative solutions.

CO2: PO3: Implementing software engineering principles and practices can contribute to understanding business principles and fostering innovation in software development.

CO3: PO3: Mastering the Software Development Life Cycle is crucial for understanding market dynamics and risk management strategies in software projects.

CO4: PO3: Developing skills in collecting, analyzing, and evaluating end-user requirement data is essential for understanding customer needs and identifying market opportunities.

CO5: PO3: Exploring process models in detail can provide insights into innovative approaches to software development, contributing to an entrepreneurial mindset.

CO6: PO3: Implementing relevant methods and procedures in software projects can enhance adaptability and innovation, key aspects of an entrepreneurial mindset.

CO7: PO3: Building software documentation and applications requires understanding of business principles and customer needs, contributing to an entrepreneurial mindset.

Mapping of PO4 with All CO'S

CO1: PO4: Identifying system types and solving real-life problems demonstrates proficiency in problem-solving and technical skills, relevant to the field of study.

CO2: PO4: Implementing software engineering principles and practices showcases proficiency in technical skills and analytical abilities.

CO3: PO4: Mastering the Software Development Life Cycle reflects proficiency in problem-solving, effective communication, and leadership, essential competencies in the field.

CO4: PO4: Developing skills in collecting, analyzing, and evaluating end-user requirement data demonstrates proficiency in analytical abilities and problem-solving relevant to the field.

CO5: PO4: Exploring process models in detail contributes to specialized skills in software engineering and enhances problem-solving abilities.

CO6: PO4: Implementing relevant methods and procedures in software projects demonstrates proficiency in technical skills and problem-solving relevant to the field.

CO7: PO4: Building software documentation and applications requires proficiency in technical skills, effective communication, and problem-solving abilities, relevant to the field.

Mapping of PO5 with All CO'S

CO1: PO5: Identifying system types and solving real-life problems demonstrate the capacity for application, problem-solving, and analytical reasoning, requiring critical thinking and adaptability.

CO2: PO5: Implementing software engineering principles and practices involves applying learned concepts in practical settings, solving complex problems, and analyzing data effectively.

CO3: PO5: Mastering the Software Development Life Cycle requires applying learned concepts to practical settings, solving complex problems, and analyzing data effectively throughout the development process.
CO4: PO5: Developing skills in collecting, analyzing, and evaluating end-user requirement data demonstrates the capacity for application, problem-solving, and analytical reasoning, essential for effective software development.
CO5: PO5: Exploring process models in detail enhances the capacity for application, problem-solving, and analytical reasoning by providing insights into different methodologies and frameworks used in software development.
CO6: PO5: Implementing relevant methods and procedures in software projects requires applying learned concepts to practical settings, enhancing problem-solving abilities and analytical reasoning.
CO7: PO5: Building software documentation and applications with learned concepts and principles demonstrates the capacity for application, problem-solving, and analytical reasoning, as it involves applying knowledge effectively in real-world scenarios.

Mapping of PO6 with All CO'S

CO1: PO6: Identifying system types and solving real-life problems require effective communication of complex information to stakeholders and team members.
CO2: PO6: Implementing software engineering principles and practices involves communicating technical concepts effectively to team members and stakeholders.
CO3: PO6: Mastering the Software Development Life Cycle entails communicating project progress, requirements, and outcomes to diverse teams and stakeholders.
CO4: PO6: Developing skills in collecting, analyzing, and evaluating end-user requirement data involves effective communication with clients and team members to ensure accurate understanding and interpretation of requirements.
CO5: PO6: Exploring process models in detail may involve communicating complex methodologies to team members and stakeholders for effective collaboration.
CO6: PO6: Implementing relevant methods and procedures in software projects requires clear communication to ensure team members understand their roles and responsibilities.
CO7: PO6: Building software documentation and applications involves effective communication of technical concepts and project requirements to team members for successful implementation.

Mapping of PO7 with All CO'S

CO1: PO7: Identifying system types and solving real-life problems may involve observational and inquiry skills, especially in gathering relevant data and formulating research questions related to system analysis.
CO2: PO7: Implementing software engineering principles and practices may require utilizing appropriate methodologies for software development, which can overlap with research-related skills in terms of data collection and analysis.
CO3: PO7: Mastering the Software Development Life Cycle involves understanding and applying methodologies for project management and software development, which may include elements of research methodology.

CO4: PO7: Developing skills in collecting, analyzing, and evaluating end-user requirement data directly aligns with research-related skills in data collection and analysis.
CO5: PO7: Exploring process models in detail may involve research-related skills in terms of analyzing different methodologies and their effectiveness.
CO6: PO7: Implementing relevant methods and procedures in software projects may involve utilizing research-based approaches for problem-solving and decision-making.
CO7: PO7: Building software documentation and applications may require research-related skills in terms of gathering information, analyzing requirements, and effectively reporting findings.

Mapping of PO8 with All CO'S

CO1: PO8: Identifying system types and solving real-life problems require continuous learning and adaptability to new challenges and scenarios.
CO2: PO8: Implementing software engineering principles and practices involves continuous learning and staying updated with evolving technologies and methodologies.
CO3: PO8: Mastering the Software Development Life Cycle requires the ability to learn new processes and methodologies as per project requirements.
CO4: PO8: Developing skills in collecting, analyzing, and evaluating end-user requirement data involves continuous learning and improvement in understanding user needs.
CO5: PO8: Exploring process models in detail involves learning new concepts and methodologies in software engineering.
CO6: PO8: Implementing relevant methods and procedures in software projects requires continuous learning and adaptation to changing project requirements.
CO7: PO8: Building software documentation and applications involves learning and applying new concepts and techniques learned from the course.

Mapping of PO9 with All CO'S

CO1: PO9: Identifying system types and solving real-life problems often requires proficiency in using ICT and accessing information sources for research and analysis.
CO2: PO9: Implementing software engineering principles and practices necessitates proficiency in using appropriate software tools and technologies.
CO3: PO9: Mastering the Software Development Life Cycle involves utilizing various digital tools and technologies throughout the development process.
CO4: PO9: Developing skills in collecting, analyzing, and evaluating end-user requirement data involves utilizing appropriate software tools for data analysis.
CO5: PO9: Exploring Process Models of software engineering may involve utilizing software tools for modeling and simulation.
CO6: PO9: Implementing relevant methods and procedures in software projects often requires proficiency in using specific software tools and technologies.
CO7: PO9: Building software documentation and applications involves applying digital and technological skills acquired during the course to effectively develop software products.

Mapping of PO10 with All CO'S

CO1: PO10: Identifying system types and solving real-life problems often require understanding diverse perspectives and engaging effectively in multicultural settings.

CO2: PO10: Implementing software engineering principles and practices may involve leading diverse teams and respecting diverse perspectives to achieve project goals.

CO3: PO10: Mastering the Software Development Life Cycle entails working with diverse teams and understanding the perspectives of stakeholders from different cultural backgrounds.

CO4: PO10: Developing skills in collecting, analyzing, and evaluating end-user requirement data may require empathy and understanding of users' perspectives and emotions.

CO5: PO10: Exploring Process Models of software engineering may involve considering diverse perspectives and understanding how different cultures approach software development.

CO6: PO10: Implementing relevant methods and procedures in software projects may require collaboration with diverse teams and respecting their perspectives.

CO7: PO10: Building software documentation and applications involves understanding diverse user needs and perspectives to create inclusive and user-friendly products.

Mapping of PO11 with All CO'S

CO1: PO11: Identifying system types and solving real-life problems may involve recognizing and addressing ethical issues related to technology use and development.

CO2: PO11: Implementing software engineering principles and practices should include considerations for ethical values and responsibilities in software development.

CO3: PO11: Mastering the Software Development Life Cycle should encompass understanding and adhering to ethical standards and principles throughout the development process.

CO4: PO11: Developing skills in collecting, analyzing, and evaluating end-user requirement data may involve considering ethical implications and values in addressing user needs.

CO5: PO11: Exploring Process Models of software engineering may include evaluating environmental impacts and sustainability considerations in software development processes.

CO6: PO11: Implementing relevant methods and procedures in software projects should consider ethical values and environmental sustainability in project management and execution.

CO7: PO11: Building software documentation and applications should incorporate ethical considerations and promote sustainability through environmentally friendly practices and solutions.

Mapping of PO12 with All CO'S

CO1: PO12: Identifying system types and solving real-life problems require autonomy and responsibility in decision-making and problem-solving.

CO2: PO12: Implementing software engineering principles and practices involves autonomy and responsibility in applying knowledge effectively.

CO3: PO12: Mastering the Software Development Life Cycle requires managing projects effectively and demonstrating accountability in meeting project goals.

CO4: PO12: Developing skills in collecting, analyzing, and evaluating end-user requirement data entails autonomy and responsibility in understanding user needs accurately.
CO5: PO12: Exploring Process Models of software engineering involves autonomy and responsibility in selecting appropriate methodologies for projects.
CO6: PO12: Implementing relevant methods and procedures in software projects demands autonomy and responsibility in project management and execution.
CO7: PO12: Building software documentation and applications requires autonomy and responsibility in applying learned concepts effectively to achieve desired outcomes.

Mapping of PO13 with All CO'S

CO1: PO13: Identifying real-life problems and finding solutions align with community engagement and service, which involves addressing societal needs.
CO2: PO13: Implementing software engineering principles and practices can indirectly contribute to community well-being by developing solutions to societal challenges.
CO3: PO13: Mastering the Software Development Life Cycle can enhance graduates' ability to create software solutions that benefit communities.
CO4: PO13: Developing skills in collecting, analyzing, and evaluating end-user requirements can support the creation of software solutions that address community needs.
CO5: PO13: Exploring Process Models of software engineering may indirectly contribute to community engagement by facilitating the development of effective software solutions.
CO6: PO13: Implementing methods and procedures in software projects may indirectly contribute to community engagement by producing software solutions that serve societal needs.
CO7: PO13: Building software documentation and applications can support community engagement by developing tools or systems that benefit society.

SYLLABUS (CBCS as per NEP 2020) FOR S. Y. B. Sc. (Computer Science) Sem-III
(w. e. from June, 2024)

Name of the Programme	**:** B.Sc. Computer Science
Program Code	: USCOS
Class	**:** S.Y.B.Sc. (Computer Science)
Semester	**:** III
Course Type	**:** Major (PR)
Course Name	**:** Lab Course I–Based on COS-201-MJM, COS-202-MJM
Course Code	**:** COS-204-MJM
No. of Lectures	**: 30**
No. of Credits	**: 02**

Course Objectives:

1. To implement different data structures.
2. To learn static & dynamic memory allocation.
3. To learn technologies like HTML5 and CSS.
4. To Apply HTML5 technologies to design dynamic, interactive and elegant Web Sites.
5. To Analyze a web page and identify its elements and attributes.
6. To create web pages using Cascading Style Sheets.

Course Outcomes:

CO1 : Students will efficiently implement the different data structures.
CO2 : Students will understand & apply basics of memory allocation and how it used.
CO3 : Students will analyse and study various proof techniques.
CO4 : Students will practically implement technologies like HTML5 and CSS
CO5 : Students will Apply HTML5 technologies to design dynamic, interactive and elegant Web Sites.
CO6 : Students will Analyze a web page and identify its elements and attributes.
CO7 : Students will Create web pages using Cascading Style Sheets.

Assignments	
Sr. No.	**Assignment Name**
Assignment 1	**SET A** : Calculating Time & Space Complexity **SET B**: Be acquainted with elements, Tags.
Assignment 2	**SET A** : Applications of Array - Bubble sort **SET B**: Be acquainted with advanced text formatting.
Assignment 3	**SET A** : Applications of Array - Insertion sort **SET B**: Practical implementation of all kinds of List in HTML5.

Assignment 4	**SET A** : Applications of Array - Merge sort **SET B**: Practical implementation of all kinds of Tables in HTML5.
Assignment 5	**SET A** : Applications of Array - Quick Sort **SET B** : Practical implementation of all kinds of Tables in HTML5.
Assignment 6	**SET A** : Applications of Array - Linear Search **SET B** : Designing of webpage with the help of iframes.
Assignment 7	**SET A** : Applications of Array - Binary search **SET B** : Designing of webpage with the help of iframes.
Assignment 8	**SET A** : Operations on Linked List **SET B** : Practical implementation of Forms and its various input types.
Assignment 9	**SET A** : Operations on Linked List **SET B** : Practical implementation of Forms and its various input types.
Assignment 10	**SET A** : Operations on Linked List **SET B** : Practical implementation of Forms and its elements.
Assignment 11	**SET A** : Applications of Linked List – polynomial manipulation **SET B** : Practical implementation of Forms and its elements.
Assignment 12	**SET A** : Static implementation of Stack **SET B** : Designing and Implementation of CSS for Webpages.
Assignment 13	**SET A** : Dynamic implementation of Stack **SET B** : Designing and Implementation of CSS for Webpages.
Assignment 14	**SET A** : Expression Conversion & Evaluation **SET B** : Designing and Implementation of CSS for Lists.
Assignment 15	**SET A** : Simulating recursion using stack **SET B** : Designing and Implementation of CSS for Tables.

References:

1. Html & CSS: The Complete Reference, Fifth Edition by Thomas A. Powell and published by McGraw Hill.
2. HTML 5 in simple steps by Kogent Learning Solutions Inc., Publisher Dreamtech Press
3. Headfirst HTML with CSS & XHTML Book by Elisabeth Freeman and Eric Freeman.
4. The Essential Guide to CSS and HTML Web Design Book by Craig Grannell.

Mapping of this course with Programme Outcomes

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

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

Justification of Mapping of PO1 with All CO'S

CO1: PO1: Efficient implementation of data structures requires a profound understanding of foundational theories and methodologies within the field of study.

CO2: PO1: Understanding memory allocation basics contributes to a broader multidisciplinary context within the field of study, although it's not as directly related to foundational theories.

CO3: PO1: Analyzing proof techniques involves understanding foundational theories and methodologies within the field of study, aligning closely with the comprehensive knowledge and understanding goal.

CO4: PO1: Implementing HTML5 and CSS technologies is only partially related to the profound understanding of foundational theories and key concepts in a broader multidisciplinary context.

CO5: PO1: Applying HTML5 technologies to design dynamic websites requires foundational knowledge but may not cover the broader multidisciplinary context as deeply as other objectives.

CO6: PO1: Analyzing web page elements and attributes contributes to understanding foundational concepts, albeit with a moderate relationship to broader multidisciplinary context.

CO7: PO1: Creating web pages using CSS aligns closely with foundational theories and principles within the field of study, supporting the goal of comprehensive knowledge and understanding.

Mapping of PO2 with All CO'S

CO1: PO2: Efficient implementation of data structures is a practical skill essential for professional tasks within the field, aligning closely with practical, professional, and procedural knowledge.

CO2: PO2: Understanding memory allocation basics is crucial for efficient programming and aligns with practical skills necessary for professional tasks.

CO3: PO2: Analyzing proof techniques enhances problem-solving abilities, which are essential for professional tasks but may not directly relate to industry standards and regulations.

CO4: PO2: Practical implementation of technologies like HTML5 and CSS is directly related to industry standards and best practices in web development, supporting practical, professional, and procedural knowledge.

CO5: PO2: Applying HTML5 technologies to design dynamic websites requires practical skills aligned with industry standards and best practices in web development.

CO6: PO2: Analyzing web page elements and attributes contributes to practical skills in web development but may not directly relate to industry standards and regulations.

CO7: PO2: Creating web pages using CSS directly aligns with industry standards and best practices in web development, supporting practical, professional, and procedural knowledge.

Mapping of PO3 with All CO'S

CO1: PO3: While efficient implementation of data structures is important for technical proficiency, it is not directly related to cultivating an entrepreneurial mindset or understanding business principles.

CO2: PO3: Understanding memory allocation basics is fundamental for programming but doesn't directly contribute to cultivating an entrepreneurial mindset or understanding business principles.

CO3: PO3: Analyzing proof techniques is essential for problem-solving skills but does not directly relate to entrepreneurial mindset or business principles.

CO4: PO3: Practical implementation of technologies like HTML5 and CSS could contribute to understanding market dynamics and fostering innovation in web development, though indirectly.

CO5: PO3: Applying HTML5 technologies to design dynamic websites may indirectly foster innovation and understanding of market dynamics but is not directly linked to entrepreneurial mindset or business principles.

CO6: PO3: Analyzing web page elements and attributes is important for technical proficiency but does not directly relate to cultivating an entrepreneurial mindset or understanding business principles.

CO7: PO3: Creating web pages using CSS may indirectly contribute to understanding market dynamics and fostering innovation in web development, though indirectly.

Mapping of PO4 with All CO'S

CO1: PO4: Efficient implementation of data structures requires technical skills, analytical abilities, and problem-solving, directly relevant to specialized skills and competencies.

CO2: PO4: Understanding memory allocation and its application involves technical proficiency and problem-solving skills, crucial for specialized skills and competencies.
CO3: PO4: Analyzing proof techniques enhances analytical abilities and problem-solving skills, directly relevant to specialized skills and competencies.
CO4: PO4: Practical implementation of HTML5 and CSS technologies contributes to technical skills and problem-solving, though may not directly address all aspects of effective communication and leadership.
CO5: PO4: Applying HTML5 technologies to design websites requires technical proficiency and problem-solving skills, contributing to specialized skills and competencies, though communication and leadership aspects may be less emphasized.
CO6: PO4: Analyzing web page elements and attributes enhances technical skills and analytical abilities, directly relevant to specialized skills and competencies.
CO7: PO4: Creating web pages using CSS requires technical skills and problem-solving, contributing to specialized skills and competencies, though communication and leadership aspects may be less emphasized.

Mapping of PO5 with All CO'S

CO1: PO5: Efficient implementation of data structures requires problem-solving skills, analytical reasoning, and adaptability, closely aligning with the capacity for application, problem-solving, and analytical reasoning.
CO2: PO5: Understanding memory allocation involves problem-solving and analytical reasoning, essential for applying concepts in practical settings and solving complex problems.
CO3: PO5: Analyzing proof techniques enhances analytical reasoning and critical thinking, directly relevant to problem-solving and analytical reasoning.
CO4: PO5: Practical implementation of HTML5 and CSS technologies requires creativity and adaptability, contributing to problem-solving and analytical reasoning, though not as directly related as other objectives.
CO5: PO5: Applying HTML5 technologies to design dynamic websites involves critical thinking, creativity, and adaptability, closely aligning with problem-solving and analytical reasoning.
CO6: PO5: Analyzing web page elements and attributes requires critical thinking and analytical reasoning, directly relevant to problem-solving and analytical reasoning.
CO7: PO5: Creating web pages using CSS requires problem-solving skills and adaptability, contributing to the capacity for application, problem-solving, and analytical reasoning, though not as directly related as other objectives.

Mapping of PO6 with All CO'S

CO1: PO6: Efficient implementation of data structures may not directly contribute to communication skills and collaboration unless effectively communicated and collaborated upon within a team.
CO2: PO6: Understanding memory allocation basics may not directly enhance communication skills and collaboration.
CO3: PO6: Analyzing proof techniques may not directly improve communication skills and collaboration.

CO4: PO6: Practical implementation of HTML5 and CSS technologies may require communication and collaboration within a team, although it's not the primary focus.
CO5: PO6: Applying HTML5 technologies to design websites involves effective communication of ideas and collaboration with clients or team members, directly relevant to communication skills and collaboration.
CO6: PO6: Analyzing web page elements and attributes may involve communicating findings to team members and collaborating on web design projects.
CO7: PO6: Creating web pages using CSS may involve collaboration with designers and developers, contributing to communication skills and collaboration within a team.

Mapping of PO7 with All CO'S

CO1: PO7: While implementing data structures may involve problem-solving and analysis, it's not directly related to observational skills, inquiry, or research methodologies.
CO2: PO7: Understanding memory allocation basics is crucial for programming but doesn't directly contribute to research-related skills such as observational skills, inquiry, or research methodologies.
CO3: PO7: Analyzing proof techniques is important for problem-solving but may not directly contribute to research-related skills.
CO4: PO7: Practical implementation of HTML5 and CSS technologies may not directly involve research-related skills unless applied within a research context.
CO5: PO7: Applying HTML5 technologies to design websites may involve inquiry, data collection, and analysis, contributing to research-related skills, albeit indirectly.
CO6: PO7: Analyzing web page elements and attributes may involve observational skills and inquiry, contributing partially to research-related skills.
CO7: PO7: Creating web pages using CSS may involve inquiry, adherence to methodologies, and effective reporting, contributing partially to research-related skills.

Mapping of PO8 with All CO'S

CO1: PO8: Efficiently implementing data structures requires self-directed learning, adaptability, and goal achievement, closely aligned with learning how to learn skills.
CO2: PO8: Understanding memory allocation involves self-directed learning and adaptability, directly relevant to learning how to learn skills.
CO3: PO8: Analyzing proof techniques enhances problem-solving abilities, contributing to learning how to learn skills, though indirectly.
CO4: PO8: Practical implementation of HTML5 and CSS technologies may require self-directed learning and adaptability to keep up with changing demands in web development.
CO5: PO8: Applying HTML5 technologies to design websites involves continuous learning, adaptation, and goal achievement, directly related to learning how to learn skills.
CO6: PO8: Analyzing web page elements and attributes requires self-directed learning and adaptability, contributing to learning how to learn skills.
CO7: PO8: Creating web pages using CSS requires continuous learning and adaptation to new design trends, supporting learning how to learn skills.

Mapping of PO9 with All CO'S

CO1: PO9: Efficiently implementing data structures may involve the use of appropriate software and ICT tools, contributing partially to digital and technological skills.

CO2: PO9: Understanding memory allocation involves utilizing appropriate software and ICT tools, contributing partially to digital and technological skills.
CO3: PO9: Analyzing proof techniques may not directly involve ICT or specific software usage.
CO4: PO9: Practical implementation of HTML5 and CSS technologies directly involves proficiency in using ICT and appropriate software, strongly related to digital and technological skills.
CO5: PO9: Applying HTML5 technologies to design websites involves proficiency in using ICT and appropriate software for web development, strongly related to digital and technological skills.
CO6: PO9: Analyzing web page elements and attributes may involve using ICT tools for web analysis, contributing moderately to digital and technological skills.
CO7: PO9: Creating web pages using CSS directly involves proficiency in using ICT and appropriate software, strongly related to digital and technological skills.

Mapping of PO10 with All CO'S

CO1: PO10: Efficient implementation of data structures does not directly involve engaging in multicultural settings, demonstrating empathy, or understanding diverse perspectives.
CO2: PO10: Understanding memory allocation basics is not directly related to engaging in multicultural settings or demonstrating empathy.
CO3: PO10: Analyzing proof techniques does not directly involve engaging in multicultural settings or demonstrating empathy.
CO4: PO10: Practical implementation of HTML5 and CSS technologies does not inherently involve engaging in multicultural settings or demonstrating empathy.
CO5: PO10: Applying HTML5 technologies to design websites does not directly involve engaging in multicultural settings or demonstrating empathy.
CO6: PO10: Analyzing web page elements and attributes does not directly involve engaging in multicultural settings or demonstrating empathy.
CO7: PO10: Creating web pages using CSS does not directly involve engaging in multicultural settings or demonstrating empathy.

Mapping of PO11 with All CO'S

CO1: PO11: Efficiently implementing data structures does not directly involve embracing ethical and moral values, practicing responsible citizenship, or promoting sustainability and environmental conservation.
CO2: PO11: Understanding memory allocation basics is not directly related to embracing ethical and moral values or promoting sustainability.
CO3: PO11: Analyzing proof techniques does not directly involve embracing ethical and moral values or promoting sustainability.
CO4: PO11: Practical implementation of HTML5 and CSS technologies does not inherently involve embracing ethical and moral values or promoting sustainability.
CO5: PO11: Applying HTML5 technologies to design websites does not directly involve embracing ethical and moral values or promoting sustainability.

CO6: PO11: Analyzing web page elements and attributes does not directly involve embracing ethical and moral values or promoting sustainability.
CO7: PO11: Creating web pages using CSS does not directly involve embracing ethical and moral values or promoting sustainability.

Mapping of PO12 with All CO'S

CO1: PO12: Efficiently implementing data structures requires autonomy, responsibility, and accountability in managing projects and applying knowledge and skills independently.
CO2: PO12: Understanding memory allocation involves applying knowledge independently and managing projects effectively, demonstrating responsibility and accountability.
CO3: PO12: Analyzing proof techniques may contribute to autonomy and responsibility in learning contexts, though not as directly related to project management.
CO4: PO12: Practical implementation of HTML5 and CSS technologies may require autonomy and responsibility in managing web development projects, though not as directly related to independent application of knowledge.
CO5: PO12: Applying HTML5 technologies to design websites involves autonomy and responsibility in managing web projects, though not as directly related to independent application of knowledge.
CO6: PO12: Analyzing web page elements and attributes may contribute to autonomy and responsibility in learning contexts, though not as directly related to project management.
CO7: PO12: Creating web pages using CSS requires autonomy and responsibility in managing web projects, though not as directly related to independent application of knowledge.

Mapping of PO13 with All CO'S

CO1: PO13: Efficiently implementing data structures may not directly contribute to community engagement and service activities.
CO2: PO13: Understanding memory allocation basics is not directly related to community engagement and service.
CO3: PO13: Analyzing proof techniques may not directly involve community engagement and service.
CO4: PO13: Practical implementation of HTML5 and CSS technologies may not inherently involve community engagement and service activities.
CO5: PO13: Applying HTML5 technologies to design websites may not directly involve community engagement and service activities.
CO6: PO13: Analyzing web page elements and attributes may not directly involve community engagement and service activities.
CO7: PO13: Creating web pages using CSS may not directly involve community engagement and service activities.

SYLLABUS (CBCS as per NEP 2020) FOR S. Y. B. Sc. (Computer Science) Sem-III (w. e. from June, 2024)

Name of the Programme	**:** For S.Y. UG Sem-III
Program Code	: USCOS
Class	**:** S.Y.U.G.
Semester	**:** III
Course Type	**:** Minor for SY UG (TH)
Course Name	**:** HTML5 using CSS
Course Code	**:** COS-211-MN (D)
No. of Lectures	**: 30**
No. of Credits	**: 02**

Prerequisites:

- Basic knowledge of computers and its concepts.

Course Objectives:

1. To construct HTML documents with proper basic structures and by utilizing HTML tags effectively.
2. To implement specific HTML5 elements such as lists, tables, iframes, various layout components and forms.
3. To introduce the basics of CSS and understand its role in styling HTML elements and enhancing web page aesthetics.
4. To apply CSS rules effectively to control the appearance of HTML elements.
5. To design web pages using HTML5 and CSS.
6. To design dynamic, interactive, and elegant Web sites.
7. To analyze a web page and identify its elements and attributes.

Course Outcomes:

CO1: Students will be able to construct HTML documents with proper basic structures and by utilizing HTML tags effectively.

CO2: Students will be able to implement specific HTML5 elements such as lists, tables, iframes, various layout components and forms.

CO3: Students will be able to apply the basics of CSS and understand its role in styling HTML elements and enhancing web page aesthetics.

CO4: Students will be able to apply CSS rules effectively to control the appearance of HTML elements.

CO5: Students will be able to design web pages using HTML5 and CSS.

CO6: Students will be able to design dynamic, interactive, and elegant Web sites.

CO7: Students will be able to analyze and explore a web page and identify its elements and attributes.

Unit	Title and Contents	No. of Lectures
Unit 1	**Introduction to HTML5** **1.1** Difference between HTML & HTML5 **1.2** HTML Document and Basic Structure **1.3** Working with HTML Text, Heading, Paragraph, Formatting, Styles **1.4** Block Level Elements and Inline Elements **1.5** HTML Color **1.6** HTML Hyperlink **1.7** HTML Image	8
Unit 2	**Specific Elements of HTML5** **2.1** HTML Lists **2.2** HTML Tables **2.6** HTML Iframes **2.7** HTML Layout : Header & Footer, Navigation Section, Article and Aside **2.8** Working with Forms and controls	10
Unit 3	**Basics of CSS** **3.7** Introduction of CSS **3.8** CSS Rules **3.9** CSS Selectors and Ways to add Selectors **3.10** CSS Color **3.11** CSS Border **3.12** CSS Background and CSS Display	6
Unit 4	**Working with CSS** **4.7** CSS Margins **4.8** CSS Padding **4.9** CSS Outline **4.10** CSS Links **4.11** CSS Lists **4.12** CSS Tables	6

References:

1. Html & CSS: The Complete Reference, Fifth Edition by Thomas A. Powell and published by McGraw Hill.
2. HTML 5 in simple steps by Kogent Learning Solutions Inc., Publisher Dreamtech Press
3. Headfirst HTML with CSS & XHTML Book by Elisabeth Freeman and Eric Freeman.
4. The Essential Guide to CSS and HTML Web Design Book by Craig Grannell.

Mapping of this course with Programme Outcomes

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

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

Justification of Mapping of PO1 with All CO'S

CO1: PO1: Constructing HTML documents with proper structures and utilizing HTML tags effectively directly demonstrates a profound understanding of foundational theories, principles, and methodologies in web development, aligning strongly with the comprehensive knowledge and understanding of the field of study.
CO2: PO1: Implementing specific HTML5 elements and various layout components requires a deep understanding of foundational concepts and key principles in web development, contributing significantly to the comprehensive knowledge and understanding of the field.
CO3: PO1: Applying the basics of CSS and understanding its role in styling HTML elements enhances the comprehension of foundational theories and methodologies in web design, closely linked with the broader multidisciplinary context of the field of study.
CO4: PO1: Applying CSS rules effectively to control the appearance of HTML elements demonstrates a profound understanding of CSS principles and methodologies, reinforcing the comprehensive knowledge and understanding of the field.
CO5: PO1: Designing web pages using HTML5 and CSS showcases a deep understanding of foundational theories, methodologies, and key concepts in web development, contributing significantly to the broader multidisciplinary context of the field of study.
CO6: PO1: Designing dynamic, interactive, and elegant websites requires a profound understanding of advanced concepts and principles in web development, aligning strongly with the comprehensive knowledge and understanding of the field.
CO7: PO1: Analyzing and exploring web pages to identify their elements and attributes demonstrates a deep understanding of foundational theories and methodologies in web development, reinforcing the comprehensive knowledge and understanding of the field.

Mapping of PO2 with All CO'S

CO1: PO2: Constructing HTML documents with proper structures and utilizing HTML tags effectively aligns closely with practical skills and expertise essential for professional tasks in web development, demonstrating knowledge of industry standards and best practices.
CO2: PO2: Implementing specific HTML5 elements demonstrates practical skills essential for professional tasks in web development, incorporating knowledge of industry standards and best practices to create functional and effective web pages.
CO3: PO2: Applying the basics of CSS to enhance web page aesthetics reflects practical knowledge and expertise in web design, considering industry standards and best practices to create visually appealing websites.
CO4: PO2: Applying CSS rules effectively to control the appearance of HTML elements showcases practical skills in web development, incorporating industry standards and best practices to achieve desired styling outcomes.
CO5: PO2: Designing web pages using HTML5 and CSS demonstrates practical expertise in web development, applying industry standards and best practices to create professional and functional websites.
CO6: PO2: Designing dynamic, interactive, and elegant websites requires practical skills and expertise in web development, incorporating industry standards and best practices to create engaging user experiences.
CO7: PO2: Analyzing and exploring web pages to identify their elements and attributes showcases practical knowledge essential for professional tasks in web development, incorporating industry standards and best practices to understand and manipulate web content effectively.

Mapping of PO3 with All CO'S

CO1: PO3: Constructing HTML documents demonstrates technical proficiency, which is partially related to fostering innovation and understanding business principles but is not directly linked to entrepreneurial mindset or risk management strategies.
CO2: PO3: Implementing specific HTML5 elements showcases technical skills but is only partially related to identifying opportunities and fostering innovation in entrepreneurial contexts.
CO3: PO3: Applying CSS basics to enhance web page aesthetics is partially related to understanding business principles and market dynamics, but it doesn't directly contribute to cultivating an entrepreneurial mindset.
CO4: PO3: Applying CSS rules to control the appearance of HTML elements is partially related to understanding business principles and market dynamics but doesn't directly contribute to fostering innovation or risk management strategies.
CO5: PO3: Designing web pages using HTML5 and CSS demonstrates technical skills but is only partially related to cultivating an entrepreneurial mindset.
CO6: PO3: Designing dynamic, interactive, and elegant websites may indirectly contribute to fostering innovation and understanding market dynamics but is only partially related to cultivating an entrepreneurial mindset.

CO7: PO3: Analyzing and exploring web pages is partially related to identifying opportunities and understanding market dynamics but is not directly linked to fostering innovation or risk management strategies.

Mapping of PO4 with All CO'S

CO1: PO4: Constructing HTML documents and utilizing HTML tags effectively demonstrates technical proficiency and problem-solving skills, directly related to specialized skills and competencies in web development.
CO2: PO4: Implementing specific HTML5 elements requires technical skills and problem-solving abilities, closely related to specialized competencies in web development.
CO3: PO4: Applying CSS basics to enhance web page aesthetics demonstrates technical proficiency and analytical abilities, directly relevant to specialized skills and competencies in web design.
CO4: PO4: Applying CSS rules effectively to control the appearance of HTML elements showcases technical skills and problem-solving abilities, directly related to specialized competencies in web development.
CO5: PO4: Designing web pages using HTML5 and CSS requires technical proficiency, problem-solving skills, and effective communication, all of which are specialized competencies in web development.
CO6: PO4: Designing dynamic, interactive, and elegant websites showcases technical skills, analytical abilities, and innovation, directly relevant to specialized competencies in web development.
CO7: PO4: Analyzing and exploring web pages demonstrates analytical abilities, problem-solving skills, and adaptability, all of which are specialized competencies in web development.

Mapping of PO5 with All CO'S

CO1: PO5: Constructing HTML documents and utilizing HTML tags effectively requires problem-solving and analytical reasoning, directly linked to the capacity for application and problem-solving.
CO2: PO5: Implementing specific HTML5 elements involves problem-solving and analytical reasoning to select appropriate elements and layouts, directly contributing to the capacity for application and problem-solving.
CO3: PO5: Applying CSS basics to enhance web page aesthetics requires analytical reasoning and adaptability, directly relevant to problem-solving and analytical reasoning in practical web development scenarios.
CO4: PO5: Applying CSS rules effectively to control the appearance of HTML elements involves problem-solving and analytical reasoning to achieve desired outcomes, directly related to the capacity for application and problem-solving.

CO5: PO5: Designing web pages using HTML5 and CSS necessitates problem-solving, analytical reasoning, and creativity, directly contributing to the capacity for application and problem-solving in web development.
CO6: PO5: Designing dynamic, interactive, and elegant websites requires problem-solving, creativity, and adaptability, directly linked to the capacity for application, problem-solving, and analytical reasoning.
CO7: PO5: Analyzing and exploring a web page demonstrates problem-solving, analytical reasoning, and adaptability, directly relevant to the capacity for application, problem-solving, and analytical reasoning in web development contexts.

Mapping of PO6 with All CO'S

CO1: PO6: Constructing HTML documents and utilizing HTML tags effectively may involve communication when collaborating with team members to ensure consistency and clarity in code, moderately related to effective communication in diverse teams.
CO2: PO6: Implementing specific HTML5 elements requires collaboration and communication within teams to discuss layout components and functionalities, moderately related to effective communication and collaboration.
CO3: PO6: Applying CSS basics to enhance web page aesthetics may involve communicating design preferences or requirements, moderately related to effective communication in conveying visual concepts.
CO4: PO6: Applying CSS rules effectively may involve communication with team members to ensure consistency in styling across web pages, moderately related to effective communication and collaboration.
CO5: PO6: Designing web pages using HTML5 and CSS may involve collaboration and communication to discuss design choices and functionalities, moderately related to effective communication and collaboration.
CO6: PO6: Designing dynamic, interactive, and elegant websites often requires collaboration and communication to align on design goals and functionalities, strongly related to effective communication and collaboration.
CO7: PO6: Analyzing and exploring a web page may involve communication within teams to discuss findings and implications for design changes, moderately related to effective communication and collaboration.

Mapping of PO7 with All CO'S

CO1: PO7: Constructing HTML documents and utilizing HTML tags effectively may involve some observational skills when analyzing existing web pages for inspiration or research purposes, partially related to research-related skills.
CO2: PO7: Implementing specific HTML5 elements requires some observational skills when analyzing different websites for functionality and layout ideas, partially related to research-related skills.

CO3: PO7: Applying CSS basics to enhance web page aesthetics involves observational skills when evaluating design choices, partially related to research-related skills.
CO4: PO7: Applying CSS rules effectively may involve some observational skills when examining the impact of styling changes on web page appearance, partially related to research-related skills.
CO5: PO7: Designing web pages using HTML5 and CSS may involve observational skills when researching design trends or analyzing competitor websites, partially related to research-related skills.
CO6: PO7: Designing dynamic, interactive, and elegant websites involves observational skills when researching user preferences and behaviors, partially related to research-related skills.
CO7: PO7: Analyzing and exploring a web page demonstrates strong observational and inquiry skills, directly related to research-related skills in data collection and analysis.

Mapping of PO8 with All CO'S

CO1: PO8: Constructing HTML documents and utilizing HTML tags effectively requires self-directed learning and goal setting to acquire and apply new knowledge independently.
CO2: PO8: Implementing specific HTML5 elements involves self-directed learning and adaptability to learn new techniques and functionalities independently.
CO3: PO8: Applying the basics of CSS and understanding its role in styling HTML elements necessitates self-directed learning and goal setting to master CSS techniques independently.
CO4: PO8: Applying CSS rules effectively requires self-directed learning and adaptability to keep up with evolving CSS standards and techniques independently.
CO5: PO8: Designing web pages using HTML5 and CSS involves self-directed learning and goal setting to integrate HTML and CSS effectively to achieve design goals independently.
CO6: PO8: Designing dynamic, interactive, and elegant websites requires continuous self-directed learning and adaptability to incorporate new technologies and design trends independently.
CO7: PO8: Analyzing and exploring a web page demonstrates self-directed learning and adaptability to acquire and apply analytical skills independently.

Mapping of PO9 with All CO'S

CO1: PO9: Constructing HTML documents and utilizing HTML tags effectively demonstrate proficiency in using ICT and accessing information sources to create web content.
CO2: PO9: Implementing specific HTML5 elements involves proficiency in using ICT and accessing information sources to select and integrate appropriate elements into web pages.
CO3: PO9: Applying the basics of CSS to enhance web page aesthetics requires proficiency in using ICT and accessing information sources to learn and apply styling techniques.
CO4: PO9: Applying CSS rules effectively involves proficiency in using ICT to manipulate and control the appearance of HTML elements.

CO5: PO9: Designing web pages using HTML5 and CSS demonstrates proficiency in using ICT to create functional and aesthetically pleasing websites.
CO6: PO9: Designing dynamic, interactive, and elegant websites showcases proficiency in using ICT to integrate advanced features and technologies into web design.
CO7: PO9: Analyzing and exploring a web page demonstrates proficiency in using ICT to navigate and understand web content and identify its elements and attributes.

Mapping of PO10 with All CO'S

CO1: PO10: Constructing HTML documents and utilizing HTML tags effectively doesn't directly involve engagement in multicultural settings or demonstrating empathy and understanding of diverse perspectives.
CO2: PO10: Implementing specific HTML5 elements may involve collaboration with diverse teams, but it doesn't inherently demonstrate multicultural competence or empathy.
CO3: PO10: Applying CSS to enhance web page aesthetics doesn't directly relate to engagement in multicultural settings or demonstrating empathy.
CO4: PO10: Applying CSS rules effectively also doesn't directly involve engagement in multicultural settings or demonstrating empathy.
CO5: PO10: Designing web pages using HTML5 and CSS may involve considering diverse user perspectives, but it doesn't inherently demonstrate engagement in multicultural settings or empathy.
CO6: PO10: Designing dynamic, interactive, and elegant websites may involve collaboration with diverse teams, but it doesn't directly demonstrate multicultural competence or empathy.
CO7: PO10: Analyzing and exploring a web page may involve considering diverse user perspectives, but it doesn't inherently demonstrate engagement in multicultural settings or empathy.

Mapping of PO11 with All CO'S

CO1: PO11: Constructing HTML documents and utilizing HTML tags effectively doesn't inherently involve embracing ethical and moral values, practicing responsible citizenship, or addressing environmental issues.
CO2: PO11: Implementing specific HTML5 elements may involve considering accessibility standards, but it doesn't directly relate to promoting sustainability or environmental conservation.
CO3: PO11: Applying CSS to enhance web page aesthetics doesn't directly relate to embracing ethical values or promoting environmental awareness.
CO4: PO11: Applying CSS rules effectively also doesn't directly involve embracing ethical values or promoting environmental awareness.
CO5: PO11: Designing web pages using HTML5 and CSS may involve considering the environmental impact of design choices, but it doesn't inherently promote sustainability or environmental conservation.
CO6: PO11: Designing dynamic, interactive, and elegant websites may involve considering user experience, but it doesn't directly relate to embracing ethical values or promoting environmental awareness.

CO7: PO11: Analyzing and exploring a web page may involve considering user needs, but it doesn't inherently involve embracing ethical values or promoting environmental awareness.

Mapping of PO12 with All CO'S

CO1: PO12: Constructing HTML documents and utilizing HTML tags effectively demonstrates autonomy and responsibility in applying knowledge and skills independently in web development projects.

CO2: PO12: Implementing specific HTML5 elements requires autonomy and responsibility in managing projects effectively and applying skills independently to achieve project goals.

CO3: PO12: Applying CSS to enhance web page aesthetics demonstrates autonomy and responsibility in independently managing design aspects of web development projects.

CO4: PO12: Applying CSS rules effectively showcases autonomy and responsibility in managing the appearance of HTML elements independently within web development projects.

CO5: PO12: Designing web pages using HTML5 and CSS requires autonomy and responsibility in independently managing the entire web development process.

CO6: PO12: Designing dynamic, interactive, and elegant websites demonstrates autonomy and responsibility in managing complex web development projects independently.

CO7: PO12: Analyzing and exploring a web page showcases autonomy and responsibility in independently evaluating and understanding web content within work and learning contexts.

Mapping of PO13 with All CO'S

CO1: PO13: Constructing HTML documents and utilizing HTML tags effectively doesn't directly involve community engagement or promoting societal well-being.

CO2: PO13: Implementing specific HTML5 elements may involve designing web pages for community organizations or initiatives, but it doesn't inherently involve active participation in community-engaged services and activities.

CO3: PO13: Applying CSS to enhance web page aesthetics doesn't directly relate to community engagement or promoting societal well-being.

CO4: PO13: Applying CSS rules effectively also doesn't directly involve community engagement or promoting societal well-being.

CO5: PO13: Designing web pages using HTML5 and CSS may involve creating websites for community projects, but it doesn't inherently involve active participation in community-engaged services and activities.

CO6: PO13: Designing dynamic, interactive, and elegant websites may involve creating platforms for community initiatives, but it doesn't directly demonstrate active participation in community-engaged services and activities.

CO7: PO13: Analyzing and exploring a web page may involve evaluating community-related content, but it doesn't inherently involve active participation in community-engaged services and activities.

SYLLABUS (CBCS as per NEP 2020) FOR S. Y. B. Sc. (Computer Science) Sem-III (w. e. from June, 2024)

Name of the Programme	**:** B.Sc. Computer Science
Program Code	**:** USCOS
Class	**:** S. Y. U.G.
Semester	**:** III
Course Type	**:** Minor (PR)
Course Name	**:** Lab Course based on COS-211-MN(D)
Course Code	**:** COS-212-MN(D)
No. of Lectures	**: 60**
No. of Credits	**: 02**

Prerequisites:

- Basic knowledge of computers and its concepts.

Course Objectives:

1. To construct HTML documents with proper basic structures and by utilizing HTML tags effectively.
2. To implement specific HTML5 elements such as lists, tables, iframes, various layout components and forms.
3. To introduce the basics of CSS and understand its role in styling HTML elements and enhancing web page aesthetics.
4. To apply CSS rules effectively to control the appearance of HTML elements.
5. To design web pages using HTML5 and CSS.
6. To design dynamic, interactive, and elegant Web sites.
7. To analyse a web page and identify its elements and attributes.

Course Outcomes:

CO1: Students will be able to construct HTML documents with proper basic structures and By utilizing HTML tags effectively.
CO2: Students will be able to implement specific HTML5 elements such as lists, tables, Iframes, various layout components and forms.
CO3: Students will be able to apply the basics of CSS and understand its role in styling HTML elements and enhancing web page aesthetics.
CO4: Students will be able to apply CSS rules effectively to control the appearance of HTML elements.
CO5: Students will be able to design web pages using HTML5 and CSS.
CO6: Students will be able to design dynamic, interactive, and elegant Web sites.
CO7: Students will be able to analyse and explore a web page and identify its elements and Attributes.

Sr. No.	Assignment Name	No. of Practical's
1.	Basic and Advanced HTML5 Tags	2
2.	Creating List through HTML5	1
3.	Creating Tables through HTML5	2
4.	Creating Frames through HTML5	2
5.	Creating Forms through HTML5	2
6.	Image Mapping	2
7.	Styling HTML5 with CSS	2
8	Case Study 1	1
9.	Case Study 2	1

Mapping of PO's With CO's

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

1. **PO1 with all CO's :**
   Each Course Outcome is strongly aligned with Program Outcome 1, indicating that the course effectively contributes to the development of graduates' comprehensive knowledge and understanding in their field of study.
2. **PO2 with all CO's:**
   Strongly Agree (3): When a CO directly addresses the PO with significant emphasis. Moderately agree (2): When a CO partially addresses the PO or does so with less emphasis. Partially agree (1): When a CO only slightly addresses the PO or has minimal relevance.
3. **PO3 with all CO's :**
   Each Course Outcome (CO) contributes equally to the development of an entrepreneurial mindset and knowledge, as they all provide foundational skills necessary for web development, which could be applied in entrepreneurial endeavours. Therefore, each CO is given a weightage of 1, indicating a partial agreement with the Program Outcome.
4. **PO4 with all CO's :**
   The weightage is distributed based on how each Course Outcome contributes to the demonstration of specialized skills and competencies relevant to the field of study. Weightage 3 is assigned to CO5 and CO6 as they directly address the proficiency in technical skills, analytical abilities, problem-solving, effective communication, and leadership in web design. CO1 to CO4 are assigned weightage 2 as they provide the foundational knowledge and skills necessary for web development, contributing to the overall proficiency. CO7 is given a weightage of 2 as it enhances analytical abilities and problem-solving skills by requiring students to analyse and explore web pages.

5. **PO5 with all CO's :**
   The weightage is distributed based on how each Course Outcome contributes to the capacity for application, problem-solving, and analytical reasoning. CO5, CO6, and CO7 are given the highest weightage (3) as they directly involve applying learned concepts in practical settings, solving complex problems, and analyzing data effectively. CO1 to CO4 are assigned weightage 2 as they provide the foundational knowledge and skills necessary for web development, contributing to the overall capacity for application, problem-solving, and analytical reasoning.

6. **PO6 with all CO's :**
   CO1 to CO4 contribute more directly to the development of communication skills as they involve constructing and styling web content, which often requires effective communication to convey information clearly. Therefore, they are assigned a weightage of 2. CO5 to CO7 also contribute to communication skills but to a lesser extent compared to CO1 to CO4, so they are assigned a weightage of 1. All COs contribute partially to communication skills and collaboration, reflecting a moderate agreement with the Program Outcome.

7. **PO7 with all CO's :**
   CO7 is given a weightage of 2 as it directly contributes to the development of observational and inquiry skills, formulation of research questions, and utilization of appropriate methodologies for data collection and analysis. CO1 to CO6, while indirectly related to research-related skills, may involve elements of research methods and reporting findings but to a lesser extent compared to CO7. Therefore, they are assigned a weightage of 1, indicating a partial agreement with the Program Outcome.

8. **PO8 with all CO's :**
   All Course Outcomes (COs) contribute directly to the acquisition of new knowledge and skills through self-directed learning, adaptation to changing demands, and setting and achieving goals independently. Therefore, each CO is assigned a weightage of 2, indicating a strong agreement with the Program Outcome.

9. **PO9 with all CO's :**
   Each Course Outcome (CO) contributes directly to the demonstration of proficiency in using ICT, accessing information sources, and analysing data using appropriate software, as stated in PO9. Therefore, each CO is assigned a weightage of 2, indicating a strong agreement with the Program Outcome.

10. **PO10 with all CO's :**
    Each Course Outcome (CO) is assigned a weightage of 1, indicating a partial agreement with the Program Outcome. While the skills learned in web development may indirectly contribute to multicultural competence, inclusive spirit, and empathy, the direct relationship is not as strong as with other outcomes such as technical proficiency or problem-solving skills. Therefore, each CO is given a weightage of 1 to reflect this partial alignment with PO10.

11. **PO11 with all CO's :**
    Each Course Outcome (CO) is assigned a weightage of 1, indicating a partial agreement with the Program Outcome. While the skills learned in web development may indirectly contribute to ethical values and environmental awareness (e.g., through the responsible use of technology), the direct relationship is not as strong as with other outcomes such as technical proficiency or problem-solving skills. Therefore, each CO is given a weightage of 1 to reflect this partial alignment with PO11.

12. **PO12 with all CO's :**
    CO5 and CO6 are assigned a weightage of 3 as they directly involve applying knowledge and skills independently, managing projects effectively, and demonstrating responsibility and accountability in work and learning contexts, aligning strongly with PO12. CO1 to CO4 contribute to these outcomes to a slightly lesser extent but still significantly, hence they are given a weightage of 2. CO7 enhances the analytical and problem-solving skills, contributing indirectly to autonomy and responsibility hence it assigned a weightage of 2.

13. **PO13 with all CO's** :

    Each Course Outcome (CO) is assigned a weightage of 1, indicating a partial agreement with the Program Outcome. While the skills learned in web development may indirectly contribute to community engagement and service by enabling graduates to create online platforms for community engagement or by promoting societal well-being through digital means, the direct relationship is not as strong as with other outcomes such as technical proficiency or problem-solving skills. Therefore, each CO is given a weightage of 1 to reflect this partial alignment with PO13.

SYLLABUS (CBCS as per NEP 2020) FOR B. Sc. (Computer Science) Sem-III

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

Name of the Program	: B.Sc. Computer Science
Program Code	: USCOS
Class	: S.Y. B.Sc. (Computer Science)
Semester	: III
Course Type	: Open Elective (TH)
Course Name	: Fundamental Concepts in Computer Science
Course Code	: COS-216-OE
No. of Lectures	: 30
No. of Credits	: 02

A) Course Objectives:

1 - To understand and gain knowledge of Computer.

2 - To understand and solve functional and procedural problems.

3 – To understand working of Database

4 - Understand and working of OS.

5 – To understand basic Software Engineering.

6 - use basic of Database.

7 - To understand the Emerging Technologies

B) Course Outcomes:

CO 1 - To understand Basic Concept of Database System.

CO 2 - To learn how to use Software Engineering Concept.

CO 3 - To learn Function of Operating System.

CO 4 - To learn what is Emerging Technologies.

CO 5 - To learn different Emerging Technologies.

CO 6 - To learn about the Application using Emerging Technologies.

CO 7 - To learn the Life cycle of software engineering.

Units	Contents and Assignment	No of Lectures
Unit 1	**Database Concepts** • Introduction • Database Schema • Data Constraints • Data dictionary or Metadata. • Database instance. • Query • Data manipulation • Data Engine • DDL and DML Command	**8**

Unit 2	**Software Engineering Concepts** • Introduction • Why is Software Engineering required. • Need of Software Engineering • Characteristics of a good software engineer • Importance of Software Engineering • SDLC	**7**
Unit 3	**Operating System Concepts** • Introduction of Operating System • Types of Operating Systems • Examples of Operating System (Android, iPhone, Windows etc.) • Functions of Operating System • Real time systems • Difference between multitasking, multithreading and multiprocessing	**7**
Unit 4	**Emerging Technologies Concepts** **Technologies** • Machine Learning • Blockchain • DevOps • Big Data • AI • Cloud Computing **Application** • Uber, Zoom, Airbnb, Netflix • Extended Reality (AR/VR), Drones • Speech Recognition • Social Media Applications (e.g. Facebook, Twitter, Blog, what's app, Instagram)	8

Online Links:

https://www.apptunix.com/blog/12-emerging-mobile-app-technologies/

Reference Books:

1. "Database Management Systems" by Raghu Ramakrishnan and Johannes Gehrke,3rd Edition, Publication: McGraw-Hill Education, 2002
2. "Operating System Concepts" by Abraham Silberschatz, Peter B. Galvin, and Greg Gagne, 10th Edition, Publication: Wiley, 2018
3. "Software Engineering: A Practitioner's Approach" by Roger S. Pressman, 9th Edition, Publication: McGraw-Hill Education, 2014

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

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

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

- **Justification of PO1 to ALL COs :**

CO 1 - PO 3 Understanding the basic concepts of database systems is fundamental in computer science and directly applies to various applications.
CO 2 - PO 3 Learning software engineering concepts is essential for applying fundamental principles in developing software applications.
CO 3 - PO 3 Understanding the function of operating systems is crucial for developing and managing software applications.
CO 4 - PO 2 Knowing about emerging technologies is important for staying updated in the field but may not directly apply to all applications.
CO 5 - PO 2 Learning about different emerging technologies provides a broader understanding of the field, which can be beneficial in various applications.
CO 6 - PO 2 Understanding the applications of emerging technologies can enhance the scope of applying fundamental principles in various applications.
CO 7 - PO 3 Understanding the software engineering life cycle is essential for effectively applying fundamental principles in software development.

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

CO 1 - PO 3 Understanding the basic concepts of database systems is crucial for designing and implementing solutions that involve data storage and retrieval.
CO 2 - PO 3 Learning software engineering concepts helps in designing and implementing solutions in a systematic and well-documented manner.
CO 3 - PO 3 Understanding the function of operating systems is essential for designing solutions that interact effectively with the underlying hardware and manage resources efficiently.
CO 4 - PO 2 Knowing about emerging technologies can inspire innovative solutions to computational problems but may not always be directly applicable.
CO 5 - PO 2 Learning about different emerging technologies can broaden the range of solutions considered for computational problems.
CO 6 - PO 2 Understanding the applications of emerging technologies can lead to the adoption of new and more efficient solutions to computational problems.
CO 7 - PO 3 Understanding the software engineering life cycle is crucial for designing and documenting solutions to computational problems effectively.

3. Justification of PO3 to ALL COs :

CO 1 - PO 3 Understanding the basic concepts of database systems is fundamental in our discipline and forms the basis for many applications.

CO 2 - PO 3 Learning software engineering concepts is crucial for applying structured and disciplined approaches to developing software solutions.
CO 3 - PO 3 Understanding the function of operating systems is essential for grasping how software interacts with hardware, a fundamental concept in our discipline.
CO 4 - PO 2 Knowing about emerging technologies provides a glimpse into future trends in our discipline, which is important for understanding the evolving nature of the field.
CO 5 - PO 2 Learning about different emerging technologies expands the understanding of the breadth of our discipline, showing its diverse applications.
CO 6 - PO 2 Understanding the applications of emerging technologies provides insight into how our discipline is evolving and being applied in new ways.
CO 7 - PO 3 Understanding the software engineering life cycle is fundamental for developing software solutions, a core aspect of our discipline.

4. Justification of PO4 to ALL COs :

CO 1 - PO 3 Understanding the basic concepts of database systems is essential for continued professional development in fields that rely on data management and storage.
CO 2 - PO 3 Learning software engineering concepts is crucial for professional development, as it provides a structured approach to software development that is applicable in various industries.
CO 3 - PO 3 Understanding the function of operating systems is important for continued professional development in fields related to system development and management.
CO 4 - PO 2 Knowing about emerging technologies can contribute to professional development by keeping professionals informed about new trends and opportunities in the field.
CO 5 - PO 2 Learning about different emerging technologies can broaden one's skillset and knowledge base, enhancing professional development opportunities.
CO 6 - PO 2 Understanding the applications of emerging technologies can open up new avenues for professional growth and development.
CO 7 - PO 3 Understanding the software engineering life cycle is crucial for professional development in software development and project management roles.

5. Justification of PO5 to ALL COs :

CO 1 - PO 2 Understanding database systems can contribute to societal and environmental impact by enabling efficient data management practices.
CO 2 - PO 3 Knowledge of software engineering concepts is crucial for developing solutions that consider societal and environmental impacts, such as designing energy-efficient software.
CO 3 - PO 2 Understanding the function of operating systems can contribute to sustainable development by optimizing resource utilization in computing environments.
CO 4 - PO 2 Knowing about emerging technologies can lead to the development of innovative solutions that address societal and environmental challenges.
CO 5 - PO 2 Learning about different emerging technologies can provide insights into how technology can be leveraged for sustainable development.
CO 6 - PO 2 Understanding the applications of emerging technologies can lead to the development of solutions that address societal and environmental needs.
CO 7 - PO 3 Understanding the software engineering life cycle is crucial for developing sustainable software solutions that consider societal and environmental impacts throughout the development process.

6. Justification of PO6 to ALL COs :

CO 1 - PO 3 Understanding database systems is crucial for developing proficiency in data management and storage, which is a core practice in computing.

CO 2 - PO 3 Learning software engineering concepts is essential for developing proficiency in software development practices.
CO 3 - PO 3 Understanding the function of operating systems is fundamental for developing proficiency in system-level computing practices.
CO 4 - PO 2 Knowing about emerging technologies can contribute to developing proficiency in adopting new technologies and practices in computing.
CO 5 - PO 2 Learning about different emerging technologies can broaden one's skillset and proficiency in applying new technologies.
CO 6 - PO 2 Understanding the applications of emerging technologies can enhance proficiency in developing innovative solutions using new technologies.
CO 7 - PO 3 Understanding the software engineering life cycle is crucial for developing proficiency in software development practices and project management.

7. Justification of PO7 to ALL COs :

CO 1 - PO 2 Understanding database systems can contribute to independent study and research by providing a foundational concept applicable in various contexts.
CO 2 - PO 3 Learning software engineering concepts is essential for independent study and research, as it provides a structured approach to problem-solving and project management.
CO 3 - PO 2 Understanding the function of operating systems can enhance independent study and research by enabling a deeper understanding of computer systems.
CO 4 - PO 2 Knowing about emerging technologies can inspire independent study and research in new and evolving areas of computing.
CO 5 - PO 2 Learning about different emerging technologies can stimulate independent study and research in diverse areas of computing.
CO 6 - PO 2 Understanding the applications of emerging technologies can inspire independent study and research in innovative computing applications.

CO 7 - PO 3 Understanding the software engineering life cycle is crucial for independent study and research in software development methodologies and best practices.

SYLLABUS (CBCS AS PER NEP 2020) FOR S. Y. B. Sc. (Computer Science) Sem-II

(w. e. from June, 2024)

Name of the Programme	**:** B.Sc. Computer Science
Program Code	**:** USCOS
Class	**:** S. Y. B.Sc. (Computer Science)
Semester	**:** III
Course Type	**:** Vocational Skill Course (VSC) (TH)
Course Name	**:** Programming in C++
Course Code	**:** COS-221-VSC
No. of Lectures	**:** 30
No. of Credits	**:** 02

A) Course Objectives:

1. Introduce students to the C++ programming language
2. To learn principles of Object Oriented Programming (OOP).
3. Develop problem-solving skills
4. Learn how to write and execute C++ programs
5. Understand the basic syntax and structure of C++
6. To use the object-oriented paradigm in program design.

B) Course Outcomes:

CO1- Compare and contrast procedural and object oriented programming (OOP)
CO2- Apply principles of OOP
CO3- Design and develop applications using OOP language C++
CO4- Develop problem-solving skills
CO5- Gain a foundation for advanced programming concepts
CO6- Apply C++ programming concepts to real-world problems
CO7- Develop debugging and error handling skills

TOPICS/CONTENTS:

UNIT	CONTENT	NO. OF LECTURES
Unit – I	**Introduction to C++** 1.1 History 1.2 Structure of C++ Program 1.3 Object Oriented Concepts 1.4 Procedure-Oriented Programming Vs Object-Oriented Programming 1.5 Applications	**04**
Unit - II	**Programming in C++** 2.1 Data Types, 2.2 New operators and keywords, 2.3 Type casting in C++,	**08**

	2.4 reference variables, 2.5 Classes and Access Specifiers 2.6 Defining data members and member functions 2.7 Arrays and Array of objects 2.8 Usage of namespace, Managing Console I/O, Usage of Manipulators	
Unit – III	**Functions and overloading** 3.1 Static Members 3.2 Call by reference, return by reference 3.3 Inline Function 3.4 Friend Function 3.5 Function overloading 3.6 Constructer & Destructor and their types 3.7 Overloading unary and binary operators (with member function and with friend function) 3.8 Usage of this pointer	**08**
Unit – IV	**Inheritance** 4.1 Introduction 4.2 Types of Inheritance 4.3 Base class and derived class examples 4.4 Virtual base class 4.5 Abstract class 4.6 Polymorphism 4.7 Virtual functions and pure virtual functions, Overriding	**05**
Unit – V	**Working with files** 5.1 File operations – Text files, Binary files 5.2 File stream class and methods 5.3 File with random access	**05**

Reference Books:

1. C++: The Complete Reference- Schildt, McGraw-Hill Education (India)
2. Object Oriented Programming with C++ - Rajiv Sahay, Oxford
3. Object Oriented Programming (C++) Balaguruswamy, McGraw Hill Education; Seventh edition
4. Mastering C++ by Venugopal, T Ravishankar, McGraw Hill Education; 2 edition
5. Let us C++ by – YashwantKanitkar

E-Resources:

1. Head First C++ Programming – Harry. H. Chaudhary

https://books.google.co.in/books?id=-xzlAwAAQBAJ&printsec=frontcover&dq=C%2B%2B+ebook&hl=en&sa=X&ved=0ahUKEwj7yKfmnaLpAhXhX3wKHX31Bn4Q6AEIJzAA#v=onepage&q&f=false

2. A Complete Guide to Programming C++ - Jones and Bartett Computer Science https://books.google.co.in/books?id=-yhuY0Wg_QcC&printsec=frontcover&dq=C%2B%2B+ebook&hl=en&sa=X&ved=0ahUKEwj7yKfmnaLpAhXhX3wKHX31Bn4Q6AEINzAC#v=onepage&q&f=false
3. Programming with C++ - D Ravichandran https://books.google.co.in/books?id=Zw0jqouq61gC&printsec=frontcover&dq=C%2B%2B+ebook&hl=en&sa=X&ved=0ahUKEwj7yKfmnaLpAhXhX3wKHX31Bn4Q6AEILzAB#v=onepage&q=C%2B%2B%20ebook&f=false
4. C++ Programming – D.S.Malik https://books.google.co.in/books?id=NxIeCgAAQBAJ&printsec=frontcover&dq=C%2B%2B+ebook&hl=en&sa=X&ved=0ahUKEwj7yKfmnaLpAhXhX3wKHX31Bn4Q6AEIajAI#v=onepage&q=C%2B%2B%20ebook&f=false
5. https://nptel.ac.in/courses

Mapping of this course with Programme Outcomes

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

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

CO1: PO1: strongly relates (3) - This directly contributes to the understanding of different programming paradigms, enhancing the overall knowledge and understanding of programming.
CO2: PO1: strongly relates (3) - Applying principles of OOP contributes significantly to understanding programming concepts in-depth, broadening the comprehension of programming paradigms.
CO3: PO1: strongly relates (3) - Designing and developing applications using OOP in C++ directly enhances overall knowledge and understanding of programming languages and paradigms.
CO4: PO1: strongly relates (3) - Problem-solving skills are fundamental to understanding and applying programming concepts effectively, contributing significantly to comprehensive knowledge and understanding.
CO5: PO1: strongly relates (3) - Gaining a foundation for advanced programming concepts enriches overall knowledge and understanding of programming, forming a solid base for further learning.
CO6: PO1: strongly relates (3) - Applying programming concepts to real-world problems enhances understanding by providing practical experience and context.
CO7: PO1: strongly relates(3) - Developing debugging and error handling skills is essential for comprehensive knowledge and understanding, as it ensures the ability to identify and resolve issues in programs effectively.

CO1: PO2: strongly relates (3) - Understanding the differences between procedural and object-oriented programming provides practical and procedural knowledge essential for professional programming practices.
CO2: PO2: strongly relates (3) - Applying principles of OOP is a fundamental aspect of practical and professional programming knowledge, as it forms the basis of many software development practices.
CO3: PO2: strongly relates (3) - Designing and developing applications using C++ involves practical and procedural knowledge of the language, its libraries, and best practices.
CO4: PO2: strongly relates (3) - Problem-solving skills are crucial in practical and professional programming scenarios, contributing directly to procedural knowledge and expertise.
CO5: PO2: strongly relates (3) - Establishing a foundation for advanced programming concepts is essential for developing practical and professional expertise in programming.
CO6: PO2: strongly relates (3) - Applying programming concepts to real-world problems is a demonstration of practical and professional knowledge in using C++ effectively.
CO7: PO2: strongly relates (3) - Debugging and error handling skills are integral to practical programming knowledge, ensuring the smooth functioning of software systems in professional environments.
CO1: PO3: partially related (1) - While understanding different programming paradigms can contribute to an entrepreneurial mindset by providing a broader perspective on software development approaches, it's not directly tied to entrepreneurial skills or knowledge.

CO2: PO3: partially related (1) - Applying principles of OOP can indirectly support entrepreneurial mindset by fostering structured problem-solving approaches, but it's not inherently tied to entrepreneurial skills or knowledge.
CO3: PO3: partially related (1) - Designing and developing applications may have some indirect relevance to entrepreneurship, as it involves creativity and innovation, but it's not specifically focused on entrepreneurial skills or knowledge.
CO4: PO3: partially related (1) - Problem-solving skills are valuable in entrepreneurship, but they are also essential in various other contexts. While they can be applied in entrepreneurial ventures, they are not exclusively tied to entrepreneurship.
CO5: PO3: partially related (1) - Gaining a foundation for advanced programming concepts can indirectly support entrepreneurial endeavours by providing technical knowledge, but it's not directly focused on entrepreneurial skills or knowledge.
CO6: PO3: partially related (1) - Applying programming concepts to real-world problems may involve some elements of entrepreneurial thinking, such as identifying opportunities and creating solutions, but it's not solely focused on entrepreneurship.
CO7: PO3: partially related (1) - Debugging and error handling skills are essential in software development, including entrepreneurial ventures involving software products, but they are not specific to entrepreneurship.

CO1: PO4: moderately related (2) - Understanding different programming paradigms can contribute to specialized skills and competencies by providing a broader understanding of software development approaches.
CO2: PO4: strongly relates (3) - Applying principles of OOP is directly tied to specialized skills and competencies, as object-oriented programming is a widely used paradigm in modern software development.
CO3: PO4: strongly relates (3) - Designing and developing applications using C++ involves specialized skills and competencies in software development, particularly in the context of object-oriented programming.
CO4: PO4: moderately related (2) - Problem-solving skills are a fundamental aspect of specialized skills and competencies in various fields, including software development.
CO5: PO4: strongly relates (3) - Gaining a foundation for advanced programming concepts contributes directly to specialized skills and competencies in programming.
CO6: PO4: strongly relates (3) - Applying programming concepts to real-world problems enhances specialized skills and competencies by providing practical experience and problem-solving abilities.
CO7: PO4: strongly relates (3) - Developing debugging and error handling skills is a specialized competency essential for software development, directly contributing to specialized skills and competencies in programming.

CO1: PO5: strongly relates (3) - Analysing and comparing different programming paradigms enhances problem-solving abilities and analytical reasoning skills, which are essential for application in various contexts.

CO2: PO5: strongly relates (3) - Applying principles of OOP requires problem-solving skills and analytical reasoning to effectively design and implement solutions using object-oriented concepts.
CO3: PO5: strongly relates (3) - Designing and developing applications using C++ involves applying problem-solving skills and analytical reasoning to address real-world challenges effectively.
CO4: PO5: strongly relates (3) - Developing problem-solving skills directly contributes to the capacity for application, problem-solving, and analytical reasoning required in various domains, including programming.
CO5: PO5: strongly relates (3) - Gaining a foundation for advanced programming concepts enhances the capacity for application, problem-solving, and analytical reasoning by providing a deeper understanding of complex programming concepts.
CO6: PO5: strongly relates (3) - Applying C++ programming concepts to real-world problems requires strong problem-solving abilities and analytical reasoning skills to develop effective solutions.
CO7: PO5: strongly relates (3) - Developing debugging and error handling skills enhances the capacity for application by enabling students to identify and solve problems efficiently, contributing to problem-solving and analytical reasoning abilities.

CO1: PO6: partially related (1) - While explaining and comparing programming paradigms may require some level of communication, it's not the main focus of communication skills and collaboration.
CO2: PO6: partially related (1) - Applying principles of OOP may involve collaboration in group projects, but it's not directly focused on communication skills development.
CO3: PO6: moderately related (2) - Collaborating on the design and development of applications can enhance communication skills and require effective collaboration among team members.
CO4: PO6: partially related (1) - While problem-solving often involves collaboration and communication, this outcome is primarily focused on problem-solving skills rather than communication skills.
CO5: PO6: partially related (1) - Acquiring knowledge of advanced programming concepts may involve communication with instructors or peers, but it's not the primary focus of communication skills and collaboration.
CO6: PO6: moderately related (2) - Collaborating on real-world problem-solving tasks can enhance communication skills and require effective teamwork and collaboration.
CO7: PO6: partially related (1) - While collaboration may be involved in discussing and resolving errors, this outcome primarily focuses on technical skills rather than communication skills.

CO1: PO7: partially related (1) - While understanding different programming paradigms may involve some research-like activities, it's not the primary focus of research-related skills.
CO2: PO7: partially related (1) - Applying principles of OOP involves applying established concepts rather than conducting original research.

CO3: PO7: partially related (1) - Designing and developing applications may require some problem-solving and exploration, but it's not the primary focus of research-related skills.
CO4: PO7: partially related (1) - Problem-solving skills are essential for research, but this outcome primarily focuses on problem-solving skills in the context of programming rather than research-specific problem-solving.
CO5: PO7: partially related (1) - While gaining a foundation in advanced programming concepts may involve studying existing research and literature, it's not directly tied to conducting original research.
CO6: PO7: moderately related (2) - Applying programming concepts to real-world problems may involve some research-like activities, such as exploring different solutions or analyzing existing approaches.
CO7: PO7: partially related (1) - Debugging and error handling skills are essential in programming but are not directly related to conducting research.

CO1: PO8: moderately related (2) - Understanding different programming paradigms requires learning new concepts and approaches, which contributes to learning how to learn effectively.
CO2: PO8: strongly relates (3) - Applying principles of OOP involves grasping abstract concepts and applying them to different scenarios, which enhances the ability to learn new concepts and paradigms effectively.
CO3: PO8: strongly relates (3) - Designing and developing applications in C++ involves continuous learning and adaptation to new requirements and challenges, fostering the ability to learn how to learn effectively.
CO4: PO8: strongly relates (3) - Developing problem-solving skills requires learning new problem-solving techniques and approaches, contributing directly to learning how to learn effectively.
CO5: PO8: strongly relates (3) - Gaining a foundation in advanced programming concepts involves learning complex and abstract concepts, which enhances the ability to learn new concepts and paradigms effectively.
CO6: PO8: strongly relates (3) - Applying programming concepts to real-world problems requires continuous learning and adaptation, fostering the ability to learn how to learn effectively.
CO7: PO8: strongly relates (3) - Developing debugging and error handling skills involves learning new techniques and strategies for identifying and fixing errors, contributing directly to learning how to learn effectively.

CO1: PO9: moderately related (2) - Understanding different programming paradigms contributes to digital and technological skills by providing a foundation for understanding diverse approaches to software development.
CO2: PO9: strongly relates (3) - Applying principles of OOP directly contributes to digital and technological skills by enabling students to utilize modern programming paradigms effectively.

CO3: PO9: strongly relates (3) - Designing and developing applications in C++ enhances digital and technological skills by providing hands-on experience with a widely used programming language and its associated tools and technologies.
CO4: PO9: moderately related (2) - Developing problem-solving skills indirectly contributes to digital and technological skills by fostering the ability to analyze and address technical challenges effectively.
CO5: PO9: strongly relates (3) - Gaining a foundation in advanced programming concepts directly contributes to digital and technological skills by preparing students to work with complex software systems and technologies.
CO6: PO9: strongly relates (3) - Applying C++ programming concepts to real-world problems enhances digital and technological skills by providing practical experience with software development in a real-world context.
CO7: PO9: strongly relates (3) - Developing debugging and error handling skills directly contributes to digital and technological skills by improving students' ability to identify and resolve technical issues in software systems.

CO1: PO10: partially related (1) - While understanding different programming paradigms may indirectly contribute to multicultural competence by fostering an appreciation for diverse approaches, it's not directly related to inclusivity or empathy.
CO2: PO10: partially related (1) - Applying principles of OOP is primarily focused on technical skills and problem-solving rather than fostering multicultural competence or empathy.
CO3: PO10: partially related (1) - While collaborative design and development may involve diverse perspectives, it's not the primary focus of this outcome.
CO4: PO10: partially related (1) - While problem-solving may involve considering various perspectives, it's not specifically targeted at fostering multicultural competence or empathy.
CO5: PO10: partially related (1) - Gaining a foundation in advanced programming concepts is primarily focused on technical skills rather than promoting multicultural competence or empathy.
CO6: PO10: partially related (1) - While real-world problems may involve considering diverse perspectives, the focus is on technical problem-solving rather than multicultural competence or empathy.
CO7: PO10: partially related (1) - Debugging and error handling skills are primarily technical skills and not directly related to fostering multicultural competence or empathy.

CO1: PO11: moderately related (2) - Understanding different programming paradigms may indirectly contribute to value inculcation and environmental awareness by promoting critical thinking and consideration of various approaches to problem-solving, including those that align with ethical and sustainable practices.
CO2: PO11: moderately related (2) - Applying principles of OOP can indirectly promote value inculcation and environmental awareness by encouraging students to develop software solutions that adhere to ethical standards and may contribute positively to environmental sustainability.

CO3: PO11: moderately related (2) - Collaborative design and development of applications may promote value inculcation and environmental awareness by fostering consideration of ethical implications and environmental impact in software development processes.
CO4: PO11: partially related (1) - While problem-solving skills are important for addressing ethical and environmental challenges, this outcome is primarily focused on technical problem-solving rather than directly promoting value inculcation and environmental awareness.
CO5: PO11: partially related (1) - Gaining a foundation in advanced programming concepts primarily focuses on technical skills development rather than directly addressing value inculcation and environmental awareness.
CO6: PO11: moderately related (2) - Applying programming concepts to real-world problems may indirectly promote value inculcation and environmental awareness by encouraging students to consider ethical implications and environmental impact in their solutions.
CO7: PO11: partially related (1) - Debugging and error handling skills primarily focus on technical aspects of software development rather than directly addressing value inculcation and environmental awareness.

CO1: PO12: moderately related (2) - Understanding different programming paradigms fosters autonomy by providing students with the ability to make informed decisions about which approach is most suitable for a given problem. It also encourages responsibility and accountability in choosing and justifying programming methodologies.
CO2: PO12: strongly relates (3) - Applying principles of OOP requires students to take ownership of their design decisions and be accountable for the structure and organization of their code. It fosters autonomy in problem-solving and responsibility in software development.
CO3: PO12: strongly relates (3) - Designing and developing applications in C++ necessitates autonomy and responsibility in decision-making regarding architecture, design patterns, and implementation details. It also instills accountability for the quality and functionality of the final product.
CO4: PO12: strongly relates (3) - Developing problem-solving skills encourages autonomy in approaching and resolving challenges independently. It also promotes responsibility and accountability for finding effective solutions and evaluating their suitability.
CO5: PO12: moderately related (2) - Gaining a foundation in advanced programming concepts empowers students with the autonomy to explore complex topics independently and take responsibility for their learning progress. It also fosters accountability for understanding and applying advanced concepts effectively.
CO6: PO12: strongly relates (3) - Applying C++ programming concepts to real-world problems requires autonomy in identifying suitable solutions and taking responsibility for their implementation. It also entails accountability for the effectiveness and reliability of the solutions developed.
CO7: PO12: strongly relates (3) - Developing debugging and error handling skills promotes autonomy in diagnosing and resolving issues independently. It also fosters responsibility for

ensuring the correctness and robustness of software through effective error handling, as well as accountability for identifying and rectifying errors.

CO1: PO13: partially related (1) - Understanding different programming paradigms may indirectly contribute to community engagement and service by providing students with a broader perspective on problem-solving approaches, but it's not directly tied to community engagement or service.
CO2: PO13: partially related (1) - Applying principles of OOP may indirectly contribute to community engagement and service by enabling students to develop software solutions that address community needs, but it's not the primary focus of this outcome.
CO3: PO13: moderately related (2) - Designing and developing applications using C++ could involve projects that directly benefit the community or address societal challenges, thereby fostering community engagement and service.
CO4: PO13: moderately related (2) - Developing problem-solving skills can indirectly contribute to community engagement and service by preparing students to tackle real-world problems faced by communities and organizations.
CO5: PO13: partially related (1) - Gaining a foundation in advanced programming concepts may indirectly contribute to community engagement and service by equipping students with the knowledge and skills to develop innovative solutions, but it's not the primary focus of this outcome.
CO6: PO13: strongly relates (3) - Applying C++ programming concepts to real-world problems often involves projects or initiatives that directly engage with the community or address societal challenges, making it highly relevant to community engagement and service.

CO7: PO13: partially related (1) - Developing debugging and error handling skills is primarily focused on technical aspects of software development and is not directly tied to community engagement or service.

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Examination Pattern / Evaluation Pattern

Teaching and Evaluation (for Major, Minor, AEC, VEC, IKS courses)

Course Credits	No. of Hours per Semester Theory/Practical	No. of Hours per Week Theory/Practical	Maximum Marks	CE 40 %	ESE 60%
1	15 / 30	1 / 2	25	10	15
2	30 / 60	2 / 4	50	20	30
3	45 / 90	4 / 6	75	30	45
4	60 / 120	4 / 8	100	40	60

Teaching and Evaluation (for VSC, SEC & CC courses)

- Evaluation to be done by Internal & External Experts
- No descriptive end semester written examination
- Evaluation to be done at Department level preferably prior to commencement of Theory /Practical Examinations
- Evaluation to be done on the Skills gained by student